Description of document: Defense Nuclear Facilities Safety Board (DNSFB) Briefing Materials for the Biden/Harris Transition Team 2020

Requested date: 01-January-2021

Release date: 15-January-2021

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Source of document: Chief FOIA Officer
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, N.W., Suite 700
Washington, D.C. 20004
Email: FOIA@dnfsb.gov
FOIA.gov

Preferred during COVID-19 pandemic:
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DEFENSE NUCLEAR FACILITIES
SAFETY BOARD
Washington, DC 20004-2901

January 15, 2021

Via E-mail

Re: Defense Nuclear Facilities Safety Board Freedom of Information Act Request No. FY 21-13

This letter responds to the Freedom of Information Act request you submitted to the Defense Nuclear Facilities Safety Board (the "Board" or "DNFSB") on January 1, 2021, tracking number FY 21-13, for a "digital/electronic copy of the transition briefing document(s) (late 2020) prepared by DNFSB for the incoming Biden Administration.

The Board has located one record, a 504 page document entitled "Presidential Transition Materials, Defense Nuclear Facilities Safety Board, November 2020," that it finds to be responsive to your request. A copy of that document, subject to the redaction of certain information pursuant to FOIA Exemption 6 described below, is attached to this letter.

FOIA Exemption 6 (5 U.S.C. § 552(b)(6)) applies to "personnel and medical files and similar files the disclosure of which would constitute a clearly unwarranted invasion of personal privacy." The phrase "similar files" covers any agency records containing information about a particular individual that can be identified as applying to that individual. *See United States Dep't of State* v. *Washington Post Co.,* 456 U.S. 595, 602 (1982). To determine whether releasing records containing information about a particular individual would constitute a clearly unwarranted invasion of personal privacy, we are required to balance the privacy interest that would be affected by disclosure against any public interest in the information. *See United States Dep't of Justice* v. *Reporters Comm. for Freedom of Press,* 489 U.S. 749, 773-75 (1989).

The information redacted pursuant to FOIA Exemption 6 consists of the names agency employees who work in a national security field involving nuclear engineering and nuclear weapons. *See Long* v. *OPM,* 692 F. 3d 185 (2nd Cir. 2012) (holding that the names of federal employees in five sensitive agencies and twenty-four sensitive occupations, including nuclear engineering in the national security context, were properly withheld because disclosing the names could subject them to risk of harassment or attack). The Board finds that those individuals have a substantial privacy interest in protecting their identities from public release. Conversely, there is nothing in the record identifying a countervailing, cognizable public interest, *e.g.*, showing that releasing the information would shed light on the Board's performance of its statutory duties. Accordingly, because the harm to affected personal privacy interests is greater than an inchoate or theoretical public interest in disclosure, the Board finds that the redactions are warranted under FOIA Exemption 6.

You have the right to file an administrative appeal within ninety (90) days of your receipt of this letter. Your appeal must be in writing, be clearly marked with the words, "Freedom of Information Act Appeal," and be addressed as follows:

General Counsel
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, N.W., Suite 700
Washington, DC 20004

You may file your appeal by mail, courier service, or e-mail. Send appeals filed by mail or courier service to the General Counsel at the above address. Transmit e-mailed appeals to FOIA@dnfsb.gov. Please include the words "Freedom of Information Act Appeal" in the subject line of the e-mail. **Note:** The Board recommends that appeals be filed by e-mail until the operational restrictions imposed in response to the COVID-19 pandemic have been lifted. By filing an appeal, you preserve your rights under FOIA and provide the Board an opportunity to review and reconsider both your request and its decision.

If you disagree with the Board's decision and would like to pursue a resolution of your dispute without going through the appeals process, you may contact the Board's FOIA Public Liaison, Paul Wilson. He can be reached directly at (202) 694-7018 and PaulW@dnfsb.gov. You may also seek the assistance of the Office of Government Services (OGIS), the Federal FOIA Ombudsman's office, which offers mediation services to help resolve disputes between FOIA requesters and Federal agencies. The contact information for OGIS is:

Office of Government Information Services
National Archives and Records Administration
8601 Adelphi Road – OGIS
College Park, Maryland 20740-6001
202-741-5770 (toll free: 877-684-6448)
Email: ogis@nara.gov
Web: https://ogis.archives.gov

Please note that your use of one or both of these alternative dispute resolution mechanisms does not stay the 90-day deadline for filing an appeal.

This concludes the Board's activities related to FOIA Request FY 21-13, and there are no associated fees with its response. Feel free to contact Mr. Wilson if you have any questions about this matter. Please include the tracking number, FY 21-13, in any such communication.

Sincerely,

Toni Reddish

Toni Reddish
Acting Chief FOIA Officer

Attachment

Presidential Transition Materials
Defense Nuclear Facilities Safety Board
November 2020

Agency Point of Contact:
Tara Tadlock, Manager of Board Operations
202-694-7176
Tarat@dnfsb.gov

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DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Pandemic Response and Recovery Plan

Health, Safety and People First

Revision 0
September 14th, 2020

Contents

I. OVERVIEW

Background. On March 13, 2020, the Chairman activated the Continuity of Operations (COOP) plan in response to the COVID-19 (coronavirus disease 2019) pandemic. Subsequently, the Chairman has provided additional direction to the Board's staff for returning to DNFSB headquarters offices using the Board's COOP. Until now, the Board's staff has operated in a maximum telework posture.

Objective. This pandemic response and recovery plan is designed to protect the health and safety of all DNFSB employees and contractors while they fulfill the agency's mission.

Staffing and Organization Succession. All Directorates will review staffing and organizational lines of succession to determine minimum on-site staffing level requirements to perform essential functions during COVID-19. Organization succession will be documented in the COOP.

Decisions regarding which federal employees and support service contractors may return to the workplace will be based on phase, the nature of their work, and other limiting factors for returning to work.

Remote Employees. Elements of this return to workplace plan also apply to DNFSB employees working in field locations, including resident inspectors. Those elements include, but are not necessarily limited to, the following:

- Entrance screening criteria and protocols
- Social distancing protocols
- Contact tracing
- Post-exposure re-entry procedure

Given the unique circumstances at each field location, the responsible Office Director will issue supplementary direction as needed.

Reporting Unsafe Conditions. Section 5(a)(1) of the Occupational Safety and Health Act (OSHA) requires the DNFSB to provide a place of employment free from recognized hazards that are "causing or are likely to cause death or serious physical harm." Employees may disclose health or safety violations or concerns about workplace safety and health to DNFSB management officials, OSHA, or the Office of Inspector General (OIG) without fear of reprisal. The DNFSB will not retaliate against an employee for raising any workplace and safety concerns.

If an employee believes that he or she has been retaliated against for raising substantial and specific safety or health violations to management, OSHA, and/or the OIG, he or she may file a complaint with the Office of Special Counsel (OSC). In addition to filing a complaint with OSC, federal employees may also contact OSHA's Office of Federal Agency Programs if they believe that they are being retaliated against for filing with OSHA.

Approval Authority. The General Manager, Technical Director, and General Counsel will ensure the completion of all phase transition prerequisites and will make a recommendation to the Board for a transition to the next phase or changes to the phased approach. The Board will make any decisions on any changes to the phased approach and decisions to transition between phases.

II. PHASED APPROACH

DNFSB will use a disciplined, phased approach for re-occupancy of building 625 Indiana Avenue N.W., Washington, DC 20004. This return to the facility will meet the goal of safely returning Federal employees and support service contractors to the workplace in accordance with White House guidance in *Opening Up America Again* and OMB memo M-20-23, *Aligning Federal Agency Operations with the National Guidelines for Opening Up America Again*.

Decisions regarding phase transitions will take into account federal, state and local government orders and conditions and the current operating conditions. Additionally, phase transitions will require agency-specific prerequisite actions to be completed (see Section VIII, Phase Transition Prerequisites). As the plan is executed, the agency will continually monitor conditions that may indicate a resurgence in COVID-19 and may re-implement controls or re-enter prior phases if warranted.

Phase 0 - Pre-planning

During this phase, DNFSB will plan and prepare the HQ workplace to mitigate risk. In Phase 0, all employees are required to telework unless explicitly directed by an Office Director. Completion of most pre-planning actions will take an estimated two to three weeks.

Phase 0 Key Actions

During Phase 0 and prior to transitioning to Phase 1, all applicable criteria in Section VIII, Phase Transition Prerequisites, will be completed. The following key actions will define the actions taken during Phase 0. Key actions may carry over into subsequent phases.

- **Guidance for Managers and Returning Employees**. Standard guidance will be developed to facilitate consistent messaging to employees who are returning to the workplace. Messages will include, for example, instructions that personnel stay home if they have flu-like symptoms, expectations for social distancing, and any new entry procedures.

  Management will identify employees to return to the workplace in each phase. Employees will also be provided with instructions on how to self-identify as being vulnerable so they may be permitted maximum workplace flexibilities as appropriate. For contact tracing purposes, supervisors will be expected to maintain a daily record of employees who reported to DNFSB HQ or to a DOE site.

- **Monitor local conditions**. DNFSB will continuously monitor the state and local conditions to help determine when to initiate Phase 1 and subsequent phases.

- **Communications**. DNFSB will maintain transparent communication with the workforce and key external stakeholders as it plans and initiates remobilization activities. DNFSB will continue to use a variety of communication methods to help connect the workforce to information about the return-to-workplace process.

- **Sanitize and secure all DNFSB leased space**. DNFSB HQ common areas will continue to be cleaned and sanitized daily by building custodial services vendor (Red Coats) using EPA-approved products and following CDC standards directed to building lessors from GSA. These standards include the routine cleaning and disinfecting of high-touch surfaces in common and high-traffic areas. These high-touch surfaces include, but are not limited to: handrails, door knobs, light switches, countertops, table tops, water faucets and handles, elevator buttons, sinks, toilets and control handles, restroom stall handles, toilet paper and other paper dispensers, door handles and push plates, and drinking fountain controls in common and high-traffic areas.

  Additionally, all employees will be expected to disinfect touched surfaces in common areas after use.

Prior to the DNFSB entering into Phase 2, and following CDC recommended guidance, the Office of the General Manager will contract with an outside vendor to perform disinfecting service of all spaces. The vendor will use a Clorox Total 360 Disinfectant Cleaning System (or equivalent) to disinfect all offices, open works spaces, conference rooms, kitchens, reception areas, and locker/shower rooms. Disinfecting will include agency-owned personal property such as office furniture, workstations, computer accessories, window dressings, and telephones.

- **Entrance screening criteria and protocols**. DNFSB HQ will use CDC-informed entrance screening criteria to determine whether an individual (e.g., federal employee, onsite support service contractor, or visitor) may enter a facility. Personnel commuting to the office will be required to perform this self-screening and document its satisfactory completion (e.g., through an email to their supervisor) **while at home prior to commuting.** In addition, personnel should periodically monitor their health throughout the workday for any onset of these symptoms. All commuting personnel will be reminded by receiving emails and reading posters/signage instructing that they may not enter the workplace if they have flu-like symptoms, including a temperature over 100.4 degrees. Notices to this effect will be posted outside all building entrances. Refer to Section IX, COVID-19 Self-Screening Checklist, for additional information.

  Individuals not meeting any of the self-screening criteria will not be permitted to enter the facility. DNFSB federal employees will be returned to an appropriate work status until they are able to answer the questions satisfactorily. Support service contractor employees will report back to their employer who will coordinate with the appropriate Contracting Officer Representative (COR) or Contracting Officer.

  Any employee who does not meet all self-screening criteria for three or more consecutive days should out of an abundance of caution be conservatively considered to have a suspected case of COVID-19 per this plan (regardless of which criteria are not met) and should follow applicable guidance for contact tracing and post-exposure re-entry.

- **Implement social distancing protocols**. Social distancing protocols will be implemented prior to Phase 1 and will be revisited prior to transitioning to subsequent phases. For HQ, this includes:

  - **Face Coverings**.

    - *Building requirements.* The wearing of face coverings will be made mandatory for all persons (i.e., employees, contractors, vendors, delivery personnel, etc.) in all the common areas (i.e., main lobby, elevators, stairwells, common bathrooms, common hallways and corridors, parking garage, loading dock) of 625 Indiana Avenue.

      The Federal Protective Service, Protective Security Officers will report to the different agencies' FSC representatives those employees, contractors, vendors, visitors, delivery personnel who refuse to wear a mask in the common areas even after one has been offered to them for corrective action.

      The United States Court of Appeals for Veterans Claims will provide temporary face coverings which will be made available on a table in the main lobby of the building.

    - *DNFSB-space requirements.* The wearing of face coverings is mandatory within the DNFSB common areas, kitchens, restrooms and in confined spaces such as conference rooms and the Limited Area (Vault).

    - While the Board will provide each staff member with a re-entry kit, which includes a face covering, the staff is allowed to bring and wear their own face covering provided it meets CDC guidelines. Staff should be prepared to bring their own face covering upon initial entry to the building and in the event supplies may not be available. Staff should follow CDC guidance for cleaning and re-use of face coverings.

- **Common Areas**. Kitchens will be open using social distancing recommendations in the 8th floor main kitchen and 7th floor kitchen. The 8th floor kitchen next to the Boardroom and the 3rd and 4th floor kitchens will be limited to 1 person at a time in the space. The 7th floor locker/shower rooms and the M level fitness center will continue to be closed until Phase 3. Elevator occupancy should be limited to two (2) persons. Restrooms should be limited to three (3) people. The middle stall and middle sink in the rest room will be closed to usage to allow for social distancing.

  To ensure social distancing, stairwells use may be directionally restricted except during emergencies. Postings and other guidance will be issued as appropriate.

  Additional or revised guidance may be issued at a later time as appropriate.

- **Meetings and other Gatherings**. To the extent practical, meetings will continue to be held using virtual tools. In-person meetings will require a minimum of six feet of social distancing between participants and will include a limited number of attendees. Conference rooms will have modified seating and a posted maximum occupancy number to ensure social distancing.

- **Workspace Redesign**. Open workspaces that do not allow at least six feet between employees will require that employees work on-site in shifts (telework/onsite), if possible, to allow for social distancing. Plexiglass desk shields have been ordered/purchased and will be placed on all open secretary work stations and the 7th floor receptionist desk. DNFSB will consider other mitigation strategies as needed.

- **Hygiene items and services**. Building Management will work to procure and install hand sanitizer stations on each floor's elevator lobbies, facility entrances, and other high traffic areas as needed. DNFSB staff should utilize sanitizer stations when touching common areas such as door handles.

- **Signage**. Building Management will identify and post signage reminding employees to use proven hygiene practices and social distancing protocols, to stay home when ill, and to report any COVID-like symptoms. DNFSB will identify and post any additional signage in DNFSB space, including at the 7th Floor Main Receptionist Area Door and the 3rd & 4th Floor Indiana Avenue-side Main Doors.

  For familiarization, all signage will be covered in training prior to employees returning to the office.

- **Parking Garage Access**. The parking garage is temporarily closed to the public. All tenants that have been issued a Datawatch Access Card by their respective agencies will be granted temporary access to the parking garage. DNFSB employees (federal and contractor) may park in any available parking place on P0 and P1, and on P2, outside of the United States Court of Appeals for Veterans Claims parking area. This is only a temporary access and will be removed at the discretion of the property manager. At such time the temporary access is removed, only employees with agency issued or paid monthly accounts will be granted parking garage access.

- **Re-entry Kits**. Each DNFSB employee will be provided a reconstitution kit on their first day back in the office. This kit will contain:
  - One (1) cloth face covering (initial issue only)
  - One (1) personal sized hand sanitizer
  - One (1) container disinfecting wipes or one (1) disinfectant spray and one (1) roll paper towels
  - Two (2) pairs of powder free nitrile gloves

- **Supplies.** Additional supply needs will be based on governmental guidance and risk assessment. Demand for supplies will increase in proportion to the number of personnel re-entering the facility. Due to the nationwide difficulty of obtaining supplies and developing accurate projections with changing CDC and industry guidance, DNFSB's Facilities Manager will continue to work with appropriate governmental authorities in ordering and distributing supplies to employees.

<u>Phase 1 – Minimum On-site Staffing</u> (i.e., Remote Operations, or Maximum Telework)

Personnel identified to return to the workplace in Phase 1 will be determined by the Office Directors. This includes employees in mission-critical positions where on-site presence may be required. These include, for example, staff that need to perform their duties in a classified workspace and those that are needed to support limited facility operations. Support service contractors may also be included. All others will remain on maximum telework or other prearranged work agreement as appropriate. Employees may not voluntarily return to the workplace without prior approval by their supervisor.

Phase 1 federal employees are expected to return to the workplace upon notification by their supervisor after the Board has approved DNFSB to move to Phase 1. However, self-identified vulnerable federal employees, employees with extenuating circumstances, and employees who live with or provide care for individuals in the vulnerable population, are not required to return to the workplace in Phase 1. Managers should give employees as much advanced notice as possible to make necessary preparations. These employees will also be provided with detailed information regarding return to workplace expectations and new protocols. Support service contractors will be notified that they have been identified to return to the workplace by their employer in coordination with the appropriate COR and Contracting Officer.

DNFSB will continue to monitor information on state and local conditions, including current state/local stay-at- home orders, school closings, day care closings, and availability of public transportation.

Phase 1 Key Actions

During Phase 1 and prior to transitioning to Phase 2, all applicable criteria in Section VIII, Phase Transition Prerequisites, will be completed. The following key actions will define the actions taken during Phase 1. Key actions may carry over into subsequent phases.

- **Limited Area (Vault) protocols** – The Limited Area (Vault) is a secured space that consists of two separate internally joined rooms [classified processing room and classified conference/meeting room] with limited ability to maintain social distancing.

  The classified processing room consist of 4 work stations that are spaced six (6) feet apart; therefore no more than four employees should be in the room at any given time for the purposes of maintaining social distancing.

  The classified conference/meeting room consists of a conference table with eight chairs; however, the seating area of the room is reduced by the furniture; therefore, no more than four (4) employees should be in the room at any given time for the purposes of maintaining social distancing.

  The wearing of face coverings is mandatory in the Limited Area (Vault) due to the confined area of the space.

  A limited amount of cleaning supplies will be kept inside the Limited Area to wipe down furniture, computer workstations, the fax machine, and printers prior to and after use.

- **Interviews** – It is recommended that interviews be conducted virtually. If not possible to be conducted virtually, the conduct of interviews should follow agency guidance for in-person meetings.

- **Visitor policy** – Visitors shall be limited to federal government and contractor employees and will only permitted entry to DNFSB space with a negative COVID-19 self-certification. The wearing of face coverings is mandatory for all visitors.

  In Phase 1, to protect visitors and employees, visitors will only be permitted to DNFSB spaces if pre-approved by the Chairman (or others designated by the Chairman) or if the visitors are contractors performing facility work under the supervision of the Office of the General Manager. To help ensure this, non-DNFSB employees with access to DNFSB space (e.g., Department of Energy, Nuclear Regulatory Commission) may temporarily have their unescorted access disabled.

Visitor requests must be submitted to Receptionist@dnfsb.gov and Security@dnfsb.gov 24 hours in advance of any visit. Visit request must include the following information:

- Visitor(s) name (Last, First MI)
- Visitor(s) Company/Agency/Affiliation
- Visitor(s) email address.
- Date and time of visit
- Duration of visit
- Name (Last, First MI) and phone number of the sponsor/escort.

The receptionist and/or security will respond with an informational email with COVID-19 self-certification guidance requiring a self-certification response by email. The DNFSB receptionist and/or security will only approve the visit following a negative COVID-19 self-certification response.

As a secondary means of self-certification, visitor(s) will also be required to read and provide verbal self-certification to the COVID-19 Self-Certification Notice posted on the 7th Floor Main Receptionist Area Door in Phases 1 and 2.

Visit requests for Department of Energy's Office of the Departmental Representative should be processed through the Office of the Technical Director. Visit requests for Nuclear Regulatory Commission (NRC) employees should be processed through the Office of Inspector General (OIG) Liaison.

- **Travel Guidance** – Official travel is recognized as presenting unique risks to DNFSB employees during the COVID-19 pandemic. Conditions experienced while travelling are unpredictable, standard controls such as self-isolation may not be available, travelers may not be immediately familiar with where and how to seek testing or medical care if necessary, and state and local conditions and restrictions can change rapidly. Finally, data used to make risk-informed decisions can be untimely, inconsistently available, or not available.

  Consequently, in Phases 2 and 3 and until viral countermeasures are widely available, non-essential travel will be strictly voluntary. Further, Office Directors shall develop prioritization criteria for travel, and authorize non-essential travel only if the priority is commensurate with risks posed by conditions likely to be encountered in transit to and at the destination location. Finally, Office Directors should consider additional controls to minimize the risk of transmission between DNFSB employees and the workforce of the Department of Energy or the general public.

  Travel designated to be essential by the Chairman and authorized by Office Directors may be permitted on a case-by-case basis regardless of phase.

<u>Phase 2 – Reduced On-site Staffing</u> (i.e., Intermediate Operations, or Mixed Telework and On-site Work)

Personnel identified to return to the workplace in Phase 2 will be determined by the Office. For Phase 2, additional returning personnel will include employees whose jobs are best performed on-site. These employees will receive advanced notification that they have been identified to return to the workplace in Phase 2. Support service contractors will be notified that they have been identified to return to the workplace by their employer in coordination with the appropriate COR and Contracting Officer.

Supervisors may develop schedules by which employees are expected to work on-site during Phase 2 at a reduced capacity. Phase 2 federal employees are expected to begin working on-site upon notification by their supervisor after the Board has approved DNFSB to move to Phase 2. All others will remain on telework or other prearranged work agreement as appropriate. Employees wishing to work on-site on days they are not scheduled to may <u>not</u> return to the workplace without prior approval by their supervisor. For planning purposes, at the earliest, it is assumed that Phase 2 will begin approximately two weeks after Phase 1.

Self-identified vulnerable federal employees, employees with extenuating circumstances, and employees who live with or provide care for individuals in the vulnerable population, are not required to return to the workplace in Phase 2.

Phase 2 Key Actions

During Phase 2 and prior to transitioning to Phase 3, all applicable criteria in Section VIII, Phase Transition Prerequisites, will be completed. The following key actions will define the actions taken during Phase 2. Key actions may carry over into subsequent phases

In addition to normal program mission activities, HQ staff offices will continue reopening support services as appropriate (see Section III, Support Activities). Also, social distancing protocols will be reviewed as necessary.

- **Agency Directives** – The agency will conduct a gap analysis of current agency policies and directives against known and anticipated long-term impacts of COVID-19. Based on the gap analysis, changes to the directives will be developed and approved, supplemented with temporary guidance as needed.
- **Supplies** – The agency will ensure adequate cleaning supplies and personal protective equipment is available for all employees prior to transitioning to Phase 3.

Phase 3 – Unrestricted On-site Staffing (i.e., Steady-state Operations)

In Phase 3, unrestricted on-site staffing of DNFSB will resume. Employees will be notified by their supervisor after the Board has approved DNFSB to move to Phase 3. Under Phase 3, DNFSB will resume normal operations where employees are expected to return to the workplace per established policies and processes. Support service contractors will be notified that they have been identified to return to the workplace by their employer in coordination with the appropriate COR and Contracting Officer. All personnel will be expected to resume their pre-COVID-19 work schedules, as deemed appropriate by their supervisor. Requests for accommodations by federal employees will be evaluated through the reasonable accommodation process on a case-by-case basis. Protocols and controls established in earlier phases will be reviewed for long-term applicability and may be relaxed or discontinued.

Resurgence Monitoring

Until such time as adequate viral countermeasures are widely available and with the advice of the Office Directors, the Board will continually assess conditions in the National Capital Region[1] and in DNFSB Headquarters to determine if instating new controls or re-instituting previously-implemented controls are appropriate to ensure the health and safety of DNFSB employees and contractors. If appropriate, the Board may formally revert the agency to an earlier Phase in the plan or to an earlier work posture.

Conditions that may warrant such actions include but are not necessarily limited to:

- New or revised guidance from federal, state, and/or local authorities
- Evidence of community spread of COVID-19 at or around DNFSB Headquarters
- A notable increase in local confirmed cases of COVID-19 per capita
- Closures of schools and/or public transportation due to confirmed or suspected COVID-19 cases

[1] For purposes of this plan, National Capitol Region will be defined as jurisdictions that fall into the DC locality pay rate in accordance with the Office of Personnel Management. As of September 2020, this includes Washington D.C., and select counties in Maryland, Virginia, Pennsylvania and West Virginia.

III. Support Activities

Support activities will be continuously evaluated based on risk and demand. Adjustments will be made as necessary, including shifting phase-specific activities to other phases.

Phase 1

Facilities Services

- Initiate increased level of custodial services, to include reopening of restrooms, as re-occupancy increases. Continue to clean lobby areas daily. High touch areas are disinfected daily.
- Begin responding to backlog of building operations routine service calls.
- Begin completing deferred routine building maintenance activities.
- Determine process for deliveries, including the loading dock.

Phase 2

Key Services

- Allow visitors to come onsite but subject to enhanced entrance screening protocols, if applicable.

Facilities Services

- Begin major building maintenance projects that had been deferred.
- Begin work on deferred office moves, carpet cleaning requests.

Phase 3

Key Services

- Transition from Virtual Onboarding to in-person onboarding. Ensure those who attended virtual onboarding are included to complete New Employee Orientation and remaining paperwork.
- Transition to in-person training, as appropriate. This will depend on social distancing protocols and availability of vendors.
- Begin scheduling new federal and contractor employees for HSPD-12 PIV enrollments and onsite drug testing for pre-employment and security clearance processing purposes.
- Begin scheduling federal and contractor employees for HSPD-12 PIV reenrollments and certificate updates.
- Allow OTD Staff to resume official travel to DOE sites, where COVID-19 restrictions have been relaxed and, or public health emergencies have expired.

Facilities Services

- Begin addressing backlog of deferred moving services.
- Ensure Help Desk staff is prepared for surge in IT support calls as customers return onsite.

IV. Contact Tracing

A DNFSB federal employee who has returned to the workplace shall immediately report any suspected or confirmed contraction of COVID-19 to the COVID-19 notification email address (COVID-19Notifications@DNFSB.GOV). If an employee reports their COVID-19 case to a supervisor, the supervisor will ensure the Division of Human Resources (DHR) is notified within two hours. DHR will maintain a Contact Tracing Report for DNFSB, and it will be considered highly sensitive in nature.[2] DHR will contact an employee who has contracted COVID-19 or is suspected of having COVID-19 to obtain detailed information about his or her work contacts and locations he or she has been within DNFSB facilities 48 hours before the onset of symptoms through the date of contact. DHR will work with supervisors and the OGM security office as appropriate to determine potentially affected locations and other employees who may have been potentially exposed. DHR will immediately make notifications to all employees who have been potentially exposed but will not reveal the identity of the employee who tested positive for COVID-19.

Employees who have been potentially exposed are defined as those who have had close contact (within 6 feet) for fifteen minutes or more with a person with COVID-19 up to two days before symptoms appeared, or if the person with COVID-19 does not have symptoms, then two days before the specimen was collected for testing. Employees who have been potentially exposed will be required to quarantine for a minimum of 14 days and telework if possible. DHR will advise these employees to self-monitor for symptoms.

DNFSB contracted administrative and IT staff will adhere the COVID-19 reporting protocol as defined by their respective employers. The contractor will inform the DNFSB Contracting Officer and/or COR if their employee was inside DNFSB spaces up to 2 days before the employee's COVID-19 detection or suspected contraction as defined in the above paragraph. If the employee was in DNFSB spaces up to 2 days prior to detection, DNFSB Contracting Officer will inform the COR, Security Office and Facilities Manager. They will initiate contact tracing in DNFSB spaces, and perform required notification and cleaning procedures. Contractor staff DNFSB Contracting Officer will ensure contractor continues to meet contract performance requirements.

[2] The EEOC considers information about COVID symptoms or a COVID diagnosis a medical record (reference https://www.eeoc.gov/wysk/what-you-should-know-about-covid-19-and-ada-rehabilitation-act-and-other-eeo-laws). The Rehabilitation Act and the American with Disabilities Act (ADA) require that all medical records for employees, whether disabled or not, be kept in medical files separate from personnel files and be treated as a confidential medical record. Refer to 29 C.F.R. § 1614.203(e)(4) and 1630.14(c). Failure to keep these records separate and confidential is a violation and entitles the employee to an award of damages. Refer to *Brunnel v. USPS*, EEOC Appeal No. 07A10009 (2001).

V. Post-Exposure Re-Entry Procedure

Those staff members that have been confirmed (e.g., with a positive test) or suspected of having COVID-19 may return to work if they satisfy one of the following three options.

OPTION 1 (Symptom-based criteria):

If you have a confirmed or suspected case of COVID-19 and you did not get tested for COVID-19, you can leave isolation and go back to work when all the following are true:

a. You have had at least 3 days in a row with no fever at all; AND

b. During those 3 days you have not taken any fever-reducing medication (e.g., Tylenol, Acetaminophen, Advil, Ibuprofen, Aleve, or Naproxen); AND

c. You have had at least 3 days of improved cough or shortness of breath if you had these symptoms; AND

d. It has been at least 10 days since your symptoms first started.

Note that because people may continue to test positive on a viral test long after they are recovered from COVID-19, you can end isolation/return to work if all of the above criteria are true even if you have one or more positive viral tests beyond 14 days after your symptoms first started. If you meet all the criteria for Option 1 you are considered not contagious, even if you have a positive test.

OPTION 2 (Time-based criteria):

If you have a confirmed case of COVID-19 but never had symptoms, you can return to work 14 days after the date of your positive test.

OPTION 3 (Test-based criteria):

If you have a confirmed case of COVID-19 and have two negative viral test results from at least two consecutive respiratory specimens collected more than 24 hours apart, you can return to work as soon as you get the second negative test result if all of the following are true:

a. You do not have a fever, AND

b. You are not using fever reducing medication, AND

c. Your respiratory symptoms (if you had them) have improved over the previous three days.

Options 1 and 2 are preferred. Most people with a confirmed test for COVID-19 will continue to have positive viral tests for several weeks even though they are not contagious. This is because dead virus particles can still show up as a positive viral test but are not considered contagious. Choosing Option 3 will likely lead to people being out from work for longer than they need to be.

Any staff member may return to work sooner than the timeframes provided in options 1, 2, or 3 if he or she provides a doctor note stating that he or she is healthy and is able to return to workplace.

VI. DNFSB Space Cleaning After COVID-19 Contraction Notification

Facility Readiness

- The ability to respond quickly with standard, cost-effective, and CDC approved cleaning protocols following a reported case is required to sustain a broad-based reconstitution at a facility.
- The facility must have the ability to report and trace any confirmed or presumptive positive case of COVID-19.
- Notification and Cleaning: DNFSB has the responsibility to inform the building Facility Security Committee (FSC) and GSA of a confirmed or suspected case of COVID-19/Coronavirus. DNFSB will provide date and time of the incident and areas accessed. This notification will not include PII.

GSA Responsibility: GSA will determine if the lessor has a pandemic plan in place that follows CDC guidelines and matches the GSA scope of work for COVID-19/coronavirus cleaning. GSA will fund and provide for detailed deep cleaning and disinfection of those portion(s) of the facility accessed by the infected individual(s) according to CDC guidance, which may exceed GSA's National Custodial Specification or as otherwise described in the lease agreement.

VII. Limiting Factors for Returning to Work at DNFSB

Limiting factors will limit the agencies staff's ability to fully occupy a space or execute some mission functions at DNFSB HQ or DOE Defense Nuclear Facilities in Phases 1 and 2. These factors will be considered subject to the guidance in the *DNFSB Pandemic Response and Recovery Plan* or other Board-approved guidance.

CDC Defined Vulnerable Population Sets

COVID-19 is a new disease and there is limited information regarding risk factors for severe disease. Based on currently available information and clinical expertise, older adults and people of any age who have serious underlying medical conditions might be at higher risk for severe illness from COVID-19.

Based on what we know now, those at high-risk for severe illness from COVID-19 are:

- People 65 years and older
- People who live in a nursing home or long-term care facility
- People of all ages with underlying medical conditions, particularly if not well controlled, including:
    - People with chronic lung disease or moderate to severe asthma
    - People who have serious heart conditions
    - People who are immunocompromised
- Many conditions can cause a person to be immunocompromised, including cancer treatment,
- smoking, bone marrow or organ transplantation, immune deficiencies, poorly controlled HIV or AIDS, and prolonged use of corticosteroids and other immune weakening medications
- People with severe obesity (body mass index [BMI] of 40 or higher)
- People with diabetes
- People with chronic kidney disease undergoing dialysis
- People with liver disease
- People with disabilities
- Pregnant woman and breastfeeding mothers
- Racial and Ethnic Minority Groups

Employees should refer to the CDC's website for the most up-to-date information.

Dependent Care

- Flexibilities are still necessary for employees, especially those who are caring for children or others who are at higher risk.
- Flexibilities will follow federal guidance for those caring for children or adults where school or dependent care services are not available.

Supervisors will have ultimate responsibility in granting telework activities based on the employees situation and guidance from Human Resources. ***Approved use of leave or telework will not result in discrimination or disparate treatment in terms of ratings, work assignments, or other conditions of employment.***

VIII. Phase Transition Prerequisites

The following actions are designated as prerequisites to be completed prior to transitioning to a new phase. Any prerequisite actions not completed prior to phase transition should be completed as soon as practicable. Additional prerequisite actions may be identified at a later date.

Prior to each phase transition

- [ ] 1. Management has encouraged use of telework flexibilities and extended work flexibility programs.
- [ ] 2. Brief and encourage all staff to practice CDC hand washing, disinfecting, social distancing and mask wearing guidance at all times.
- [ ] 3. Monitor state and local conditions and incorporate guidance from Federal Government entities.
- [ ] 4. Update self-certification guidance and checklist, if needed.
- [ ] 5. Office Directors have reviewed organization charts and succession plans and made necessary changes.
- [ ] 6. Human Resources Division is monitoring trends of illness among employees.
- [ ] 7. Employee surveys have been conducted to measure levels of employee concern about returning to the workplace and possible limitations on their ability to come back to an office environment.
- [ ] 8. Review floor plans and provide social distancing guidance for shared work spaces, conference rooms, enclosed spaces, mailroom, kitchens, locker/ shower rooms, and rest rooms.
- [ ] 9. Procure and distribute adequate sanitization and disinfectant supplies and personal protective equipment.
- [ ] 10. The agency's compliance with applicable federal, state, and local COVID-19 guidance has been reviewed, and all gaps have been identified and addressed.
- [ ] 11. Local guidance pertaining to availability of public transportation has been disseminated to commuting staff members.
- [ ] 12. Visitor policies have been developed, reviewed, and updated if appropriate.
- [ ] 13. Routine enhanced cleaning and sanitizing in Board HQ space has been scheduled.
- [ ] 14. Identify and address internal and external lessons learned or best practices relating to COVID-19 or the return to workplace plan.
- [ ] 15. A staff communications plan has been developed or, if appropriate, revised.
- [ ] 16. Appropriate guidance specific to resident inspectors and remote employees has been developed and promulgated.

Prior to Phase 1

- [ ] 1. National Capital Region (NCR) Governments have already declared they are in Phase 1.
- [ ] 2. Department of Energy has already declared both Forrestal and Germantown to be in Phase 1.
- [ ] 3. Completed all of the criteria applicable to each phase transition.
- [ ] 4. Telework policies, guidance, and infrastructure adequately support maximum telework
- [ ] 5. Staff have been provided with adequate opportunity to self-identify as a member of a high-risk group in accordance with N-125.1, *Telework Program*, or successor document.
- [ ] 6. Identified mission essential functions that can only be accomplished at HQ Building and DOE/NNSA site locations.
- [ ] 7. Identified available Essential Personnel capable to perform essential functions at HQ Building and DOE/NNSA Site locations. Authorize limited access to perform essential functions.
- [ ] 8. Enhanced Cleaning in Board space has begun.
- [ ] 9. Provide direction that limits staff entry into the building; restrict visitors' access into the building;
- [ ] 10. Sanitizing and disinfectant supplies made available to staff working in the building.
- [ ] 11. Provide direction that all outside contractors must wear PPE, and properly escorted in Board space by the building engineer or appropriate DNFSB staff.
- [ ] 12. Provided direction that on-site Facilities, IT, and Security services will be limited at HQ building.
- [ ] 13. Human Resources Division has resumed or is performing hiring/staffing.
- [ ] 14. Provided direction that government essential travel is restricted and subject to Chairman's approval.
- [ ] 15. Appropriate signage has been posted in Board spaces.
- [ ] 16. Occupancy limits placed in all conference rooms, kitchens, enclosed spaces
- [ ] 17. Disseminate Facility Security Committee policies regarding building common areas.

Prior to Phase 2

☐	1. NCR Governments have already declared they are in Phase 2.
☐	2. Department of Energy has already declared both Forrestal and Germantown to be in Phase 2.
☐	3. NCR's new case total over last 14 days per 100,000 people is less than or equal to 100.
☐	4. Completed all criteria applicable to each phase transition and all criteria for prior to Phase 1.
☐	5. Telework policies, guidance, and infrastructure have been reviewed and, if appropriate, updated and communicated to staff.
☐	6. Staff have been trained on flexible work arrangements and have been provided with adequate opportunity to self-identify as a member of a high risk group in accordance with N-125.1, *Telework Program*, or successor document, and to request reasonable accommodations or other flexible work arrangements.
☐	7. Office Directors and Managers have developed a reduced work schedule by which eligible staff return to their workplaces. Schedule has been communicated to applicable staff.
☐	8. Re-entry kits have been issued to staff.
☐	9. Appropriate COVID-19 controls (e.g., social distancing, facial coverings) have been established for Board common areas.
☐	10. Office Directors have developed guidance for resumption of non-essential travel.
☐	11. Adequate on-site customer service is available at IT Help Desk, Security Office, and Human Resources Division.
☐	12. Adequate on-site facilities maintenance support, office moves, and other related support is available.
☐	13. Appropriate occupancy limits posted in all conference rooms, kitchens, enclosed spaces.
☐	14. If appropriate, Specialized Electro-Static Clorox Total 360 Cleaning or other deep cleaning service(s) has been performed.
☐	15. Review HQ building ventilation system, determine if additional controls need to be implemented.
☐	16. Contact tracing procedures have been implemented and staff has been notified of the procedures.
☐	17. Supervisors are ensuring that personnel perform self-screenings on days they enter the office.
☐	18. Ensure self-screening protocols for visitors to the DNSB spaces have been established and implemented.

Prior to Phase 3

☐	1. NCR Governments have already declared they are in Phase 3.
☐	2. Department of Energy has already declared both Forrestal and Germantown to be in Phase 3.
☐	3. NCR's new case total over last 14 days per 100,000 people is less than or equal to 10.
☐	4. Completed all criteria applicable to each transition and all criteria prior to Phases 1 and 2.
☐	5. Appropriate amounts of cleaning supplies and PPE are available for all employees with processes in place to ensure they are restocked as needed.
☐	6. Completed a gap analysis of current agency policies and directives against known and anticipated long-term impacts of COVID-19.
☐	7. Based on gap analysis, necessary changes to directives have been developed and approved, supplemented with temporary guidance as needed.

IX. COVID-19 Self-Screening Checklist

Review this each day before reporting to work. If you have newly or unexpectedly experienced any of the following symptoms in the past 24 hours or answer yes to any other question, **STAY HOME** and call your supervisor or office director to let them know. You should call your primary care physician for further direction.

Do you have a fever (temperature over 100.4°F) without having taken any fever reducing medications?

☐ Yes ☐ No

New Loss of Taste or Smell?

☐ Yes

☐ No

Muscle Aches?

☐ Yes

☐ No

Sore Throat?

☐ Yes

☐ No

Cough?

☐ Yes

☐ No

Shortness of Breath?

☐ Yes

☐ No

Repeated Shaking/Chills?

☐ Yes

☐ No

Headache?

☐ Yes

☐ No

Fatigue?

☐ Yes

☐ No

Have you had any of these symptoms in the past 24 hours not related to allergies?

Runny Nose?

☐ Yes

☐ No

Congestion?

☐ Yes

☐ No

Have you experienced any GI symptoms such as nausea/ vomiting, diarrhea, or loss of appetite?

☐ Yes ☐ No

Have you, or anyone you have been in close contact with (within 6 feet for 15 or more minutes) been diagnosed with COVID-19, or been placed on quarantine for possible contact with COVID-19?

☐ Yes ☐ No

Have you been asked to self-isolate or quarantine by a medical professional or by a local public health official?

☐ Yes ☐ No

X. References

Ref. 1 - NIH Safety Guidance for Return to Physical Workplace, June 2020
Ref. 2 - CDC COVID-19 Guidance for Businesses and Employers, May 2020
Ref. 3 - Johns Hopkins Self-Assessment Tool, [https://www.hopkinsmedicine.org/coronavirus/covid-19-self-checker.html]
Ref. 4 - Office of Management and Budget and Office of Personnel Management memorandum, *Opening up America Again*, April 20, 2020
Ref. 5 - Department of Energy, *COVID-19 Return To the Federal Workplace Framework*, May 18, 2020.

DNFSB Board Members

Mr. Thomas A. Summers
Acting Chairman

Thomas A. Summers of Rochester, Pennsylvania was appointed Vice Chairman on August 17, 2020. He was confirmed by the Senate on July 2, 2020 for service through October 18, 2025. Mr. Summers previously served as the Senior Advisor and as the Deputy for Research, Development, Test, & Evaluation Office in Defense Programs for the National Nuclear Security Administration. He is a retired U.S. Air Force Colonel with over three decades of active duty in a variety of command, teaching, military staff, and scientific positions.

Mr. Summers earned a B.S. from Saint Vincent College, PA in Physics and Mathematics and four M.S. degrees: Applied Physics from the Air Force Institute of Technology, OH; Administration from Central Michigan University, MI; Military Operational Art and Science from Air Command and Staff College, AL; and National Security Strategy from the National War College, DC.

Ms. Jessie Hill Roberson
Board Member

Ms. Jessie Hill Roberson has more than 30 years of experience in the nuclear field in the public and private sectors. She has managed field operations at several Department of Energy Nuclear Plants and has served as Assistant Secretary of Energy for the Environmental Management Program in Washington, DC, where she had leadership responsibilities including operations, safety, financial, and policy across the Department of Energy's Defense Nuclear Complex. She has also served in management roles at several commercial nuclear facilities with responsibilities including plant engineering, regulatory/licensing and compliance, nuclear operations, public interface and emergency management.

Ms. Joyce L. Connery
Board Member

Ms. Joyce L. Connery, a native of Massachusetts, was appointed to the Board by President Obama in August 2015, following confirmation by Congress as a member of the Board for a term expiring October 18, 2019. Ms. Connery served as the Board's Chair from her confirmation in August 2015 until January 2017. Ms. Connery has had an extensive career in the fields of nuclear security, safety, nonproliferation and energy policy. Ms. Connery began her career at the national laboratories, first serving in Kazakhstan working on the shutdown of the BN-350 fast breeder reactor and then returning to Washington D.C. to work in the Office of International Safety in the National Nuclear Security Administration (NNSA). She has served in several capacities at the Department of Energy, including as the senior policy advisor for the Deputy Secretary. She also served two tours in the National Security Council from February 2008 through May 2010 in the area of nonproliferation and nuclear security and then again from January 2012 through July 2015 as Director for Nuclear Energy Policy within the Office of International Economics. Ms. Connery received a B.A. and (after a two year stint with the Peace Corps in Turkmenistan) an M.A. from Tufts University.

ENABLING STATUTE OF THE
DEFENSE NUCLEAR FACILITIES SAFETY BOARD

**ATOMIC ENERGY ACT OF 1954,
CHAPTER 21, AS AMENDED**

42 U.S.C. § 2286 *ET SEQ.*

JANUARY 2020

ENABLING STATUTE OF THE
DEFENSE NUCLEAR FACILITIES SAFETY BOARD

ATOMIC ENERGY ACT OF 1954, CHAPTER 21, AS AMENDED
CODIFIED AT 42 U.S.C. § 2286 *ET SEQ.*

As Amended by,
National Defense Authorization Act, Fiscal Year 1989
(Pub. L. No. 100-456, September 29, 1988),
National Defense Authorization Act for Fiscal Year 1991
(Pub. L. No. 101-510, November 5, 1990),
National Defense Authorization Act for Fiscal Years 1992 and 1993
(Pub. L. No. 102-190, December 5, 1991),
Energy Policy Act of 1992
(Pub. L. No. 102-486, October 24, 1992),
National Defense Authorization Act for Fiscal Year 1994
(Pub. L. No. 103-160, November 30, 1993),
Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001
(Pub. L. No. 106-398, October 30, 2000),
Bob Stump National Defense Authorization Act for Fiscal Year 2003
(Pub. L. No. 107-314, December 2, 2002),
National Defense Authorization Act for Fiscal Year 2004
(Pub. L. No. 108-136, November 7, 2003),
Duncan Hunter National Defense Authorization Act for Fiscal Year 2009
(Pub. L. No. 110-417, October 14, 2008),
National Defense Authorization Act for Fiscal Year 2013
(Pub. L. No. 112-239, January 2, 2013),
Carl Levin and Howard P. "Buck" McKeon
National Defense Authorization Act for Fiscal Year 2015
(Pub. L. No. 113-291, December 19, 2014),
National Defense Authorization Act for Fiscal Year 2016
(Pub. L. No. 114-92, November 25, 2015), and
National Defense Authorization Act for Fiscal Year 2020
(Pub. L. No. 116-92, December 20, 2019).

As of 01/02/2020

TITLE 42. THE PUBLIC HEALTH AND WELFARE
CHAPTER 23. DEVELOPMENT AND CONTROL OF ATOMIC ENERGY
SUBCHAPTER XVII.A.
DEFENSE NUCLEAR FACILITIES SAFETY BOARD
42 U.S.C. § 2286 *et seq.*

§ 2286. Establishment [Atomic Energy Act, Sec. 311]

(a) Establishment

There is hereby established an independent establishment in the executive branch, to be known as the Defense Nuclear Facilities Safety Board" (hereafter in this subchapter referred to as the "Board").

(b) Membership

(1) The Board shall be composed of five members appointed from civilian life by the President, by and with the advice and consent of the Senate, from among United States citizens who are respected experts in the field of nuclear safety with a demonstrated competence and knowledge relevant to the independent investigative and oversight functions of the Board. Not more than three members of the Board shall be of the same political party.

(2) Any vacancy in the membership of the Board shall be filled in the same manner in which the original appointment was made.

(3) No member of the Board may be an employee of, or have any significant financial relationship with, the Department of Energy or any contractor of the Department of Energy.

(4) The President shall enter into an arrangement with the National Academy of Sciences under which the National Academy shall maintain a list of individuals who meet the qualifications described in paragraph (1) to assist the President in selecting individuals to nominate for positions as members of the Board.

(c) Chairman, Vice Chairman, and Members

(1) The President shall designate a Chairman and Vice Chairman of the Board from among members of the Board.

(2) In accordance with paragraphs (5) and (6), the Chairman shall be the chief executive officer of the Board and, subject to such policies as the Board may establish, shall exercise the functions of the Board with respect to—

(A) the appointment and supervision of employees of the Board;

(B) the organization of any administrative units established by the Board; and

(C) the use and expenditure of funds.

(3) (A) The Chairman may delegate any of the functions under this paragraph to any other member or to any appropriate officer of the Board.

(B) In carrying out subparagraph (A), the Chairman shall delegate to the Executive Director of Operations established under section 2286b(b)(3) the following functions:

(i) Administrative functions of the Board.

(ii) Appointment and supervision of employees of the Board not specified under paragraph (6).

(iii) Distribution of Business among the employees and administrative units and offices of the Board.

(iv) Preparation of—

(I) proposals for the reorganization of the administrative units or offices of the Board;

(II) the budget estimate for the Board; and

(III) the proposed distribution of funds according to purposes approved by the Board.

(4) The Vice Chairman shall act as Chairman in the event of the absence or incapacity of the Chairman or in case of a vacancy in the office of Chairman.

(5) Each member of the Board, including the Chairman and Vice Chairman, shall—

(A) have equal responsibility and authority in establishing decisions and determining actions of the Board;

(B) have full access to all information relating to the performance of the Board's functions, powers, and mission; and

(C) have one vote.

(6)(A) The Chairman, subject to the approval of the Board, shall appoint the senior employees described in subparagraph (C). Any member of the Board may propose to the Chairman an individual to be so appointed.

(B) The Chairman, subject to the approval of the Board, may remove a senior employee described in subparagraph (C). Any member of the Board may propose to the Chairman an individual to be so removed.

(C) The senior employees described in this subparagraph are the following senior employees of the Board:

(i) The Executive Director of Operations established under section 2286b(b)(3).

(ii) The general counsel.

(d) Terms

(1) Except as provided under paragraph (2), the members of the Board shall serve for terms of five years. A member may be reappointed for a second term only if the member was confirmed by the Senate more than two years into the member's first term. A member may not be reappointed for a third term.[1]

(2) Of the members first appointed—

(A) one shall be appointed for a term of one year;

(B) one shall be appointed for a term of two years;

(C) one shall be appointed for a term of three years;

(D) one shall be appointed for a term of four years; and

(E) one shall be appointed for a term of five years, as designated by the President at the time of appointment.

(3) (A) Any member appointed to fill a vacancy occurring before the expiration of the term of office for which such member's predecessor was appointed shall be appointed only for the remainder of such term.

(B) A member may not serve after the expiration of the member's term, unless the departure of the member would result in the loss of a quorum for the Board. If more than one member is serving after the expiration of the member's term and a new member is appointed to the Board so that one of the members serving after the expiration of the member's term is no longer necessary to maintain a quorum, the member whose term expired first may no longer serve on the Board.[2]

(4)(A) Not later than 180 days after the expiration of the term of a member of the Board, the President shall—

(i) submit to the Senate the nomination of an individual to fill the vacancy; or

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[1] The second and third sentences of this paragraph become effective on December 20, 2020. National Defense Authorization Act for Fiscal Year 2020 § 2303(b)(2), Pub. L No. 116-92.
[2] This subparagraph becomes effective on December 20, 2020. *Id.*

(ii) submit to the Committee on Armed Services of the Senate a report that includes—

(I) a description of the reasons the President did not submit such a nomination; and

(II) a plan for submitting such a nomination during the 90-day period following the submission of the report.

(B) If the President does not submit to the Senate the nomination of an individual to fill a vacancy during the 90-day period described in subclause (II) of subparagraph (A)(ii), the President shall submit to the Committee on Armed Services a report described in that subparagraph not less frequently than every 90 days until the President submits such a nomination.

(e) Quorum

Three members of the Board shall constitute a quorum, but a lesser number may hold hearings.

<u>§ 2286a. Mission and Functions of the Board</u> [Atomic Energy Act, Sec. 312]

(a) Mission

The mission of the Board shall be to provide independent analysis, advice, and recommendations to the Secretary of Energy to inform the Secretary, in the role of the Secretary as operator and regulator of the defense nuclear facilities of the Department of Energy, in providing adequate protection of public health and safety at such defense nuclear facilities, including with respect to the health and safety of employees and contractors at such facilities.

(b) Functions

The Board shall perform the following functions:

(1) Review and evaluation of standards

The Board shall review and evaluate the content and implementation of the standards relating to the design, construction, operation, and decommissioning of defense nuclear facilities of the Department of Energy (including all applicable Department of Energy orders, regulations, and requirements) at each Department of Energy defense nuclear facility. The Board shall recommend to the Secretary of Energy those specific measures that should be adopted to ensure that public health and safety are adequately protected. The Board shall include in its recommendations necessary changes in the content and implementation of such standards, as well as matters on which additional data or additional research is needed.

(2) Investigations

(A) The Board shall investigate any event or practice at a Department of Energy defense nuclear facility which the Board determines has adversely affected, or may adversely affect, public health and safety.

(B) The purpose of any Board investigation under subparagraph (A) shall be—

(i) to determine whether the Secretary of Energy is adequately implementing the standards described in paragraph (1) of the Department of Energy (including all applicable Department of Energy orders, regulations, and requirements) at the facility;

(ii) to ascertain information concerning the circumstances of such event or practice and its implications for such standards;

(iii) to determine whether such event or practice is related to other events or practices at other Department of Energy defense nuclear facilities; and

(iv) to provide to the Secretary of Energy such recommendations for changes in such standards or the implementation of such standards (including Department of Energy orders, regulations, and requirements) and such recommendations relating to data or research needs as may be prudent or necessary.

(3) Analysis of design and operational data

The Board shall have access to and may systematically analyze design and operational data, including safety analysis reports, from any Department of Energy defense nuclear facility.

(4) Review of facility design and construction

The Board shall review the design of a new Department of Energy defense nuclear facility before construction of such facility begins and shall recommend to the Secretary, within a reasonable time, such modifications of the design as the Board considers necessary to ensure adequate protection of public health and safety. During the construction of any such facility, the Board shall periodically review and monitor the construction and shall submit to the Secretary, within a reasonable time, such recommendations relating to the construction of that facility as the Board considers necessary to ensure adequate protection of public health and safety. An action of the Board, or a failure to act, under this paragraph may not delay or prevent the Secretary of Energy from carrying out the construction of such a facility.

(5) Recommendations

The Board shall make such recommendations to the Secretary of Energy with respect to Department of Energy defense nuclear facilities, including operations of such facilities, standards, and research needs, as the Board determines are necessary to ensure adequate protection of public health and safety. In making its recommendations the Board shall consider, and specifically assess risk (whenever sufficient data exists), the technical and economic feasibility of implementing the recommended measures.

(c) Excluded functions

The functions of the Board under this subchapter do not include functions relating to the safety of atomic weapons. However, the Board shall have access to any information on atomic weapons that is within the Department of Energy and is necessary to carry out the functions of the Board.

§ 2286b. Powers of Board [Atomic Energy Act, Sec. 313]

(a) Hearings

(1) The Board or a member authorized by the Board may, for the purpose of carrying out this subchapter, hold such hearings and sit and act at such times and places, and require, by subpoena or otherwise, the attendance and testimony of such witnesses and the production of such evidence as the Board or an authorized member may find advisable.

(2)(A) Subpoenas may be issued only under the signature of the Chairman or any member of the Board designated by him and shall be served by any person designated by the Chairman, any member, or any person as otherwise provided by law. The attendance of witnesses and the production of evidence may be required from any place in the United States at any designated place of hearing in the United States.

(B) Any member of the Board may administer oaths or affirmations to witnesses appearing before the Board.

(C) If a person issued a subpoena under paragraph (1) refuses to obey such subpoena or is guilty of contumacy, any court of the United States within the judicial district within which the hearing is conducted or within the judicial district within which such person is found or resides or transacts business may (upon application by the Board) order such person to appear before the Board to produce evidence or to give testimony relating to the matter under investigation. Any failure to obey such order of the court may be punished by such court as a contempt of the court.

(D) The subpoenas of the Board shall be served in the manner provided for subpoenas issued by a United States district court under the Federal Rules of Civil Procedure for the United States district courts.

(E) All process of any court to which application may be made under this section may be served in the judicial district in which the person required to be served resides or may be found.

(b) Staff

(1) The Board may, for the purpose of performing its responsibilities under this subchapter—

(A) in accordance with section 2286(c)(6) of this title, hire such staff as it considers necessary to perform the functions of the Board, including such scientific and technical personnel as the Board may determine necessary, but not more than the equivalent of 130 full-time employees;[3] and

(B) procure the temporary and intermittent services of experts and consultants to the extent authorized by section 3109(b) of title 5 at rates the Board determines to be reasonable.

(2) The authority and requirements provided in section 2201(d) of this title with respect to officers and employees of the Commission shall apply with respect to scientific and technical personnel hired under paragraph (1)(A).

(3)(A) The Board shall have an Executive Director of Operations who shall be appointed under section 2286(c)(6).

(B) The Executive Director of Operations shall report to the Chairman.

(C) The Executive Director of Operations shall be the senior employee of the Board Responsible for –

(i) general administration and technical matters;

(ii) ensuring that the members of the Board are fully and currently informed with respect to matters for which the members are responsible; and

(iii) the functions delegated by the Chairman pursuant to section 2286(c)(3)(B).

(4) Subject to the approval of the Board, the Chairman may organize the staff of the Board as the Chairman considers appropriate to best accomplish the mission of the Board described in section 2286a(a).

(c) Regulations

The Board may prescribe regulations to carry out the responsibilities of the Board under this subchapter.

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[3] "TEMPORARY PERSONNEL LEVELS.—During fiscal year 2020, the Defense Nuclear Facilities Safety Board shall employ not fewer than the equivalent of 100 full-time employees." National Defense Authorization Act for Fiscal Year 2020 § 2302(a)(5), Pub. L No. 116-92.

(d) Reporting requirements

The Board may establish reporting requirements for the Secretary of Energy which shall be binding upon the Secretary. The information which the Board may require the Secretary of Energy to report under this subsection may include any information designated as classified information, or any information designated as safeguards information and protected from disclosure under section 2167 or 2168 of this title.

(e) Use of Government facilities, etc.

The Board may, for the purpose of carrying out its responsibilities under this subchapter, use any facility, contractor, or employee of any other department or agency of the Federal Government with the consent of and under appropriate support arrangements with the head of such department or agency and, in the case of a contractor, with the consent of the contractor.

(f) Assistance from certain agencies of Federal Government

With the consent of and under appropriate support arrangements with the Nuclear Regulatory Commission, the Board may obtain the advice and recommendations of the staff of the Commission on matters relating to the Board's responsibilities and may obtain the advice and recommendations of the Advisory Committee on Reactor Safeguards on such matters.

(g) Assistance from organizations outside Federal Government

Notwithstanding any other provision of law relating to the use of competitive procedures, the Board may enter into an agreement with the National Research Council of the National Academy of Sciences or any other appropriate group or organization of experts outside the Federal Government chosen by the Board to assist the Board in carrying out its responsibilities under this subchapter.

(h) Resident inspectors

The Board may assign staff to be stationed at any Department of Energy defense nuclear facility to carry out the functions of the Board.

(i) Special studies

The Board may conduct special studies pertaining to adequate protection of public health and safety at any Department of Energy defense nuclear facility.

(j) Evaluation of information

The Board may evaluate information received from the scientific and industrial communities, and from the interested public, with respect to—

(1) events or practices at any Department of Energy defense nuclear facility; or

(2) suggestions for specific measures to improve the content of standards described in section 312(b)(1), the implementation of such standards, or research relating to such standards at Department of Energy defense nuclear facilities.

§ 2286c. Responsibilities of the Secretary of Energy [Atomic Energy Act, Sec. 314]

(a) Cooperation

Except as specifically provided by this section, the Secretary of Energy shall fully cooperate with the Board and provide the Board with prompt and unfettered access to such facilities, personnel, and information as the Board considers necessary to carry out its responsibilities under this subchapter. Each contractor operating a Department of Energy defense nuclear facility under a contract awarded by the Secretary shall, to the extent provided in such contract or otherwise with the contractor's consent, fully cooperate with the Board and provide the Board with prompt and unfettered access to such facilities, personnel, and information of the contractor as the Board considers necessary to carry out its responsibilities under this subchapter. The access provided to defense nuclear facilities, personnel, and information under this subsection shall be provided without regard to the hazard or risk category assigned to a facility by the Secretary.

(b) Authority of the Secretary to deny information

(1) The Secretary of Energy may deny access to information under subsection (a) only to any person who—

(A) has not been granted an appropriate security clearance or access authorization by the Secretary; or

(B) does not need such access in connection with the duties of such person.

(2) If the Board requests access to information under subsection (a) in written form, and the Secretary denies access to such information pursuant to paragraph (1)—

(A) the Secretary shall provide the Board notice of such denial in written form; and

(B) not later than January 1 and July 1 of each year beginning in 2020—

(i) the Board shall submit to the congressional defense committees a report identifying each request for access to information under subsection (a) submitted to the Secretary in written form during the preceding six-month period and denied by the Secretary; and

(ii) the Secretary shall submit to the congressional defense committees a report identifying—

(I) each such request denied by the Secretary during that period; and

(II) the reason for the denial.

(3) In this subsection, the term ‘congressional defense committees’ has the meaning given that term in section 101(a) of title 10, United States Code.

(c) Application of nondisclosure protections by Board.

The Board may not publicly disclose information provided under this section if such information is otherwise protected from disclosure by law, including deliberative process information.

§ 2286d. Board Recommendations [Atomic Energy Act, Sec. 315]

(a) Submission of Recommendations

(1) Subject to subsections (h) and (i), not later than 30 days before the date on which the Board transmits a recommendation to the Secretary of Energy under section 312, the Board shall transmit to the Secretary in writing a draft of such recommendation and any related findings, supporting data, and analysis to ensure the Secretary is adequately informed of a formal recommendation and to provide the Secretary an opportunity to provide input to the Board before such recommendation is finalized.

(2) The Secretary may provide to the Board comments on a draft recommendation transmitted by the Board under paragraph (1) by not later than 30 days after the date on which the Secretary receives the draft recommendation. The Board may grant, upon request by the Secretary, additional time for the Secretary to transmit comments to the Board.

(3) After the period of time in which the Secretary may provide comments under paragraph (2) elapses, the Board may transmit a final recommendation to the Secretary.

(b) Public availability and comment

Subject to subsections (h) and (i), after the Secretary of Energy receives a recommendation from the Board under subsection (a)(3), the Board shall promptly make available to the public such recommendation and any related correspondence from the Secretary by—

(1) providing such recommendation and correspondence to the public in the regional public reading rooms of the Department of Energy; and

(2) publishing in the Federal Register—

(A) such recommendation and correspondence; and

(B) a request for the submission to the Board of public comments on such recommendation that provides interested persons with 30 days after the date of the publication in which to submit comments, data, views, or arguments to the Board concerning the recommendation.

(c) Response by Secretary

(1) The Secretary of Energy shall transmit to the Board, in writing, a statement on whether the Secretary accepts or rejects, in whole or in part, the recommendations submitted to him by the Board under section 2286a of this title, a description of the actions to be taken in response to the recommendations, and his views on such recommendations. The Secretary of Energy shall transmit his response to the Board within 45 days after the date of the publication, under subsection (b), of the notice with respect to such recommendations or within such additional period, not to exceed 45 days, as the Board may grant.

(2) At the same time as the Secretary of Energy transmits his response to the Board under paragraph (1), the Secretary, subject to subsection (i), shall publish such response, together with a request for public comment on his response, in the Federal Register.

(3) Interested persons shall have 30 days after the date of the publication of the Secretary of Energy's response in which to submit comments, data, views, or arguments to the Board concerning the Secretary's response.

(4) The Board may hold hearings for the purpose of obtaining public comments on its recommendations and the Secretary of Energy's response.

(d) Provision of information to Secretary

The Board shall furnish the Secretary of Energy with copies of all comments, data, views, and arguments submitted to it under subsection (b) or (c) of this section.

(e) Final decision

If the Secretary of Energy, in a response under subsection (c)(1), rejects (in whole or part) any recommendation made by the Board under section 2286a of this title, the Board shall either reaffirm its original recommendation or make a revised recommendation and shall notify the Secretary of its action. Within 30 days after receiving the notice of the Board's action under this subsection, the Secretary shall consider the Board's action and make a final decision on whether to implement all or part of the Board's recommendations. Subject to subsection (i), the Secretary shall publish the final decision and the reasoning for such decision in the Federal Register and shall transmit to the Committees on Armed Services, Appropriations, and Energy and Commerce of the House of Representatives and the Committees on Armed Services, Appropriations, and Energy and Natural Resources of the Senate a written report containing that decision and reasoning.

(f) Implementation plan

The Secretary of Energy shall prepare a plan for the implementation of each Board recommendation, or part of a recommendation, that is accepted by the Secretary in his final decision. The Secretary shall transmit the implementation plan to the Board within 90 days after the date of the publication of the Secretary's final decision on such recommendation in the

Federal Register. The Secretary may have an additional 45 days to transmit the plan if the Secretary submits to the Board and to the Committees on Armed Services, Appropriations, and Energy and Commerce of the House of Representatives and the Committees on Armed Services, Appropriations, and Energy and Natural Resources of the Senate a notification setting forth the reasons for the delay and describing the actions the Secretary is taking to prepare an implementation plan under this subsection. The Secretary may implement any such recommendation (or part of any such recommendation) before, on, or after the date on which the Secretary transmits the implementation plan to the Board under this subsection.

(g) Implementation

(1) Subject to paragraph (2), not later than one year after the date on which the Secretary of Energy transmits an implementation plan with respect to a recommendation (or part thereof) under subsection (f), the Secretary shall carry out and complete the implementation plan. If complete implementation of the plan takes more than 1 year, the Secretary of Energy shall submit a report to the Committees on Armed Services, Appropriations, and Energy and Commerce of the House of Representatives and the Committees on Armed Services, Appropriations, and Energy and Natural Resources of the Senate setting forth the reasons for the delay and when implementation will be completed.

(2) If the Secretary of Energy determines that the implementation of a Board recommendation (or part thereof) is impracticable because of budgetary considerations, or that the implementation would affect the Secretary's ability to meet the annual nuclear weapons stockpile requirements established pursuant to section 2121 of this title, the Secretary shall submit to the President, and to such committees a report containing the recommendation and the Secretary's determination.

(h) Imminent or severe threat

(1) In any case in which the Board determines that a recommendation submitted to the Secretary of Energy under section 2286a of this title relates to an imminent or severe threat to public health and safety, the Board and the Secretary of Energy shall proceed under this subsection in lieu of subsections (a) through (e) of this section.

(2) At the same time that the Board transmits a recommendation relating to an imminent or severe threat to the Secretary of Energy, the Board shall also transmit the recommendation to the President and for information purposes to the Secretary of Defense. The Secretary of Energy shall submit his recommendation to the President. The President shall review the Secretary of Energy's recommendation and shall make the decision concerning acceptance or rejection of the Board's recommendation.

(3) After receipt by the President of the recommendation from the Board under this subsection, the Board promptly shall make such recommendation available to the public and shall transmit such recommendation to the Committees on Armed Services, Appropriations, and Energy and Commerce of the House of Representatives and the Committees on Armed

Services, Appropriations, and Energy and Natural Resources of the Senate. The President shall promptly notify such committees of his decision and the reasons for that decision.

(i) Limitation

Notwithstanding any other provision of this section, the requirements to make information available to the public under this section—

(1) shall not apply in the case of information that is classified; and

(2) shall be subject to the orders and regulations issued by the Secretary of Energy under sections 2167 and 2168 of this title to prohibit dissemination of certain information.

§ 2286e. Reports [Atomic Energy Act, Sec. 316]

(a) Board report[4]

(1) The Board shall submit to the Committees on Armed Services, Appropriations, and Energy and Commerce of the House of Representatives and the Committees on Armed Services, Appropriations, and Energy and Natural Resources of the Senate each year, at the same time that the President submits the budget to Congress pursuant to section 1105(a) of Title 31, a written report concerning its activities under this subchapter, including all recommendations made by the Board, during the year preceding the year in which the report is submitted. The Board may also issue periodic unclassified reports on matters within the Board's responsibilities.

(2) The annual report under paragraph (1) shall include an assessment of—

(A) the improvements in the safety of Department of Energy defense nuclear facilities during the period covered by the report;

(B) the improvements in the safety of Department of Energy defense nuclear facilities resulting from actions taken by the Board or taken on the basis of the activities of the Board; and

(C) the outstanding safety problems, if any, of Department of Energy defense nuclear facilities.

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[4] *Certification of Budget Sufficiency* - The National Defense Authorization Act for Fiscal Year 2018 § 2301(b), Pub. L. No. 115-91, provided that: "Not later than 10 days after the date on which the budget of the President for fiscal year 2019 or any fiscal year thereafter is submitted to Congress pursuant to section 1105(a) of title 31, United States Code, the Defense Nuclear Facilities Safety Board shall submit to the congressional defense committees a letter certifying that the requested budget is sufficient to carry out the mission of the Defense Nuclear Facilities Safety Board during the fiscal year covered by the budget request."

(b) DOE report

The Secretary of Energy shall submit to the Committees on Armed Services, Appropriations, and Energy and Commerce of the House of Representatives and the Committees on Armed Services, Appropriations, and Energy and Natural Resources of the Senate each year, at the same time that the President submits the budget to Congress pursuant to section 1105(a) of Title 31, a written report concerning the activities of the Department of Energy under this subchapter during the year preceding the year in which the report is submitted.

§ 2286f. Judicial review [Atomic Energy Act, Sec. 317]

Chapter 7 of Title 5 shall apply to the activities of the Board under this subchapter.

§ 2286g. "Department of Energy defense nuclear facility" defined [Atomic Energy Act, Sec. 318]

As used in this subchapter, the term "Department of Energy defense nuclear facility" means any of the following:

(1) A production facility or utilization facility (as defined in section 2014 of this title) that is under the control or jurisdiction of the Secretary of Energy and that is operated for national security purposes, but the term does not include—

(A) any facility or activity covered by Executive Order No. 12344, dated February 1, 1982 [42 U.S.C. § 7158 note], pertaining to the Naval nuclear propulsion program;

(B) any facility or activity involved with the transportation of nuclear explosives or nuclear material;

(C) any facility that does not conduct atomic energy defense activities; or

(D) any facility owned by the United States Enrichment Corporation.

(2) A nuclear waste storage facility under the control or jurisdiction of the Secretary of Energy, but the term does not include a facility developed pursuant to the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101 et seq.) and licensed by the Nuclear Regulatory Commission.

§ 2286h. Contract Authority Subject to Appropriations [Atomic Energy Act, Sec. 319]

The authority of the Board to enter into contracts under this subchapter is effective only to the extent that appropriations (including transfers of appropriations) are provided in advance for such purpose.

§ 2286h-1. Transmittal of Certain Information to Congress **[Atomic Energy Act, Sec. 320]**

Whenever the Board submits or transmits to the President or the Director of the Office of Management and Budget any legislative recommendation, or any statement or information in preparation of a report to be submitted to the Committees on Armed Services, Appropriations, and Energy and Commerce of the House of Representatives and the Committees on Armed Services, Appropriations, and Energy and Natural Resources of the Senate pursuant to section 2286e(a) of this title, the Board shall submit at the same time a copy thereof to such committees.

§ 2286i. Annual Authorization of Appropriations **[Atomic Energy Act, Sec. 321]**

Authorizations of appropriations for the Board for fiscal years beginning after fiscal year 1989 shall be provided annually in authorization Acts.

§ 2286j. Inspector general services for Defense Nuclear Facilities Safety Board[5]

Within 90 days of enactment of this Act [enacted Dec. 23, 2011], the Defense Nuclear Facilities Safety Board shall enter into an agreement for inspector general services with the Office of Inspector General for the Nuclear Regulatory Commission for fiscal years 2012 and 2013: *Provided further,* That at the expiration of such agreement, the Defense Nuclear Facilities Safety Board shall procure inspector general services annually thereafter.

§ 2286k. Inspector General **[Atomic Energy Act, Sec. 322]**

(a) In general

The Inspector General of the Nuclear Regulatory Commission shall serve as the Inspector General of the Board, in accordance with the Inspector General Act of 1978 (5 U.S.C. App.).

(b) Budget

In the budget materials submitted to the President by the Board in connection with the submission to Congress, pursuant to section 1105 of title 31, United States Code, of the budget for each fiscal year, the Board shall ensure that a separate, dedicated procurement line item is designated for the services of an Inspector General under subsection (a).

§ 2286l. Authority of Inspector General

Notwithstanding any other provision of law, the Inspector General of the Nuclear Regulatory Commission is authorized in this and subsequent years to exercise the same authorities with respect to the Defense Nuclear Facilities Safety Board, as determined by the Inspector General of the Nuclear Regulatory Commission, as the Inspector General exercises under the Inspector General Act of 1978 (5 U.S.C. App.) with respect to the Nuclear Regulatory Commission.

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[5] Sections 2286j and 2286l were added to the United States Code by appropriations acts and are not part of the Atomic Energy Act of 1954. Consolidated and Further Continuing Appropriations Act, 2015, Pub. L. No. 113-235; Consolidated Appropriations Act, 2012, Pub. L. No. 112-74.

Our Mission

The mission of the Board shall be to provide independent analysis, advice, and recommendations to the Secretary of Energy to inform the Secretary, in the role of the Secretary as operator and regulator of the defense nuclear facilities of the Department of Energy, in providing adequate protection of public health and safety at such defense nuclear facilities.

The Board is composed of five respected experts in the field of nuclear safety with demonstrated competence and knowledge relevant to its independent investigative and oversight functions. The Congress established the Board in September 1988 in response to growing concerns about the level of health and safety protection that DOE was providing the public and workers at defense nuclear facilities. In so doing, Congress sought to provide the general public with added assurance that DOE's defense nuclear facilities are being safely designed, constructed, operated, and decommissioned.

DOE Defense Nuclear Sites

Name	Primary Function	State	Status
Fernald Closure Project	Former Uranium processing plant	Ohio	Closure Project
Hanford	Plutonium Production for WWII and Cold War Operations	Washington	Active
Idaho National Laboratory	Research and development under the DOE Office of Nuclear Energy and major waste retrieval and remediation activities under the DOE Office of Environmental Management.	Idaho	Active
Lawrence Livermore National Laboratory	Stewardship of the U.S. nuclear weapons stockpile is the foremost responsibility of the Lawrence Livermore National Laboratory (LLNL).	California	Active
Los Alamos National Laboratory	Primary responsibility is ensuring the safety, security, and reliability of the nation's nuclear deterrent.	New Mexico	Active
Mound	To process development, production engineering, manufacturing, surveillance, and evaluation of explosive components for the U.S. nuclear defense stockpile	Ohio	Closure Project
Nevada National Security Site	Support the nation's nuclear stockpile, including storage, assessment, disposal and testing, if it were to be resumed.	Nevada	Active
Pantex	To maintain the safety and security of the nation’s nuclear weapons stockpile.	Texas	Active
Rocky Flats Environmental Technology Site	Production of nuclear and nonnuclear weapons components for the nation's nuclear arsenal.	Colorado	Closure Project
Sandia National Laboratories	Ensuring the U.S. nuclear arsenal is safe, secure, and reliable through six mission areas: nuclear weapons; nonproliferation; homeland security and defense; energy and infrastructure assurance; defense systems and assurance; and science, technology, and engineering.	New Mexico	Active
Savannah River Site	Environmental cleanup, waste management, disposition of nuclear materials, and tritium operations in support of nuclear weapon programs.	South Carolina	Active
Waste Isolation Pilot Plant	The mission of the Carlsbad Field Office (CBFO) is to protect human health and the environment by operating the Waste Isolation Pilot Plant (WIPP) for the safe disposal of Transuranic (TRU) waste and by	New Mexico	Active

Name	Primary Function	State	Status
	establishing an effective system for management of TRU waste from generation to disposal.		
West Valley Demonstration Project	The Western New York Nuclear Service Center (WNYNSC) is comprised of approximately 3,300 acres approximately 35 miles south of Buffalo, New York. The site, which is managed by New York State Energy Research and Development Authority (NYSERDA) on behalf of the State of New York, was the home of the nation's only commercial nuclear fuel reprocessing facility.	New York	Closure Project
Y-12 National Security Complex / Oak Ridge National Laboratory	Uranium Component Manufacturing and Storage. Research and Development.	Tennessee	Active

DATE: November 16, 2020

98 positions on board;
1 positions EOD TBA.
2 position FY21 TBA.

*TOTAL 14 Vacancies
Board - 2 positions
OTD - 7 positions
OGM - 4 positions
OGC - 1 position
Total 115 FTE authorized.

FOR OFFICIAL USE ONLY

DEFENSE NUCLEAR FACILITIES SAFETY BOARD
OFFICE OF THE CHAIRMAN

(Acting) CHAIRMAN—THOMAS SUMMERS
BOARD MEMBER—JESSIE H. ROBERSON
BOARD MEMBER—JOYCE L. CONNERY BOARD MEMBER—(FILL)
BOARD MEMBER - (FILL)

Ngozi Butler-Guerrier
EEO DIRECTOR

JAMES P. BIGGINS
Special Assistant
to the Chairman

EDO (ES)
(TBA)

OFFICE OF THE GENERAL MANAGER
GLENN E. SKLAR
GENERAL MANAGER

DEPUTY GENERAL MANAGER
Toni Reddish

Tara Tadlock
Manager of Board Operations

Donita Vines
Exec. Office Asst.

Dana Hienz
Exec. Office Asst.

Rosalind Howard
Management Analyst

DIVISION OF INFORMATION TECHNOLOGY (DIT)

Scott Lee (TBA)
CIO Director

Jeremy Bingham
IT Specialist

Elizabeth L. Smith
IT Specialist

Brian Hamilton
IT Specialist

Barry Breland
IT Specialist

DIVISION OF OPERATIONAL SERVICES (DOS)

FILL
Division Director

Kim K. Knight
Security Specialist

Jeremy D. Parmer
Security Specialist

Nathaniel B. Melvin
Facilities Operations Specialist

Patricia Cuff
Contract Specialist

FILL Contract Specialist

DIVISION OF ACQUISITION AND FINANCE (DAF)

FILL
Division Director

Hyun Woo
Budget Analyst

Vera L. Johnson
Financial Management Specialist

Gwendolyn Archer-Pailen
Program Support Specialist

DIVISION OF HUMAN RESOURCES (DHR)

VANESSA. PROUT
Division Director

Deborah Bisciegliа
Assco. Director

Veronica McCray
HR Specialist

Paul Owens Sr.
HR Specialist

FILL
HR Specialist

Engineers

FILL (4)

(b) (6) [redacted]

OFFICE OF THE TECHNICAL DIRECTOR
(b) (6) [redacted]
TECHNICAL DIRECTOR

KATHERINE R. HERRERA
DEPUTY TECHNICAL DIRECTOR

(b) (6) [redacted]
Senior Advisor

(b) (6) [redacted]
Assoc. Technical Director
Nuclear Programs and Analysis
(NPA)

(b) (6) [redacted] (Acting)
SUP. ENGINEER ENGINEERS (ANALYSIS)
(b) (6) [redacted]

(b) (6) [redacted] S
(Acting)
SUP. ENGINEER ENGINEERS (DESIGN)
(b) (6) [redacted]

(b) (6) [redacted]
Assoc. Technical Director
Nuclear Weapon Programs
(NWP)

ENGINEERS
(b) (6) [redacted]

RESIDENT INSPECTORS
(b) (6) [redacted]

FILL (1)
RESIDENT INSPECTOR (LANL)

(b) (6) [redacted]
Assoc. Technical Director
Nuclear Materials
Processing & Stabilization
(NMPS)

ENGINEERS
(b) (6) [redacted]

RESIDENT INSPECTORS
(b) (6) [redacted]

FILL (2)
RESIDENT INSPECTORS
(HFD & SRS)

OFFICE OF THE GENERAL COUNSEL
KEVIN LYSKOWSKI GENERAL COUNSEL

FILL(1)
DEPUTY GENERAL

Joseph Gilman
(Acting)
DEPUTY GENERAL

Eric F. Fox
Associate General Counsel

Patricia Hargrave
Associate General Counsel

ON HOLD
SL

Peter S. Winokur, Chairman
Jessie H. Roberson, Vice Chairman
John E. Mansfield
Joseph F. Bader

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

May 9, 2012

The Honorable Steven Chu
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Chu:

On May 9, 2012 the Defense Nuclear Facilities Safety Board (Board), in accordance with 42 U.S.C. § 2286a(a)(5), unanimously approved Recommendation 2012-1, *Savannah River Site Building 235-F Safety*, which is enclosed for your consideration. This Recommendation identifies the need to execute actions that can reduce the hazards associated with the material at risk that remains as residual contamination within Building 235-F.

After you have received this Recommendation and as required by 42 U.S.C. § 2286d(a), the Board will promptly make it available to the public. The Board believes that this Recommendation contains no information that is classified or otherwise restricted. To the extent that this Recommendation does not include information restricted by the Department of Energy (DOE) under the Atomic Energy Act of 1954, 42 U.S.C. §§ 2161-2168, as amended, please arrange to have it placed promptly on file in your regional public reading rooms. The Board will also publish this Recommendation in the *Federal Register*.

The Board will evaluate DOE's response to this Recommendation in accordance with the Board's Policy Statement 1, *Criteria for Judging the Adequacy of DOE Responses and Implementation Plans for Board Recommendations*.

Sincerely,

Peter S. Winokur, Ph.D.
Chairman

Enclosure

c: Mr. David Huizenga
Dr. David C. Moody, III
Mrs. Mari-Jo Campagnone

RECOMMENDATION 2012-1 TO THE SECRETARY OF ENERGY
Savannah River Site Building 235-F Safety
Pursuant to 42 U.S.C. § 2286a(a)(5),
Atomic Energy Act of 1954, As Amended

Dated: May 9, 2012

Background

The Defense Nuclear Facilities Safety Board (Board) believes that the Department of Energy (DOE) needs to take action to remove and/or immobilize the residual contamination within Building 235-F because of the potential dose consequences to collocated workers and the public. Furthermore, the Board believes that DOE must also take near-term action to more effectively prevent a major fire in Building 235-F.

Building 235-F at the Savannah River Site (SRS) houses several partially deactivated processing lines including the Plutonium Fuel Form (PuFF) facility, Actinide Billet Line, Plutonium Experimental Facility, and the old metallography lab glovebox. Building 235-F no longer has a DOE mission. It is currently operated in a surveillance and maintenance mode and is normally unoccupied.

With the exception of residual contamination, Building 235-F has been de-inventoried of special nuclear material. The remaining residual contamination is the principal hazard posed by Building 235-F and includes a significant quantity of plutonium-238 (Pu-238). More than 95 percent of the Pu-238 is located in the PuFF facility; approximately 82 percent is concentrated in 2 of the 9 PuFF facility cells. It should be noted that the residual Pu-238 contamination is a fine ball-milled powder that is in a highly dispersible form, which increases the potential dose consequences associated with a radiological release.

The responsible SRS contractor, Savannah River Nuclear Solutions (SRNS), has determined that the unmitigated consequences of a seismically-induced full-facility fire are greater than 10 rem offsite and 27,000 rem to the collocated worker at 100 meters. F-Area routinely has more than a thousand site workers who are normally in the facilities, construction sites, and trailers located adjacent to Building 235-F. Some of the trailers that house workers are located within the Building 235-F fence line.

While DOE does not conduct any operations within Building 235-F, fires could start inside the building if energized electrical equipment or wiring failed or was damaged during a seismic or other natural hazard event. Electrical sparks or heat from electrical equipment could ignite adjacent combustible material. Two of the key preventive controls for fire scenarios are eliminating potential ignition sources and controlling the amount of combustibles. In September 2011, during a walkdown of Building 235-F, the Board's staff identified a significant quantity of transient and fixed combustibles and unnecessary electrical equipment that had not been air gapped. DOE has taken action to remove the transient combustible material and to limit access to Building 235-F. However, no actions are currently planned to remove the fixed combustibles or unneeded electrical equipment.

In the event of a fire, Building 235-F has several vulnerabilities. First, the Building 235-F fire detection system is not credited, does not provide complete coverage, nor is the building normally occupied; consequently, a fire could smolder and burn undetected. Second, Building 235-F does not have a fire suppression system to prevent an incipient stage fire from growing into a room fire. Third, Building 235-F does not have fire barriers with a qualified fire rating to prevent the spread of a fire to adjacent rooms. The Building 235-F Fire Hazards Analysis notes that the subdividing walls and floors are in many places incomplete or penetrated and are not adequately sealed to achieve a qualified fire rating. In addition, some of the existing walls contain cellulose, which is combustible and could allow a room fire to spread to other portions of the building. Fourth, the absence of standpipes or hose connections inhibits the ability of the fire department to fight a fire inside Building 235-F. To combat a fire, firefighters would need to prop open the exterior doors to allow the passage of fire hoses; this would allow smoke and firewater, potentially contaminated with radioactive material, into the environment.

The July 2011 draft of the Basis for Interim Operations (BIO), prepared by SRNS notes that the Building 235-F structure can only provide limited confinement during or following a seismic event because seismically-induced building cracks may develop. Consequently, the building structure cannot be credited as a control to prevent a post-seismic unfiltered release. In 2010, DOE took action to improve the safety posture of Building 235-F by reducing the height of the abandoned stack located adjacent to the building. The contractor's structural analysis indicated that the concrete stack, prior to the height reduction, could have collapsed onto Building 235-F during a seismic event causing significant structural damage.

In addition to fires, loss of confinement accidents could also release radioactive material. For instance, a release could be caused by a breach of the confinement or the ventilation system during a seismic event. However, the Building 235-F confinement ventilation system cannot be relied upon to continue to perform its safety function during or following a seismic event. The draft BIO states that non-load-bearing building elements may fail during a Performance Category-3 seismic event, resulting in impact damage to safety-related structures, systems, and components such as ventilation ducts. The draft BIO states that the metal ventilation ducts may leak after an earthquake because they are not completely welded and that the concrete roof exhaust tunnel may develop cracks.

Loss of confinement can be caused by degraded equipment. The deteriorated condition of the PuFF facility was noted in an October 1991 report by DOE's Office of Nuclear Safety,[1] which identified as an issue the integrity of elastomer seals that form part of the confinement boundaries inside Building 235-F. In addition to degradation with age, these elastomer seals also degrade with exposure to Pu-238. Although identified two decades ago, this issue remains. The cells have numerous penetrations (e.g., glove ports, viewing windows, ventilation supply and

[1] U.S. Department of Energy, 1991, *Report of an Investigation into the Deterioration of the Plutonium Fuel Form Fabrication Facility (PuFF) at the DOE Savannah River Site*, DOE/-NS-0002P, http://www.osti.gov/bridge/servlets/purl/6246281-tBgi3H/6246281.pdf.

exhaust, utility services). In the draft BIO, SRNS stated that "the [elastomer] seals around the cell and glovebox penetrations are expected to be in a degraded condition due to the years of operation in a radiation environment." The continued deterioration of the elastomer seals increases the potential for the spread of the contamination outside of the cells. Even under normal operations, a loss of confinement from these cells would greatly increase the complexity and hazard associated with decontamination and decommissioning of Building 235-F.

DOE conducted a small fire drill at Building 235-F in December 2011, which simulated a minor radiological release. While DOE conducts periodic drills, DOE has not conducted a Building 235-F radiological drill involving the adjacent Mixed Oxide Fuel Fabrication Facility or Waste Solidification Building construction sites to examine how these facilities would respond to a significant radiological release from Building 235-F. In the event of a significant radiological release, the amount of mitigation provided by sheltering in place may not be sufficient to protect nearby workers. This is especially true for seismically-induced fires, since the same seismic event may also damage nearby trailers and administrative buildings.

The Board has previously identified the need to address the residual contamination in Building 235-F. In a June 12, 2003, letter to the Secretary of Energy, the Board noted that the risk associated with several hazards in Building 235-F, including the Pu-238 residual contamination, had been accepted rather than eliminated. The report enclosed with the June letter further noted that DOE should consider decontaminating areas with residual contamination to reduce the risk associated with a potential release. Since that time, DOE has on a number of occasions evaluated options and developed plans to address the residual contamination. However, these efforts have not successfully transitioned from planning to execution, and the residual contamination and the hazard it poses still remain in Building 235-F.

Conclusion

The Board believes that due to the potential dose consequences to collocated workers and the public, it is unacceptable for the residual contamination within Building 235-F to continue to remain unaddressed.

Recommendation

Given the continuing hazard posed by Building 235-F as detailed above, the Board recommends that DOE:

1. Take action to immobilize and/or remove the Pu-238 that remains as residual contamination within Building 235-F.

2. Concurrent with sub-Recommendation 1, take near-term actions and implement compensatory measures to improve the safety posture of Building 235-F and reduce the potential for and severity of a radiological release, including but not limited to the following.

a. To the extent feasible, remove from Building 235-F all transient and fixed combustibles that are not directly necessary for surveillance and maintenance activities and ensure that the transient combustible loading in the facility remains as low as reasonably achievable.

b. Ensure that all electrical equipment not necessary to support facility safety systems, life safety, or surveillance and maintenance activities is de-energized and air gapped. Remove all electrical and support equipment remaining within former process areas that is not necessary for surveillance and maintenance.

c. Evaluate the condition and operability of early detection and alarm systems in the PuFF facility, such as the heat and smoke detectors (with the exception of those located within the PuFF facility cells, if evaluating them would require intrusion into the cells). Take action, as necessary, to ensure that these systems are credited in the safety basis, are remotely monitored, provide reliable detection of hazards, and are maintained in accordance with National Fire Protection Association 72, *National Fire Protection Alarm and Signaling Code.*

3. Concurrent with sub-Recommendation 1, take action to ensure that the SRS emergency response to a radiological release from Building 235-F is adequate and effective, including but not limited to the following.

   a. Ensure that an integrated emergency response plan is in place that considers the collocated workers in facilities, construction sites, and trailers located adjacent to Building 235-F. Development of this plan should include an evaluation of the specific locations where collocated workers are directed to shelter in place to ensure their adequate protection during and following a potential radiological release from Building 235-F.

   b. Ensure that periodic coordinated drills in response to a simulated event at Building 235-F are conducted. Such drills should include appropriate response actions by personnel in the adjacent facilities and construction sites, such as sheltering in place or evacuating depending on proximity to the simulated plume of radioactive material.

The Board urges the Secretary to avail himself of the authority under the Atomic Energy Act (42 U.S.C. § 2286d(e)) to "implement any such recommendation (or part of any such recommendation) before, on, or after the date on which the Secretary transmits the implementation plan to the Board under this subsection."

Peter S. Winokur, Ph.D., Chairman

Timeline (2012 - 2020)

2020

June 22, 2020
DOE Letter Notifying all Actions Completed for Recommendation 2012-1 IP

June 3, 2020
DOE Revised IP for Recommendation 2012-1

2019

December 19, 2019
DOE Letter Transmitting Implementation Plan Annual Report (FY 2019) for Board Recommendation 2012-1

2018

December 21, 2018
DOE Letter Transmitting Implementation Plan Annual Report (FY 2018) for Board Recommendation 2012-1

August 14, 2018
Board letter providing its evaluation of DOE's progress on Recommendation 2012-1

2017

December 15, 2017
DOE Letter Transmitting Implementation Plan Annual Report (FY 2017) for Board Recommendation 2012-1

2016

December 21, 2016
DOE Letter Transmitting Implementation Plan Annual Report (FY 2016) for Board Recommendation 2012-1

January 28, 2016
DOE letter transmitting deliverable for Action 1-3 (Restore cell infrastructure in Plutonium fuel Form cells 6 through 9) of the Implementation Plan for Recommendation 2012-1, Savannah River Site Building 235-F Safety

January 15, 2016
DOE response to Board letter of November 10, 2015, documenting the anticipated scope and schedule for Building 235-F risk reduction activities in fiscal years 2016 and 2017, to support the Implementation Plan (IP) for Recommendation 2012-1

2015

December 22, 2015

Transmittal of Recommendation 2012-1 Implementation Plan Annual Report for Fiscal Year 2015

November 10, 2015

Recommendation 2012-1 Implementation Plan Progress

July 29, 2015

Update on the Progress of Activities to Meet Recommendations 2012-1, Savannah River Site Building 235-F Safety, Implementation Plan (IP) Deliverables 1-3 and 1-4

March 9, 2015

Recommendation 2012-1 Implementation Plan Changes

February 2, 2015

DOE Transmittal of Board Recommendation 2012-1 Implementation Plan Action 2c-3

2014

December 31, 2014

DOE transmittal of the DOE Recommendation 2012-1 Implementation Plan (IP) for Fiscal Year 2014

November 28, 2014

DOE Letter Providing a Summary of Changes for the Remaining Actions and Deliverables in DOE's Implementation Plan for Board Recommendation 2012-1, Savannah River Site (SRS) Building 235-F Safety

2013

December 23, 2013

DOE Transmittal of Deliverable 1-2 of the Implementation Plan (IP) for Recommendation 2012-1, Savannah River Site Building 235-F Safety

August 29, 2013

DOE Transmittal of Deliverable 3-4 of the Implementation Plan (IP) for Board Recommendation 2012-1, Savannah River Site Building 235-F Safety

May 30, 2013

DOE Transmittal of Deliverable 1.1 of the Implementation Plan for Recommendation 2012-1, Savannah River Site Building 235-F Safety

April 16, 2013

Board Reserves Acceptance of the Implementation Plan (IP) for Recommendation 2012-1, Savannah River Site Building 235-F Safety, until Receipt and Review of the Building 235-F Deactivation Plan

April 3, 2013
DOE Transmittal of Deliverable 3-3 of the Implementation Plan for Recommendation 2012-1, Savannah River Site Building 235-F Safety

April 1, 2013
DOE Transmittal of Deliverable 2c-2 of the Implementation Plan for Recommendation 2012-1, Savannah River Site Building 235-F Safety

March 22, 2013
DOE Transmittal of Deliverable 2B-1 of the Implementation Plan for Recommendation 2012-1, Savannah River Site Building 235-F Safety

March 4, 2013
DOE Transmittal of Implementation Plan (IP) Deliverable 2A-2 for Recommendation 2012-1, Savannah River Site Building 235-F Safety

February 28, 2013
DOE Transmittal of Implementation Plan (IP) Deliverable 3-2 for Board Recommendation 2012-1, Savannah River Site Building 235-F Safety

February 13, 2013
DOE Transmittal of Implementation Plan (IP) Deliverable 2a-1 for Board Recommendation 2012-1, Savannah River Site Building 235-F Safety

January 31, 2013
DOE Transmittal of Implementation Plan (IP) Deliverable 3-1 for Board Recommendation 2012-1, Savannah River Site Building 235-F Safety

2012

December 7, 2012
DOE Implementation Plan Due

December 5, 2012
DOE Implementation Plan for Recommendation 2012-1

October 19, 2012
DOE will take an Extension of 45 days to Complete the Implementation Plan for Board Recommendation 2012-1, Savannah River Site Building 235-F Safety

August 24, 2012
Public Comment on DOE Response Due

July 25, 2012
DOE Response Printed in Federal Register

July 10, 2012
DOE Response Received

July 5, 2012
DOE Response Due

June 20, 2012
Public Comment Due

May 21, 2012
Recommendation Printed in Federal Register

May 9, 2012
Recommendation Delivered to DOE

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

February 20, 2019

The Honorable James Richard Perry
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Perry:

On January 28, 2019, the Defense Nuclear Facilities Safety Board received the NNSA Administrator's response to Draft Recommendation 2018-1, *Uncontrolled Hazard Scenarios and 10 CFR 830 Implementation at the Pantex Plant*. The Board considered the NNSA Administrator's response and appreciates the actions DOE/NNSA is taking. We welcome the offer for DOE/NNSA to brief us regarding the improvement actions taken in 2018 and planned for 2019. We will schedule this briefing once the disposition of the Recommendation is finalized. The information contained in the NNSA Administrator's response does not, however, obviate the need for the Recommendation, because the Board concludes there remains an issue of adequate protection. On February 19, 2019, the Board—in accordance with 42 U.S.C. § 2286d(a)(3)—approved Recommendation 2019-1, which is enclosed for your consideration. Recommendation 2019-1 concerns uncontrolled hazard scenarios and Title 10, Code of Federal Regulations, Part 830, *Nuclear Safety Management*, implementation at the Pantex Plant.

After you have received this Recommendation, and as required by 42 U.S.C. § 2286d(b), the Board will promptly make the Recommendation and any related Secretarial correspondence available to the public. The Board believes that Recommendation 2019-1, its supporting documentation, and risk assessment contain no information that is classified or otherwise restricted by the DOE under the Atomic Energy Act of 1954, as amended. Please arrange to have this Recommendation and any related Secretarial correspondence placed promptly on file in your regional public reading rooms. The Board will also publish this Recommendation in the Federal Register.

The Board will evaluate DOE's response to this Recommendation in accordance with the Board's Policy Statement 1, *Criteria for Judging the Adequacy of DOE Responses and Implementation Plans for Board Recommendations.*

Yours truly,

Bruce Hamilton

Bruce Hamilton
Chairman

Enclosures

c: Mr. Joe Olencz

RECOMMENDATION 2019-1 TO THE SECRETARY OF ENERGY
Uncontrolled Hazard Scenarios and 10 CFR 830 Implementation at the Pantex Plant
Pursuant to 42 U.S.C. § 2286a(b)(5)
Atomic Energy Act of 1954, as Amended

Dated: February 20, 2019

Introduction. The Defense Nuclear Facilities Safety Board (Board) has evaluated the adequacy of safety controls for nuclear explosive operations at the Pantex Plant and the processes that ensure those operations have a robust safety basis. Based on this evaluation, we conclude the following:

- Portions of the safety basis for nuclear explosive operations at Pantex do not meet Title 10, Code of Federal Regulations, Part 830, *Nuclear Safety Management* (10 CFR 830). There are high consequence hazards that (1) are not adequately controlled; (2) may have controls, but lack documentation linking the controls to the hazards; or (3) have controls that are not sufficiently robust or that lack sufficient pedigree to reliably prevent or mitigate the event.

- Multiple components of the process for maintaining and verifying implementation of the safety basis at Pantex are deficient, including (1) completion of annual updates as required by 10 CFR 830, (2) processes for handling Unreviewed Safety Questions (USQ) and Justifications for Continued Operations (JCO), and (3) processes for performing Implementation Verification Reviews of credited safety controls.

- To date, the National Nuclear Security Administration (NNSA) Production Office (NPO) and the Pantex contractor have been unable to resolve known safety basis deficiencies. The Board initially identified similar issues and communicated them to NNSA in a letter dated July 6, 2010. Specifically, the letter found that the use of combined probabilities (i.e., initiating event probability multiplied by the weapon response) to determine scenario credibility and the treatment of falling technician scenarios were inappropriate. NNSA and the Pantex contractor have made little progress resolving these deficiencies despite the development of multiple corrective action plans.

Analysis. The enclosed *Findings, Supporting Data, and Analysis* document provides reports that support the Board's conclusions in this Recommendation.

The first report concludes there are deficiencies in the safety basis and control strategy for B61, W76, W78, W87, and W88 operations, which are designed to prevent or mitigate high consequence hazards. Pantex dispositioned a subset of the issues in the report via the USQ process in January 2018. Subsequently, the Pantex contractor submitted a JCO[1] to NPO in June 2018 to continue operations on weapon programs with known legacy safety basis deficiencies.

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[1] Consolidated Nuclear Security, LLC, *Justification for Continued Operations for Legacy Issues Associated with Documented Safety Analyses at Pantex*, June 29, 2018.

The Pantex contractor subsequently withdrew the JCO and instead submitted a safety basis supplement (SBS)[2] that NPO approved in September 2018. The SBS had content similar to the previously submitted JCO, but identified certain compensatory measures to be treated as specific administrative controls for falling technician scenarios (e.g., safety requirements identifying appropriate approach paths to the unit and removing tripping hazards at the beginning of work shifts). However, neither the JCO nor the SBS is based on a comprehensive analysis of the approved safety basis documents to identify areas requiring further enhancement and in need of additional controls. The SBS provides the Pantex contractor relief for safety basis deficiencies in advance of comprehensive evaluations to determine the extent of these issues. In addition, neither the JCO nor the SBS address the suite of hazard scenarios that the enclosed supporting technical analysis identified as deficient. The Pantex contractor has developed a corrective action plan[3] to address safety basis quality issues. This corrective action plan includes efforts to review the safety analysis documents for hazard scenarios with no controls and high order consequences caused by production technician trips.

The second report describes the results of a safety investigation (preliminary safety inquiry) regarding the implementation of 10 CFR 830 at Pantex. It identifies examples of lack of compliance that support all the above conclusions. For example, contrary to 10 CFR 830.202(c), the Pantex contractor has failed to update annually the hazard and safety analysis reports. In addition, contrary to 10 CFR 830.203(g), the Pantex USQ procedures allow three days to correct discrepant-as-found conditions—or safety basis implementation and execution errors—without stopping operations, notifying the Department of Energy (DOE), or initiating the Pantex process for addressing a potential inadequacy of the safety analysis.

The third report describes deficiencies identified within the special tooling program at Pantex and was sent to the Secretary of Energy from the Board on October 17, 2018.

Based on this analysis, the Board finds that deficiencies exist within the processes used to ensure operations at Pantex have a robust safety control strategy—the safety basis is inadequate and credible accident scenarios with high consequences exist with insufficient or no controls. Hazard scenarios of concern include those with high explosive violent reaction and/or inadvertent nuclear detonation consequences, which significantly exceed the DOE Evaluation Guideline dose consequence of 25 rem total effective dose to the maximally exposed offsite individual. As a result, the Board finds that DOE and NNSA need to take actions to ensure that adequate protection from hazards associated with nuclear operations at Pantex is sustained.

Recommendations. The Board recommends that DOE and NNSA take the following actions at Pantex:

1. Implement compensatory measures to address all the deficiencies described in Appendix 1 and Appendix 2.

2. Perform an extent-of-condition evaluation of the Pantex safety basis (including the

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[2] Consolidated Nuclear Security, LLC, *Safety Basis Supplement for Legacy Issues Associated with Documented Safety Analyses at Pantex*, September 18, 2018.
[3] Consolidated Nuclear Security, LLC, *Corrective Action Plan for DSA Quality Issues*, September 27, 2018.

procedures for development and configuration control of the safety basis documents) and implement subsequent corrective actions to ensure compliance with DOE regulations and directives.

3. Implement actions to ensure process design and engineering controls (including the use of special tooling) eliminate or protect a unit from impact and falling technician scenarios, including those scenarios identified in Enclosure 1.

4. Ensure the design, procurement, manufacturing, and maintenance of special tooling is commensurate with its safety function (see Enclosure 1).

5. Train safety basis personnel to ensure future revisions to the safety basis comply with 10 CFR 830 requirements.

Bruce Hamilton

Bruce Hamilton, Chairman

RISK ASSESSMENT FOR RECOMMENDATION 2019-1
Uncontrolled Hazard Scenarios and 10 CFR 830 Implementation at the Pantex Plant

Recommendation 2019-1 addresses uncontrolled hazard scenarios and Title 10, Code of Federal Regulations, Part 830, *Nuclear Safety Management* (10 CFR 830), implementation at the Pantex Plant. In accordance with the Defense Nuclear Facilities Safety Board's (Board) enabling statute and Policy Statement 5, *Policy Statement on Assessing Risk*, this risk assessment considers initiating event frequencies, adequacy of preventive and/or mitigative controls, and consequences from the hazards.

As detailed in the Recommendation and supporting technical analysis, deficiencies exist within processes used to ensure operations at Pantex have a robust safety basis. Furthermore, accident scenarios exist at Pantex with inadequate control strategies, including scenarios without any preventive or mitigative controls. As specified within the Pantex safety analysis and hazard analysis reports, these scenarios of concern—including those without any applied controls—have high explosive violent reaction and/or inadvertent nuclear detonation consequences. These consequences have the potential for significant special nuclear material aerosolized dispersal and therefore significantly exceed the Department of Energy (DOE) Evaluation Guideline dose consequence of 25 rem total effective dose to the maximally exposed offsite individual.

For the identified inadequately controlled scenarios, the initiating events primarily involve operational incidents, such as impacts, drops, gouges, and personnel trips. Following nomenclature outlined in DOE Standard 3009-1994, Change Notice 3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, initiating event frequencies for the scenarios include Anticipated (probability between 10^{-1} and 10^{-2}) and Unlikely (probability between 10^{-2} and 10^{-4}) events. Coupled with the significant consequences to the public, DOE Standard 3009 ranks the risk associated with these events as Unacceptable. Furthermore, in accordance with DOE Standard 3016-2016, *Hazard Analysis Reports for Nuclear Explosive Operations*, the design agencies provided unscreened (i.e., conditional probability of greater than 10^{-9} per insult) weapon responses for these scenarios. Based on the weapon response, there is sufficient probability that the consequence could occur given the postulated insult and therefore controls are required to prevent the accident. In accordance with DOE Standard 3009 and Standard 3016—safe harbors for compliance with 10 CFR 830—safety class controls are required to provide adequate protection.

Using the deterministic process outlined in DOE Standard 3009 demonstrates that Pantex needs safety class controls to maintain adequate protection. A quantitative risk assessment is not practicable because the data does not exist. However, there is a qualitative risk as scenarios currently exist without any applied controls, or with insufficient control strategies. As a result, the Board finds that DOE and NNSA need to take actions to ensure that adequate protection from hazards associated with nuclear operations at Pantex is sustained.

FINDINGS, SUPPORTING DATA, AND ANALYSIS
APPENDIX 1

NUCLEAR EXPLOSIVE OPERATIONS WITH UNCONTROLLED HAZARDS AT THE PANTEX PLANT[1]

Members of the Defense Nuclear Facilities Safety Board's (Board) staff reviewed the hazard analysis reports (HAR) for B61, W76, W78, W87, and W88 nuclear explosive operations at the Pantex Plant (Pantex). The staff team held multiple interactions between November 2017 and March 2018 with personnel from the National Nuclear Security Administration (NNSA) Production Office (NPO) and the Pantex contractor, Consolidated Nuclear Security, LLC (CNS), responsible for development and maintenance of the Pantex documented safety analysis (DSA)[2] to discuss specific scenarios identified in the safety basis documents.

The Board's staff team identified credible hazard scenarios that lack documented evidence that Pantex has identified and implemented credited safety controls to prevent high order consequences, i.e., inadvertent nuclear detonation (IND) and/or high explosive violent reaction (HEVR). High order consequences have the potential to significantly exceed the Evaluation Guideline to the maximally exposed offsite individual. Through evaluation of the Pantex safety basis, the staff team identified additional deficiencies related to (1) the design and classification of administrative controls relied upon for specific risk reduction, (2) the processing of new information through the approved unreviewed safety question (USQ) process, and (3) quality issues in the safety basis documentation.

Following the multiple interactions conducted during this review, the staff team concluded that CNS and NPO have not demonstrated how the current suite of credited controls—i.e., safety class and safety significant structures, systems, and components (SSC); specific administrative controls (SAC); and safety management programs—effectively prevent the identified hazard scenarios from resulting in high order consequences.

Background. In July 2010, the Board transmitted a letter to the NNSA Administrator communicating issues with HARs for several nuclear explosive operations at Pantex [1]. The issues included concerns that the Pantex contractor[3] inappropriately used initiating event probabilities to exclude credible hazards from further consideration. In some instances, this resulted in hazard scenarios where the responsible design agency provided a credible weapon response but the Pantex contractor did not identify or implement controls to address these hazards. In its 2010 letter, the Board concluded that this practice was inconsistent with the safety

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[1] This report updated on July 27, 2018, to incorporate issuance of the Justification for Continued Operations (JCO), *Justification for Continued Operations for Legacy Issues Associated with Documented Safety Analyses at Pantex*, dated June 29, 2018. Report does not reflect issuance of the subsequent Safety Basis Supplement, *Safety Basis Supplement for Legacy Issues Associated with Documented Safety Analyses at Pantex*, dated September 18, 2018.
[2] DSA refers to the full framework of safety analysis documents comprising the safety basis for conducting nuclear operations at Pantex. This includes HARs, safety analysis reports (SAR), the technical safety requirements (TSR) document, JCOs, and Evaluations of the Safety of the Situation.
[3] At the time of the 2010 Board letter, Babcock & Wilcox Technical Services Pantex, LLC, was the management and operating (M&O) contractor. Following a contract transition in July 2014, CNS became the M&O contractor.

basis safe harbor methodologies in use at the time, i.e., DOE-NA-STD-3016-2006, *Hazard Analysis Reports for Nuclear Explosive Operations* [2], and DOE-STD-3009-1994, Change Notice 3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses* [3].

NNSA[4] and the former Pantex contractor, Babcock & Wilcox Technical Services Pantex, LLC (B&W), developed a DSA Upgrade Initiative (DSAUGI), in part, to address the concerns communicated in the Board's 2010 letter. DSAUGI included goals to (1) develop accident analyses for all hazardous events that do not have screened responses for IND and HEVR, and (2) update the safety management programs to ensure that the key provisions of the programs, as they relate to operational and facility safety, are adequately described and translated into TSRs [4]. As indicated in initial revisions of the upgrade initiative, B&W and NNSA intended DSAUGI to be a multi-year effort[5], with detailed schedules of deliverables maintained to ensure that its goals were accomplished in a timely and complete manner. Completion of DSAUGI, as it was initially described, would have entailed significant revisions to the W76, W78, W87, and W88 HARs to address deficient legacy conditions such as those identified in the 2010 Board letter [4].

In 2013, B&W developed the DSA Improvement Plan (DSAIP) to "improve the Pantex DSA to achieve consistency and simplification, and to address legacy issues" [5]. DSAIP superseded DSAUGI. DSAIP had a stated goal to "achieve continuous improvement through incremental change," as realized by incorporation of its core principles in DSA change package development and during the DSA annual update process [5]. The original revision of DSAIP specified 15 core principles, including the following principles relevant to the issues presented in this report:

- **Core Principle 4 –** "Evaluate important to safety controls for either elimination or for elevation to a [credited safety-related] control" [5].

- **Core Principle 10 –** "Evaluate key elements for either elimination or for re-categorization as a [credited safety-related] control" [5].

- **Core Principle 11 –** "Ensure Specific Administrative Controls (SACs) are appropriately classified per DOE-STD-1186" [5].

Additionally, DSAIP stipulated specific initiatives necessary to address legacy issues in the safety basis and to accomplish the plan's goals. These initiatives, developed in part to address the issues identified by the Board, included an effort to resolve "screening of high consequence/low probability events (in both Hazard and Accident Analyses)" [5]. The original issue of DSAIP included a notional schedule to complete this effort through proposed safety basis change packages, scheduled for submittal to NPO in February 2014 [5].

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[4] At the time of the 2010 Board letter, the local NNSA office was referred to as the Pantex Site Office (PXSO). In 2012, PXSO merged functions with the Y-12 Site Office to form NPO.

[5] The original plan, issued in 2011, was to complete DSAUGI by the end of fiscal year 2015.

B&W and CNS updated DSAIP annually from 2014 to 2017. The 2015 and 2016 DSAIP revisions listed the status of "Resolving High Consequence/Low Probability Events in the Accident Analysis" as "Ongoing," and no longer provided an explicit path to closure [6, 7].

The 2017 revision of DSAIP represented a significant change to the plan—CNS retained the core principles and higher-level objectives, but no longer provided the status of the specific initiatives, including the initiative related to resolving high consequence, low probability events [8]. Based on feedback and concerns from NPO related to the quality of DSA change package submittals, CNS plans to revise DSAIP in 2018 "to identify 'Core Principle' efforts as discrete projects" [9].

In November 2017, the staff team performed a focused review of the W88 HAR to determine if actions NNSA and CNS had taken, including those accomplished through DSAUGI and DSAIP, effectively addressed the concerns presented in the 2010 Board letter. Based on the issues the staff team identified in the W88 HAR, the team expanded the review scope to include additional HARs. The issues and conclusions described in this report stem from that focused review and the staff team's additional follow-on activities.

The remainder of this report will explore four types of deficiencies the staff team identified: (1) credible hazard scenarios that lack documented evidence that Pantex has identified and implemented credited safety controls to prevent high order consequences, (2) the design and classification of administrative controls relied upon for specific risk reduction, (3) the processing of new information through CNS's approved USQ process, and (4) quality issues in the safety basis documentation.

Identification of Credited Safety Controls for Credible Hazards. The Board's staff team reviewed the hazard disposition tables and related hazard and accident analyses located in the approved HARs for B61, W76, W78, W87, and W88 operations to identify the controls relied upon to prevent hazard scenarios from resulting in high order consequences. While the safety bases identify adequate controls for the vast majority of credible hazard scenarios, the Board's staff team identified credible hazard scenarios with unscreened weapon responses for IND and HEVR for which the safety bases either do not define credited safety controls or for which the credited safety controls are not sufficient. Of note, the staff team's review of applicable safety basis documents was thorough but not exhaustive—additional problematic scenarios may exist.

DOE Expectations for the Identification of Credited Safety Controls—Title 10, Code of Federal Regulations, Part 830, *Nuclear Safety Management* (10 CFR 830), requires that the contractor responsible for DOE nonreactor nuclear facilities establish and maintain the safety basis for the facility. In doing so, the DSA for the facility must "[d]erive the hazard controls necessary to ensure adequate protection of workers, the public, and the environment, demonstrate the adequacy of these controls to eliminate, limit, or mitigate identified hazards, and define the process for maintaining the hazard controls current at all times and controlling their use" [10]. The Pantex DSA is intended to implement the safety basis requirements specified in 10 CFR 830 through adherence to the following two safe-harbor methodologies: DOE-NA-STD-3016 for nuclear explosive operations and DOE-STD-3009 for the facilities in which nuclear explosive and nuclear material operations are performed. The guidance and requirements specified in these documents describe DOE's expectations for identification of necessary hazard controls.

Per DOE-NA-STD-3016-2016, "[h]azard scenarios that are not screened for IND or HEVR consequences…are designated as Design Basis Accidents (DBAs), and are retained for consideration in the accident analysis section per DOE-STD-3009….With the exception of [natural phenomena hazards], initiating event probability information must not be used to dismiss the need to apply controls for plausible accident scenarios resulting in IND or HEVR" [11]. In this context, "screened" is defined as "[t]he weapon response likelihood provided for given hazards and associated nuclear weapon configuration combinations that the responsible DA(s) [design agency] asserts will not result in a specific weapon response consequence. The assignment of an IND or HEVR numerical likelihood [weapon response] will be treated as screened if the likelihood were $\leq 10^{-9}$" [11].

The 2016 revision of DOE-NA-STD-3016 was accepted into the Pantex M&O contract in 2016, but has not yet been fully implemented. The previous revision to this standard, DOE-NA-STD-3016-2006, does not include a numerical screening threshold, and simply describes screened weapon responses as "[h]azards and associated weapon configuration combinations that cannot result in a weapon response" [2]. The HAR development approach specified in DOE-NA-STD-3016 is built around an assumption and acknowledgement that consequences from HEVR and IND accidents will challenge the Evaluation Guideline in the absence of any rigorous analysis. With this in mind, DOE-NA-STD-3016-2016 specifies that "[t]he approach to the identification and classification of controls in the hazard analysis is the same as the process described in DOE-STD-3009" [11].

The Pantex M&O contract applies the requirements of DOE-STD-3009-1994, Change Notice 3, to existing facilities. This standard specifies that "[i]n order to comply with 10 CFR 830, specific safety controls are to be developed in the DSA" [3]. It clarifies this expectation by stating that 10 CFR 830 "defines safety class designation for SSCs that are established on the basis of application of the Evaluation Guidelines. This designation carries with it the most stringent requirements (e.g., enhanced inspection, testing and maintenance, and special instrumentation and control systems)" [3]. When applied in the context of nuclear explosive operations, the standard stipulates that compliance with 10 CFR 830 requires application of safety class controls to prevent or mitigate unscreened hazards with HEVR or IND consequences.

W88 Hazards with Insufficient Safety Controls—In November 2017, the Board's staff team provided NPO and CNS with an initial list of hazard scenarios from the DSA with weapon responses that were unscreened for IND and HEVR consequences, and where safety class controls were not clearly applied. Each of these scenarios potentially is encountered during W88 operations in nuclear explosive cells. The scenarios included postulated hazards related to mechanical impacts caused by falling technicians; mechanical impacts due to dropped tooling and components; and scrapes, pinches, and gouges of critical weapon components. The Addendum to this report identifies the specific scenarios in greater detail.

Each identified hazard scenario applies a weapon response rule where the likelihood of high order consequences is listed as "sufficiently unlikely." This frequency bin generally corresponds to conditional response likelihoods of 10^{-7} or 10^{-8} depending on the weapon program and consequence, given a particular stimulus or insult. In the framework of weapon response and HAR development, sufficiently unlikely is not equivalent to "screened." While the likelihood of high order consequences for any of these scenarios is extremely low, credited safety controls are still necessary.

Mitigative controls such as the specialized nuclear explosive cell structure may be credited to reduce the consequences from HEVR accidents, but such controls are not effective for IND scenarios. Control sets for scenarios with a credible risk of IND must be preventive in nature. Additionally, while the nuclear explosive cell structure could be credited as a mitigative control to provide protection from HEVR consequences, this control would not prevent high order consequences in the immediate vicinity of the accident, requiring the consideration of additional preventive controls. Control sets for scenarios that occur in nuclear explosive bays with a credible risk of HEVR or IND must also be preventive in nature because the bay structure does not mitigate the consequence of such events

During an initial interaction with CNS safety analysis engineering (SAE) and NPO nuclear safety and engineering personnel in November 2017, CNS presented its initial analysis of the identified scenarios to the Board's staff review team. This initial analysis noted that, while not currently and explicitly documented in the safety basis, the cell structure is an in-place, safety class control that CNS could apply to mitigate the consequences from HEVR accidents in the identified scenarios.

In addition, CNS noted that currently it had addressed other scenarios by compensatory measures implemented via a JCO approved by NPO in May 2017 [12]. However, CNS acknowledged that the remaining scenarios did not have readily apparent controls. During subsequent discussions with the Board's staff team, CNS personnel also indicated that they had identified the potential for similarly treated hazard scenarios on the W76 program. Based on these initial concerns, the staff team decided to expand the scope of its review to include other HARs that CNS had not updated recently. This included the B61, W76, W78, and W87 programs.

Treatment of New Information for W88 Hazard Scenarios—The approved CNS procedure for USQ determinations defines a process whereby CNS captures new information and evaluates whether it represents a potential inadequacy of the safety analysis (PISA)[6]. At Pantex, this is termed the problem identification and evaluation (PIE) process. Soon after the initial meeting where the Board's staff team presented the W88 hazard scenarios of concern, CNS SAE personnel captured the identified scenarios as new information and initiated the PIE process. Although CNS personnel indicated to the staff review team that other programs might contain additional similar scenarios, it did not formally evaluate other weapon programs via the PIE process.

[6] CNS has submitted, and NPO has approved, separate USQ procedures at Pantex and Y-12; there may be inconsistencies with 10 CFR 830 that occur at both sites. CNS plans to consolidate the USQ processes across both sites.

After approximately one month of evaluation, CNS determined that the identified new information did not represent a PISA. Specifically, in response to the question "Does the situation indicate an unanalyzed hazard exists or a potential new credited control is needed?", the PIE process disposition form states that "[a]lthough there are hazards that identify no controls are selected, these hazards have been dispositioned" [13] with one or more specified disposition pathways. The specified pathways are as follows: (1) controls are identified, (2) scenario is covered in the May 2017 JCO, (3) scenario is not credible, (4) scenario identifies "Facility Structure" as a mitigating design feature, and (5) scenario identifies "Procedures and Training" as a safety management program key element.

The Board's staff team independently evaluated CNS's disposition of the identified hazard scenarios. The staff team agrees that the scenarios dispositioned through the first two pathways, i.e., controls are identified in the HAR or in the May 2017 JCO, are adequately controlled. Per the CNS evaluation, these pathways apply to only seven of the twenty-five identified hazard scenarios.[7] The staff team concluded that the three remaining disposition pathways—which CNS applied for 18 hazard scenarios—are either not technically justified or insufficient with regards to established expectations for control reliability and efficacy.

CNS concluded through its PIE evaluation that a specific gouge scenario, in a configuration with bare high explosives, is not credible. The conclusion that this specific scenario is not credible contradicts the Hazard Analysis Summary Table in the approved HAR, which concludes that the hazard is credible. The staff team further evaluated the scenario by reviewing the associated operating procedures and could not identify any controls that would preclude the event. With the current information provided by CNS, the staff team is unable to independently reach the same conclusion as the Pantex contractor. The staff review team further notes that CNS would need to request approval from NPO to reverse a conclusion presented in the approved safety basis.

CNS concluded that the remaining 17 scenarios were controlled through the use of the facility structure or through key elements of safety management programs. However, as discussed above, the facility structure is incapable of mitigating the consequences of IND scenarios or preventing high order consequences in the immediate vicinity of the accident, requiring consideration of additional preventive controls.

For the remaining scenarios that have credible IND consequences, the only preventive features are key elements of safety management programs, such as "procedures and training" or the "falling man awareness protocol." In some instances, these key elements are ill-defined and are not developed for the specific context for which they are currently relied upon. In the case of the W88, the "procedures and training" key element is not carried into the TSR document for application at the floor level; attributes of the key element are not defined to allow operators, supervisors, or oversight personnel to verify their implementation; and the key elements cited by CNS are not implemented via step-by-step operating procedures that would ensure they are performed properly. Key elements alone cannot reliably prevent these accident scenarios and do

[7] CNS performed its PIE response for 25 scenarios. The Board's staff team identified additional scenarios during its independent evaluation.

not meet DOE's established expectations for controls relied upon to protect the public (this is discussed further in the *Administrative Controls Credited for Specific Risk Reduction* section).

Extent of Condition Review for Hazards without Identified Safety Controls—Based on the initial concerns noted on the W88 program, the Board's staff team conducted an independent extent of condition review. Specifically, the Board's staff team reviewed the B61, W76, W78, and W87 HARs, associated nuclear explosive operating procedures, and sections of applicable SARs. Through this review, the staff team identified similar scenarios on each of the analyzed programs with the exception of B61. After a preliminary review of the B61 HAR, the staff team identified discrepancies in the identification of controls for scenarios with sufficiently unlikely weapon response but did not find any instances of a sufficiently unlikely weapon response without appropriately implemented safety controls. For the remaining programs, the staff team communicated hazard scenarios of concern to NPO and CNS as it identified the scenarios. The specific scenarios are identified in greater detail in the Addendum to this report. At the time of this report, CNS had not reviewed these scenarios via its PIE process as actionable new information, with the exception of those identified for the W88 program.

W76 Hazards without Identified Safety Controls—The staff team identified five weapon configurations during W76 cell operations where the HAR identifies a falling production technician hazard and applies a sufficiently unlikely weapon response for a high order consequence. For these hazard scenarios, there is no credited control. During discussions with NPO and CNS personnel, CNS noted that the "falling man awareness protocol" is an applicable control, albeit currently uncredited in the HAR. The protocol includes specific training to ensure the area of approach to a unit is clear of any objects that could lead to a tripping hazard, to ensure approaches to the unit by production technicians are minimized and only performed as needed to support the process, and to ensure that production technicians approach slowly and cautiously. The falling man awareness protocol was developed as a best practice when it was implemented in 2014 [14], in part, to address Board concerns and nuclear explosive safety evaluation findings [1, 15, 16]. However, CNS has since credited the protocol with performing a safety class function as a compensatory measure in B83 and W88 JCOs[8]. CNS also credited the protocol as an operational restriction following a PISA on the W76. The development of the protocol was not intended to meet DOE requirements and guidance for designation as a safety class control. It is not appropriate to credit the falling man awareness protocol as an operational restriction or compensatory measure in lieu of developing engineered controls and/or SACs and process improvements to prevent the hazard.

W78 Hazards without Identified Safety Controls—The staff team identified that the W78 HAR treats sufficiently unlikely weapon responses as screened—an approach that could result in high order consequence scenarios existing in the safety basis without safety class preventive controls. The staff team did not find deficiencies in the W78 HAR similar to those found for the other weapon programs, but this could be due to the lack of clarity in assignment of controls to process steps. Specifically, in the accident analysis, the W78 HAR inappropriately credits controls that are not applicable in all of the process steps for which they are credited to perform a safety function. As a result, the applicable control suite for hazards in each process step is not

[8] The B83 JCO that includes the falling man awareness protocol as a compensatory measure expired on May 16, 2018. CNS administratively paused B83 operations upon its expiration. The W88 JCO remains in effect.

explicitly defined. Additionally, W78 program cell operations recently implemented a transfer cart, mitigating some falling technician concerns. However, the staff team did identify the following deficiencies in the identification of safety controls for the W78 program in the Sitewide and Transportation SARs.

For a lightning insult scenario, a single control, i.e., a transportation cart, is applied that only decreases the potential for weapon response from the hazard to sufficiently unlikely. Although CNS has additional controls available that could address this gap—e.g., use of a lightning detection and warning system and prohibiting transport (e.g., movement of transportation cart containing unit within the ramps that connect the bays and cells at Pantex) during lightning warnings—W78 transport is currently authorized during lightning warnings. NPO formally has accepted the risk presented by these operations.

During the movement of the unit in other facilities, the unit is at risk from a hydraulic fluid fire (see Addendum). The hazard analysis states that based on the weapon response to this threat, there is no credible response because the frequency is sufficiently unlikely. As a result, Pantex did not identify any safety class controls to prevent the high order consequences from this scenario.

W87 Hazards without Identified Safety Controls—During W87 disassembly operations, the mechanical safe and arm detonator (MSAD) becomes exposed to mechanical impacts prior to its removal. The HAR documents mechanical impact scenarios, including dropped tooling or weapon components, seismic hazards causing an impact, and falling technicians. The identified hazard scenarios of concern apply a sufficiently unlikely weapon response for a high order consequence. Special tooling is installed and the process is defined to minimize hazards; however, the HAR does not identify any credited engineered or administrative controls to prevent the accident.

Additionally, due to the older design of the process, the special tooling itself is the drop hazard in several cases. The W87 program does not have an integrated workstand and does not use process carts to introduce tooling and remove weapon components. These techniques are standard practice for *Seamless Safety for the 21st Century (SS-21)*[9] tooling and process design and have been used successfully to control similar hazards on other weapon programs. The staff team focused on W87 disassembly operations; similar issues likely exist in assembly operations.

During certain operations, the MSAD is intentionally operated in a controlled manner. The weapon response summary document supporting the HAR includes separate response values applicable to both configurations—where the MSAD is not operated and where it is operated. The likelihood of high order weapon response for scenarios involving mechanical insult to the

[9] An SS-21 compliant process is one that incorporates the principles outlined in the Design and Production Manual, Chapter 11.3, *Seamless Safety (SS-21) For Assembly and Disassembly of Nuclear Weapons at the Pantex Plant*. Such a process prevents the application of unauthorized or unanalyzed energy from sources external to the nuclear weapon, contains no single-point failures in the operation, and minimizes radiation exposure to personnel. NNSA and the Pantex M&O contractors implemented SS-21 from 2004–2012; however, the W87 was one of the earlier programs to be evaluated. Subsequent to its implementation on the W87, SS-21 matured substantially. In 2017, NNSA directed CNS to evaluate the potential for undertaking an "SS-21 refresh" to implement tooling and processes that would reflect current SS-21 concepts.

sensitive area of an operated MSAD is higher than for the un-operated configuration. However, the HAR assumes that it is not credible to impact the sensitive area of the MSAD. The staff team reviewed both the HAR and applicable discussion in the design agencies' weapon response summary document and concluded that CNS has not adequately described the technical basis or referenced supporting documentation to support the HAR's assertion that the scenario is not credible.

Safety Implications—For the weapon programs discussed in the above sections, the staff team identified credible scenarios with potential high order consequences without applied controls. Safety class controls, meeting DOE expectations for such, are necessary to prevent scenarios with IND consequences and prevent or mitigate scenarios with potential HEVR consequences. Without adequate, reliable controls identified in the Pantex DSA, NNSA has not demonstrated that these hazards are prevented or mitigated.

NNSA, CNS, and the design agencies are currently pursuing safety basis updates on the B61 and W88 programs. The updates will improve the overall quality of the HARs by using current practices and methodologies that were not included when the original HARs were developed—e.g., meeting DOE-NA-STD-3016-2016 expectations, including additional implementation guidance. As part of the development process for upcoming modernization of the B61 and W88, both programs' operations are being overhauled, including making special tooling and process improvements and upgrading the hazard analysis with the use of *Collaborative Authorization for the Safety-Basis Total Lifecycle Environment-Pantex* (CASTLE-PX).

CASTLE-PX is a software tool used to organize, maintain, and track hazards, weapon responses, and controls as Pantex and the design agencies support hazard analysis development and maintenance. Given that the W88 HAR currently is being updated, there would be a limited period where compensatory measures would be needed to allow W88 operations to continue with a compliant and reliable control set. Given the limited time until the new HAR is approved, a near-term JCO that identifies controls to address hazard scenarios with unscreened weapon responses without currently identified controls would be an appropriate vehicle to implement these necessary compensatory measures.

With respect to the W76, W78, and W87 HARs, these programs do not fully use CASTLE-PX, nor have the HARs received a full upgrade since their implementation. With the W76, a subset of bay operations was upgraded via CASTLE-PX in 2013; however, the hazard scenarios of concern identified by the staff team occur during cell operations, which do not have a related HAR upgrade. With no near-term, comprehensive safety basis upgrades planned for the W76, W78, and W87 programs, the staff team believes that timely action is needed to identify controls and make any necessary procedure changes.

Administrative Controls Credited for Specific Risk Reduction. CNS has identified key elements of safety management programs, or the falling man awareness protocol, as the controls relied upon for preventing high order consequences for some of the hazard scenarios that the staff review team identified as lacking credited controls. However, relying on key elements of safety management programs does not provide a level of protection equivalent to an engineered SSC or a properly implemented SAC, and does not comply with codified expectations in DOE directives.

DOE Expectations for Administrative Controls Identified to Prevent or Mitigate Accident Scenarios—When a contractor responsible for operation of a nuclear facility develops the hazard analysis in accordance with DOE-STD-3009, the contractor is required to put in place controls to prevent or mitigate the consequence of hazards that challenge the Evaluation Guideline to an acceptable level. As discussed above, because the consequences from HEVR and IND are so grave, these accidents are assumed to exceed the Evaluation Guideline and therefore require safety class controls.

If a contractor cannot design engineered controls for an accident scenario, it has the option of developing an administrative control. DOE-STD-1186-2016, *Specific Administrative Controls*, states, "SACs shall be designated where an administrative control performs [a safety class (SC)] or [safety significant (SS)] safety function to prevent or mitigate a postulated hazard or accident scenario" [17]. As such, any administrative control selected to prevent postulated accident scenarios where the consequence is HEVR or IND should be designated in the TSRs as a SAC. Due to the safety importance of SACs (i.e., fulfilling the role of a safety class or safety significant engineered control), these controls require an enhanced pedigree and reliability compared to other administrative controls to ensure their dependability. For example, a human reliability assessment is recommended when developing SACs to ensure their dependability, and a SAC should be written so that it is verifiable through testing, examination, and assessment that it is performing its safety function [17].

Application of Safety Management Program Key Elements for Specific Risk Reduction—Key elements might be identified as part of an administrative control; however, when the administrative control is relied upon to prevent high order hazard scenarios, the critical elements of the control should be designated as SACs, not simply noted as key elements of the administrative control. The following discussion from DOE-STD-3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, is relevant:

> *The criteria for designating an [administrative control (AC)] as a SAC include two conditions that need to be met: (1) ACs are identified in the safety analysis as a control needed to prevent or mitigate an accident scenario and (2) ACs have a safety function that would be SS or SC if the function were provided by an SSC. These …may serve as the most important control or only control, and may be selected where existing engineered controls are not feasible to designate as SS SSCs. Therefore, when ACs are selected over engineering controls, and the AC meets the criteria for an SAC, the AC is designated as a SAC. Controls identified as part of a safety management program may or may not be SACs, based on the designations derived from the hazards and accident analyses in the DSA. Programmatic ACs are not intended to be used to provide specific or mitigative functions for accident scenarios identified in DSAs where the safety function has importance similar to, or the same as, the safety function of SC or SS SSCs – the classification of SAC was specifically created for this safety function – this generally applies to the key element of the safety management program that provides the specific preventive or mitigative safety function*. [emphasis added] [18]

DOE-STD-3009 identifies several safety management programs that an M&O contractor might want to consider for inclusion in a potential DSA. The examples include criticality safety, fire protection, and other programs. The standard also discusses key elements of these programs that are critical for ensuring that the program can perform its credited safety function:

> *Key elements are those that: (1) are specifically assumed to function for mitigated scenarios in the hazard evaluation, but not designated an SAC; or, (2) are not specifically assumed to function for mitigated scenarios, but are recognized by facility management as an important capability warranting special emphasis. <u>It is not appropriate for a key element to be identified in lieu of a SAC</u>. The basis for selection as a key element is specified, including detail on how the program element: (1) manages or controls a hazard or hazardous condition evaluated in the hazard evaluation; (2) affects or interrupts accident progression as analyzed in the accident analysis; and (3) provides a broad-based capability affecting multiple scenarios.* [emphasis added] [18]

Application of the Falling Man Awareness Protocol—Recently, CNS has credited the falling man awareness protocol to perform a safety class preventive function as a compensatory measure in B83 and W88 JCOs, as well as an operational restriction for the W76 program. This protocol includes the provisions that specific training will be provided to ensure that:

- Approaches to nuclear explosives are clear of any objects that could lead to a tripping hazard.
- Approaches to nuclear explosives by production technicians are minimized and only occur as needed to support the process.
- Production technicians approach the nuclear explosive slowly and cautiously.

DOE's nuclear safety directives establish a hierarchy of controls that specifies a preference for engineered controls over administrative controls. In instances where engineered controls are not available to prevent the falling technician hazard, CNS should formalize this protocol as a SAC during the next annual safety basis update. This is necessary to meet the intent of DOE directives, as discussed above. Moreover, CNS should consider application of this SAC across the remaining weapon programs and evaluate the application of additional measures (e.g., tooling handoffs, transfer carts, work tables closer to the unit) to increase the reliability of the control. Of note, on the W78 program, a SAC is currently implemented to remove any potential tripping hazards at the beginning of the production technicians' shift. This SAC does not provide the same level of control as the W88 JCO, which seeks to control the falling technician concern throughout the entire shift; however, CNS recently implemented transfer carts for W78 operations, mitigating some falling technician concerns. Adoption of the falling man awareness protocol SAC on the W78 program should also be considered to fully control these scenarios.

<u>*Safety Implications*</u>—Reliance on procedures and training and other safety management program key elements as controls for specific risk reduction in lieu of designation as a SAC is

not appropriate in the Pantex safety basis. There is no reliability assessment or appropriate pedigree associated with the key elements, and reliance on procedures and training has inherent weaknesses. Safety management programs do not have the requisite reliability to assure appropriate prevention or mitigation of hazards with potential consequences that exceed the Evaluation Guideline. A recent report from the Board's Pantex resident inspectors identified multiple breakdowns in the falling man awareness protocol, a compensatory measure that lacks the required pedigree of a SAC [19]. The falling man awareness protocol, if used for specific risk reduction, should be formally codified as a SAC across weapon programs, and application of additional measures, as noted above, should be considered to increase the reliability of the control. In instances where safety management programs are the only measures implemented in the Pantex DSA to control high order consequences, NNSA has not demonstrated that the hazards identified in this report are prevented or mitigated.

Processing of New Information. The USQ process as implemented at Pantex includes a PIE process to evaluate new information, operational events, and discrepant as-found conditions to determine whether they represent a PISA. As part of the PIE process, CNS safety analysts answer the following questions to determine if the problem will be addressed as a PISA:

1. Does the situation indicate that an unanalyzed hazard exists or a potential new credited control is needed?

2. Does the situation indicate that the parameters used or assumed in the DSA, or in calculations used or referenced in the DSA, may not be bounding or are otherwise inadequate with respect to consequences or frequency?

3. Does the situation indicate that a directive action SAC may not provide the safety function assigned to it within the DSA?

CNS determined that the unscreened hazard scenarios with high order consequences and without credited safety class preventive controls for the W88 program did not warrant a PISA designation. As discussed in detail earlier in this report, the staff team disagrees with CNS's evaluation. Moreover, the staff team does not believe that CNS has met the relevant DOE expectations for processing new information.

DOE Expectations for Evaluating New Information—DOE Guide 424.1-1B, *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements*, states the following for timeliness of evaluating new information:

> *10 CFR 830. 203(g) requires certain actions for a PISA. A PISA may result from situations that indicate that the safety basis may not be bounding or may be otherwise inadequate; for example, discrepant as-found conditions, operational events, or the discovery of new information. It is appropriate to allow a short period of time (hours or days but not weeks) to investigate the conditions to confirm that a safety analysis is potentially inadequate before declaring a PISA. The main consideration is that the safety analysis does not match the current physical configuration, or the safety analysis is inappropriate or contains errors. If it is*

> *immediately clear that a PISA exists, then the PISA should be declared immediately.* [20]

CNS flows down this guidance into its local implementing procedure, CD-3014, *Pantex Plant Unreviewed Safety Questions Procedure*, as follows:

> *If the determination can be readily made that a PISA does not exist within 3 business days from when [new information] is determined to be mature, or an operational event occurs, the decision will be documented. If the determination cannot be readily made in this timeframe, a PISA is declared and documented.* [21]

Evaluation of New Information Identifying Credible Hazards without Credited Safety Controls—CNS dispositioned the W88-focused PIE entry after approximately one month, concluding there was no PISA. This lack of timeliness in processing the new information is inconsistent with the expectations of relevant DOE directives and the NPO-approved site implementing procedure. Based on its evaluation of the W88 PIE entry, CNS has not entered the PIE process for the corresponding new information for the other weapon programs discussed above. Furthermore, NPO and CNS informed the staff review team that the DSA will be further improved under the current DSAIP, so more immediate actions are not needed. However, the staff team identified significant problems with relying on DSAIP to address the handling of unscreened "sufficiently unlikely" scenarios:

- DSAIP included a core principle to discontinue the use of key elements of safety management programs as a control for specific risk reduction. However, CNS has not defined a timeline or included specific tasks (e.g., individual SARs and HARs) to eliminate this use of key elements. Additionally, although the core principle has been present since the original DSAIP was developed in 2013, the use of key elements as controls for specific risk reduction remains prevalent throughout the DSA.

- DSAIP included an initiative to meet DSA requirements to address high consequence, low probability events. DSAIP revisions 1 and 2 included this initiative with explicit tasks and schedules. However, revisions 3 and 4 included it as a general initiative with an "ongoing" schedule status. CNS removed any discussion of high consequence, low probability events from the current DSAIP (revision 5).

In a February 2018 interaction with the Board's staff team and a Board member, NPO and CNS discussed the development of a safety evaluation report to justify the current safety posture [22]. Additionally, NPO and CNS discussed the concept of separating DSAIP into an improvement plan and a "compliance" directed plan, the latter of which might be included in support of the safety evaluation report. NPO and CNS are developing the documents to support the proposed safety evaluation report. CNS submitted a JCO[10] to NPO for review and approval on June 29, 2018, to justify the current safety posture and continue operations. However, the submitted JCO does not formalize safety controls for a number of the credible accident scenarios

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[10] Consolidated Nuclear Security, LLC, *Justification for Continued Operations for Legacy Issues Associated with Documented Safety Analyses at Pantex*, June 29, 2018.

detailed in this report. As of July 27, 2018, NPO was still reviewing the JCO. CNS has not taken any immediate actions in the interim, e.g., identifying and implementing compensatory measures for the applicable scenarios.

Safety Implications—The staff team finds CNS's evaluation of this new information to be inadequate. CNS has continued nuclear explosive operations on all applicable programs without applying compensatory measures or operational restrictions to address the deficiencies identified by the staff team. Furthermore, CNS's disposition of the PIE entry for W88 hazard scenarios failed to meet the timeliness expectations of relevant DOE directives and the NPO-approved site implementing procedure.

Overall Challenges with DSA Quality. Throughout the independent extent of condition review, the staff team encountered numerous DSA quality concerns, including the following:

- Poor documentation of how hazard scenarios are dispositioned.
- Unscreened hazard scenarios not carried forward for control selection.
- Multiple, duplicate scenarios existing in the safety basis document with different control suites selected.
- Unclear documentation of control selection.
- Inappropriate use of safety management program key elements.
- Assumptions in safety basis not protected in the TSRs to show that a hazard is not credible.
- Inconsistencies between HARs on what hazard scenarios require a control.
- Inconsistencies and conflicting statements between different sections of the safety basis document.
- Errors in mapping weapon response rule probabilities from the design agency document to the HAR.
- Unreferenced supporting documentation.

Additionally, while not within Pantex's control, the quantity of different design agency-provided weapon response summary documents for each program can be cumbersome. It is not clear how and when the design agencies update their weapon response summary documents or which weapon response rule version is being implemented.

Each of these quality concerns on its own might not represent a safety issue; however, it is clear that Pantex DSAs are not consistently maintained with appropriate rigor. One way DSAs are maintained and improved is through annual updates, as required by 10 CFR 830.

Specifically, 10 CFR 830 requires the M&O contractor to "[a]nnually submit to DOE either the updated documented safety analysis for approval or a letter stating that there have been no changes in the documented safety analysis since the prior submission…" [10]. In recent years, CNS has had issues with submitting annual updates on a timely basis. For example, in a December 22, 2016, memorandum NPO identified to CNS the concern with safety basis annual update timeliness, as well as quality concerns. The memorandum identified specific examples, including the annual updates for the W80 and W78 HARs being overdue for more than four and six months, respectively [23]. Additionally, the majority of improvement activities have been de-scoped from Pantex annual updates, leaving little value-added in the update efforts besides incorporating negative USQs into HARs and SARs.

CNS recently started taking actions to address issues with the quality of DSA change package submittals [9]. Throughout 2017, NPO rejected or CNS withdrew numerous DSA change package submittals due to technical and quality issues. While CNS has instituted recent actions intended to improve submittal quality, these actions will not necessarily address the types of DSA quality deficiencies encountered by the staff review team.

APPENDIX 1 ADDENDUM

Specific Hazard Scenarios with Uncontrolled Hazards. The Board's staff team reviewed Hazard Analysis Reports (HAR) and select portions of the Safety Analysis Reports (SAR) for five weapon programs—B61, W76, W78, W87, and W88. The staff team reviewed the hazard disposition tables and related hazard and accident analyses located in the approved HARs and SARs, and found that they contained hazard scenarios with unscreened weapon responses for inadvertent nuclear detonation (IND) and high explosive violent reaction (HEVR) consequences where safety class controls were not clearly applied. The tables below identify the specific scenarios of concern. The tables include the hazard identification number referenced in each corresponding HAR or SAR, a description of the insult type, the credited controls (if any) for high order consequences, and additional staff comments. Of note, while thorough, the staff team's review of applicable safety basis documents is not exhaustive. Additional scenarios with similar concerns may exist.

W88. The Board's staff team reviewed the W88 HAR. The HAR categorizes certain unscreened scenarios as "sufficiently unlikely" to result in weapon response with a high order consequence. In several such scenarios, although the HAR identified a control, the staff team identified an issue with the documentation of the control. For the remaining such scenarios, the HAR did not identify an appropriately documented control. In the table below, superscript numerals within each row associate applied controls to the hazard scenarios (if no superscript exists, the control applies to all listed hazards).

Hazard ID	Insult Type	Currently Applied Controls	Board's Staff Team Comments
C.DI.6.I.06	Drop	Personnel Evacuation (Specific Administrative Control [SAC])	No safety class controls applied to mitigate/prevent high order consequences. Control of Equipment (SAC) could be applied as preventive control.
C.ADI.I.20[1] C.A.22.I.11[1] C.A.23.I.02[1] C.A.24a.I.06[1] C.A.19.I.15[1] C.DI.6.I.02[1] C.ADI.I.21[2]	Falling Technician	Safety Management Program (SMP) Key Element (Procedures and Training)* Nuclear Explosive Cells Facility Structure[1] Personnel Evacuation (SAC)[2]	Facility Structure credited to mitigate some HEVR consequences, but no sufficient controls applied to prevent IND or to protect immediate vicinity from HEVR. SMP Key Element inappropriately used for risk reduction.
C.DI.7.I.04 C.ADI.I.22	General Falling Technician	Use of Process Transfer Cart (SAC)	Two example scenarios listed are not all inclusive. Use of Process Transfer Cart (SAC) applies for production technician manipulating special tooling, but does not apply for second technician without special tooling approaching unit.

Hazard ID	Insult Type	Currently Applied Controls	Board's Staff Team Comments
C.ADI.I.29	Falling Technician	Personnel Evacuation (SAC) Procedures and Training SMP* Conduct of Operations SMP*	No safety class controls applied to prevent/mitigate high order consequences. SMPs inappropriately used for risk reduction.
C.DI.6.G.02	Scrape	No controls applied	In response to the 11/16/2017 problem identification and evaluation entry, Consolidated Nuclear Security, LLC (CNS) concluded this event is not credible. The basis for this determination is unclear given the probability of insult specified in the approved HAR. As a result, no safety class controls applied to prevent/mitigate high order consequences.
C.DI.7.G.01	Scrape	Procedures and Training SMP*	No safety class controls applied to prevent/mitigate high order consequences. SMP Key Element inappropriately used for risk reduction.
C.DI.9.I.04[1,2] C.DI.9.I.08[3,4] C.DI.10.I.09[3,4] C.DI.10.I.10[1] C.DI.11.I.08[3] C.DI.12.I.06[3,4] C.DI.14.G.02[3] C.A.1.I.01[3,4] C.A.3.G.02[3] C.A.12.I.01[3,4] C.A.12.I.02[3,4] C.A.14.I.04[3,4] C.A.16.I.02[3] C.A.17.I.16[3] C.ADI.I.41[1] C.ADI.I.70[3]	Drop, falling technician, and gouge scenarios resulting in HEVR consequences only (no IND)	Personnel Evacuation (SAC)[1] SMP Key Element (Procedures and Training)[2,*] Procedures and Training SMP[3,*] Conduct of Operations SMP[4,*]	The Nuclear Explosive Cells Facility Structure could be credited to mitigateHEVR consequences but would not protect the immediate vicinity.
C.DI.12.I.03 C.DI.15.I.02 C.A.2.I.03 C.A.3.I.04 C.A.4.I.06 C.A.10.I.02	Drop and falling technician scenarios resulting in HEVR consequences only (no IND)	No controls applied	The Nuclear Explosive Cells Facility Structure could be credited to mitigate HEVR consequences but would not protect the immediate vicinity.

*SMP Key Element (Procedures and Training) or SMPs (Procedures and Training or Conduct of Operations) are discussed in the HAR as a reason to accept the risk without applied safety class controls. It is not clear where attributes of the Procedures and Training Key Element are developed for specific application to W88 operations (i.e., neither in W88 HAR nor Sitewide SAR).

Source: (U) *W88 Disassembly & Inspection and Assembly Hazard Analysis Report*, AB-HAR-941335, Issue 28, January 31, 2018.

Extent of Condition Review for Hazards without Identified Safety Controls—Based on the concerns identified in the W88 HAR, the Board's staff team conducted an independent extent of condition review. Members of the Board's staff reviewed the B61, W76, W78, and W87 HARs, associated nuclear explosive operating procedures, and sections of applicable SARs. Through this review, the staff team identified similar scenarios on each of the analyzed programs with the exception of the B61.

B61. After a preliminary review of the B61 HAR, the staff team identified discrepancies in the identification of controls for scenarios with sufficiently unlikely weapon response but did not identify concerns related to the application of a sufficiently unlikely weapon response without appropriately identified implemented safety controls. The hazard scenarios below include safety basis quality issues.

Hazard ID	Insult Type	Currently Applied Controls	Board's Staff Team Comments
5324 5325 5329 5342 5526 5529 5557 5558 5571 5572 5799 12716	Drop / Pressure of Force	Special tooling	Special tooling has safety significant functional requirements to address low order consequences but is not designated safety class because the HAR asserts that high order consequences are sufficiently unlikely. Based on the specifications of the special tooling program, there are limited differences between analysis activities required to meet safety significant functional requirements and safety class functional requirements. Additionally, each of the tools relied upon to prevent the accident have other safety class functional requirements applied for other hazard scenarios.

Hazard ID	Insult Type	Currently Applied Controls	Board's Staff Team Comments
5333	Impact or Crush by an Object (hose whip)	Safety Cable, Tyrap, Filament Tape, Material Access Area Operations Requirement (Sitewide SAR)	This scenario, as listed in the HAR, is controlled for several other weapon configurations. Authorization Basis Change Packages 18-06 and 17-62 implement a new control suite to require air hose restraints to be used, including step-by-step implementation with two technician verification. Per the new control description, as specified in B61 HAR section 4.3.1 and Sitewide SAR section 4.3.50, the controls do not explicitly apply to the ultimate user configuration; however, Hazard ID 5333 applies to the ultimate user configuration and lists HEVR and IND consequences as sufficiently unlikely. Rule 2.7.1 in GE1A4947, *(U) General Engineering, Weapon Response Summary, B61*, Issue C, indicates that this hazard screens in this configuration.

Source: (U) *B61 SS-21 Hazard Analysis Report*, AB-HAR-940572, Issue 44, January 18, 2018.

W76. The staff team identified the following hazard scenarios during W76 operations that have inadequate controls assigned.

Hazard ID	Insult Type	Currently Applied Controls	Board's Staff Team Comments
2.1.16.3 2.1.17.3 2.1.18.3	Mechanical Impact	Facility Structure	Section 3.4.2.2.6 of the HAR states: "Given the nature of these operations and the actions that would be required to produce a weapon response, no additional Task Exhaust or Pump Fixture controls are assigned to further reduce the potential for an impact from these items. The event contributors for Rules 2.1.16.3, 2.1.17.3, 2.1.18.3, 2.1.20.3, and 2.1.21.3, which are all uncased [high explosive] configurations, are dominated by an impact from a Production Technician that trips and falls into the uncased HE [high explosive] configuration. No controls were identified that could further reduce the potential for a trip." Facility Structure is credited to mitigate HEVR consequences, but no sufficient controls are applied to prevent IND or protect immediate vicinity from HEVR.

Hazard ID	Insult Type	Currently Applied Controls	Board's Staff Team Comments
2.1.13.8 2.1.14.11 2.1.14.16 2.1.14.2 2.1.14.4 2.1.23.16 2.1.23.18 2.2.2.21 2.2.2.24 2.2.5.8	Mechanical Impacts to the CSA	Personnel Evacuation (SAC)	The referenced scenarios list a Burning Dispersal response of sufficiently unlikely; however, the applicable weapon response summary document lists the burning dispersal response as screened. The prior revision of the weapon response summary document lists the burning dispersal response as sufficiently unlikely, so the HAR appears to present outdated information.
2.2.2.22	Mechanical Drop/Topple/Swing/Push	Personnel Evacuation (SAC)	The referenced rule is not listed in the referenced weapon response summary document. The prior revision of the weapon response document contained a rule that was formerly applicable. Based on the current weapon response summary document, the staff team concluded there is no control deficiency in this instance.

Source: (U) *W76-0/1 SS-21 Assembly, Disassembly & Inspection, and Disassembly for Life Extension Program Operations Hazard Analysis Report*, RPT-HAR-255023, Issue 71, November 30, 2017.

W78. The staff team identified the following hazard scenarios during W78 operations that have inadequate controls assigned.

Hazard ID	Insult Type	Currently Applied Controls	Board's Staff Team Comments
B.2.H.1 B.3.H.1 B.4.H.1	Exothermic Reaction	Sufficient control set for HEVR	The HAR inappropriately uses combined frequency (i.e., initiating event frequency with weapon response) to remove IND from further consideration. However, sufficient controls applied for HEVR consequences.
Sitewide SAR (Rule 4.4.3)	Lightning	W78 Transportation Configuration	The HAR asserts that the mitigated weapon response, with the applied control, is sufficiently unlikely, so no additional controls were applied. Similar concerns apply to other weapon programs.
Transportation SAR (Rule 3.1.3)	Hydraulic Fluid Fire	No controls applied	No controls applied for high order consequences. According to the Transportation SAR, "Based on weapon response, no credible response as frequency is Sufficiently Unlikely." Similar concerns apply to other weapon programs.

Source: (U) *W78 Step II Disassembly & Inspection and Repair Hazard Analysis Report*, AB-HAR-319393, Issue 63, September 22, 2017; (U) *Transportation SAR*, AB-SAR-940317, Issue 81, September 19, 2017; (U) *Sitewide SAR*, AB-SAR-314353, Issue 288, January 31, 2018.

W87. The Board's staff team reviewed the disassembly portion of the W87 HAR. Although not reviewed, similar concerns likely exist with the assembly portion of the W87 HAR. The identified hazard scenarios of concern apply a sufficiently unlikely weapon response for a high order consequence. In several instances, the control set is adequate; however, there is a safety basis quality issue with the documentation of the control. With the remaining instances, a sufficiently unlikely weapon response for a high order consequence exists without an appropriately documented control.

Hazard ID	Insult Type	Currently Applied Controls	Board's Staff Team Comments
B.ISMO.14.D.02 B.ISMO.16.D.02	Drop of unit	Special Tooling Verification of Proper Installation of the Nuclear Explosive/Tooling Interface (SAC)	While the staff team believes the control set to be adequate, the documentation of the hazard scenario does not appear to be fully developed. Tables 3.4.2.2.3-5 and -6 of the HAR state that the particular high order consequence related to the sufficiently unlikely weapon response is not carried forward for further evaluation, i.e., control selection.
D32WS-48 D32WS-52 D32WS-86 D32WS-100 D32WS-129	Drop of weapon component and/or tooling onto configuration Falling technician	No controls applied	Table 3.4.2.1.3-3 of the HAR states that the particular high order consequence related to the sufficiently unlikely weapon response is not carried forward for further evaluation, i.e., control selection.

Hazard ID	Insult Type	Currently Applied Controls	Board's Staff Team Comments
B.ISMO.24.I.03 (3rd instance, Rule 2.1.4.26a) B.ISMO.24.I.09 (1st instance, Rule 2.1.4.25a) B.ISMO.24.I.09 (2nd instance, Rule 2.1.4.25a) B.ISMO.24.I.09 (3rd instance, Rule 2.1.4.25a)	Drop of weapon component and/or tooling onto configuration Falling Technician	No controls applied	Table 3.4.2.1.3-4 of the HAR states that the particular high order consequence related to the sufficiently unlikely weapon response is not carried forward for further evaluation, i.e., control selection. An example of special tooling that could be dropped and result in an impact to the sensitive area of the component (per CODT-2004-0295 Rev. 6, the Lawrence Livermore National Laboratory weapon response summary document) is any of the three guide bearings during their removal. The removal of the guide bearings occurs after a protective cover (Skull Cap) has been removed, but before the component is removed. Note that the Skull Cap is not a credited safety class control. The Skull Cap is analyzed for a particular force but has not been evaluated to ensure it could perform a safety requirement if needed. For a falling technician, the impact location is not controlled to prevent impact to the sensitive area.
N/A	Drop of hand tool onto sensitive area of component	No controls applied	HAR does not include this scenario for the unique operation and configuration analogous to Hazard ID D32WS-86 above.
D32WS-70	Drop of flashlight with electrical coupling	Approved Equipment Program	Section 3.3.2.1 of the HAR states that the electrical hazard is sufficiently unlikely, and therefore, not carried forward for further evaluation. CODT-2004-0295 Rev. 6 states that the weapon response does not screen. However, CODT-2004-0295 Vol. 2 Rev. 3 clarifies that the weapon response screens. The staff team concluded that the scenario does screen, but the discussion in Section 3.3.2.1 is inappropriate, and lack of a singular weapon response summary document makes for unclear documentation.
D33WSa-18 D34WS-12 D34WS-14	Drop of weapon component and/or tooling onto configuration	No controls applied	Table 3.4.2.1.3-3 in the HAR states that the high order consequence is sufficiently unlikely and the hazard is not carried forward for further evaluation.

Hazard ID	Insult Type	Currently Applied Controls	Board’s Staff Team Comments
D34WS-41	Falling technician while carrying special tooling (metal with hard corners/edge)	No controls applied	Table 3.4.2.1.3-3 in the HAR states that the high order consequence is sufficiently unlikely and the hazard is not carried forward for further evaluation.
N/A	Falling technician resulting in an impact to the sensitive area of component	No controls applied	The HAR’s Appendix does not include this scenario for the unique operation and more sensitive orientation (after rotating) of configuration analogous to Hazard ID D34WS-41 above. Similar hazard scenarios (D34WS-43, D34WS-50, D34WS-60) assume the technician will only impact the side of the unit. The staff team believes a direct impact from a falling technician to the sensitive area is a credible hazard.
B.ISMO.26.I.01	Drop of Hand Tool onto configuration	No controls applied	The HAR’s Appendix states that the orange stick is the only tool used during this configuration and that weapon response “a” applies. The staff team notes that the selected weapon response (2.1.5.15) does not relate to the discussion in the HAR’s Appendix. The more sensitive orientation (after rotating) is not considered. The staff team believes that given the postulated energies, weapon response 2.1.5.11b would be applicable. That response is applicable because any postulated impact could occur over the sensitive area. However, if the orange stick is the only tool that can be used in this task, then this hazard scenario would not be credible.

Hazard ID	Insult Type	Currently Applied Controls	Board's Staff Team Comments
B.ISMO.26.I.03	Drop of special tooling onto configuration	No controls applied	The HAR's Appendix states that the design of the tool prevents a direct impact to the sensitive area of the component; therefore, weapon response "a" is applied. There is not an adequate basis for this assertion. While the weapon response summary document provides a probe size example, it also states the "b" weapon response applies if the insult is over the sensitive area. The staff team believes the special tooling could impact the sensitive area; therefore, weapon response "b" should be applied. Additionally, the tooling has sharp (i.e., 90 degree) corners.
N/A	Technician trips resulting in an impact to the sensitive area of component	No controls applied	The HAR's Appendix does not include this scenario for the same configuration and orientation analogous to Hazard ID B.ISMO.26.I.03 above.
N/A	Mechanical impact due to hand tool drop	No controls applied	Rule 2.1.5.24a is not referenced in the HAR's Appendix. However, the "a" weapon response is used to develop the impact scenario frequencies in Table 3.4.2.1.3-2. There is not an adequate basis for the selection of the "a" weapon response usage. The reviewers believe the special tooling could impact the sensitive area; therefore, weapon response "b" should be applied. Additionally, most articles of tooling have sharp (i.e., 90 degree) corners.

Source: (U) *W87 Step II Assembly and Disassembly & Inspection Hazard Analysis Report*, AB-HAR-940626, Issue 41

APPENDIX 1 REFERENCES

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[18] Department of Energy, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, DOE-STD-3009-2014, Washington, DC, 2014.

[19] Defense Nuclear Facilities Safety Board, *Pantex Plant Activity Report for Week Ending April 20, 2018*, Pantex Plant, April 2018.

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[23] Memorandum from K.A. Hoar to J. Papp, *NNSA Production Office Expectations for Pantex Documented Safety Analysis (DSA) Annual Updates*, Pantex Plant, December 22, 2016.

FINDINGS, SUPPORTING DATA, AND ANALYSIS
APPENDIX 2

NUCLEAR SAFETY MANAGEMENT AT THE PANTEX PLANT[1]

The Defense Nuclear Facilities Safety Board's (Board) conducted a safety investigation (preliminary safety inquiry) [1] of the implementation of Title 10, Code of Federal Regulations, Part 830 (10 CFR 830), *Nuclear Safety Management*, for nuclear explosive operations at the Pantex Plant located near Amarillo, Texas [2]. Overall, the inquiry team found that (1) portions of Pantex safety bases are deficient; (2) multiple components of the safety basis process are deficient; and (3) the National Nuclear Security Administration (NNSA) Production Office (NPO) and the contractor, Consolidated Nuclear Security, LLC (CNS), have been unable to resolve known safety basis deficiencies.

Pantex Safety Basis Requirements. Table 2 of 10 CFR 830, Subpart B, *Safety Basis Requirements,* prescribes the methodologies and requirements for preparation of safety analysis reports (SAR) and hazard analysis reports (HAR) for nuclear explosive facilities and operations. SARs are required for the facilities associated with nuclear explosive operations. These SARs include the *Sitewide SAR*, *Bays and Cells SAR*, and various special purpose nuclear facility SARs. An approved method of meeting the requirements of 10 CFR 830 for SARs is described in Department of Energy (DOE) Standard 3009, *Preparation Guide for US Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports* [3]. HARs are required for specific nuclear explosive operations. Hazard analysis teams prepare HARs using weapon response inputs from the associated weapon design agencies. An approved method of meeting the requirements of 10 CFR 830 for HARs is described in Department of Energy (DOE) Standard 3016, *Hazard Analysis Reports for Nuclear Explosive Operations* [4].

Review Scope. The staff team reviewed the following areas in assessing compliance with 10 CFR 830:

- *Controls to Prevent/Mitigate Unscreened Weapon Hazard Scenarios.* The staff team selected two HARs (i.e., W76 and W78) for review [5, 6]. It evaluated the hazard analyses in the HARs for events that result in inadvertent nuclear detonation (IND) and/or high explosive violent reaction (HEVR). For each event that was not screened as physically incredible by the weapon design agency, the staff team evaluated the adequacy of the safety control set to prevent or mitigate the event. Identification of hazard controls to ensure adequate protection is required by 10 CFR § 830.204.

- *Implementation of USQ Process.* An unreviewed safety question (USQ) process is required by 10 CFR § 830.203 to ensure that operations are conducted within the DOE-approved safety basis. The staff team evaluated the USQ process implemented at Pantex. It reviewed USQ procedures, specific deficiencies identified in a potential

[1] Report published on July 13, 2018, and subsequently modified to incorporate issuance of the JCO, *Justification for Continued Operations for Legacy Issues Associated with Documented Safety Analyses at Pantex*, dated June 29, 2018. Report does not reflect retraction of the JCO and issuance of the Safety Basis Supplement, *Safety Basis Supplement for Legacy Issues Associated with Documented Safety Analyses at Pantex*, dated September 18, 2018.

inadequacy of the safety analysis (PISA), and justifications for continued operations (JCO).

- *Safety Basis Maintenance.* SARs and HARs are required to be updated and maintained in accordance with 10 CFR § 830.202. These requirements obligate the contractor annually to submit updates or a letter stating no changes have been made since the last submittal. The staff team reviewed safety basis maintenance to include annual updates and improvement plans.

The staff team reviewed the pertinent documents, prepared agendas, and held onsite discussions with representatives from NPO and CNS. It conducted the onsite visits during the weeks of May 28 and June 11, 2018. The onsite visits included observing nuclear explosive operations involving the W76 and W78 programs.

Conclusions. The staff team found that (l) portions of Pantex safety bases are deficient; (2) multiple components of the safety basis process are deficient; and (3) NPO and CNS have been unable to resolve known safety basis deficiencies. The conclusions are summarized below with the detailed evidence to follow:

- **Portions of the safety bases are deficient in meeting 10 CFR § 830.204(b).** There are high consequence hazards that (1) are not adequately controlled; (2) may have controls, but the controls are not clearly linked to the hazards; or (3) have controls that are not sufficiently robust or that lack sufficient pedigree to reliably prevent or mitigate the event. This conclusion is supported by observations 1 through 6 below.

- **Multiple components of the safety basis process are deficient.** (1) Contrary to 10 CFR § 830.202(c), CNS has failed to update annually the HARs and SARs. (2) Contrary to 10 CFR § 830.203(g), Pantex USQ procedures allow three days to correct discrepant-as-found conditions or implementation/execution errors without stopping operations, notifying DOE, or issuing a PISA. (3) Contrary to DOE G 424.1-1B, NPO and CNS revise existing JCOs instead of issuing new ones, thereby extending the expiration date and reliance on the compensatory measures beyond a year. (4) Contrary to DOE Guide 423.1-1B, CNS does not re-assess procedural controls via implementation verification reviews (IVR) every three years. This conclusion is supported by observations 7 through 10 below.

- **NPO and CNS have been unable to resolve known safety basis deficiencies.** (1) NPO and CNS have been unable to resolve several legacy conditions of approval (COA). (2) CNS has a *Documented Safety Analysis Improvement Plan* (DSAIP) that lacks sufficient information and resource loading required for the process to be successful, and is behind schedule. (3) Despite the fact that issues related to falling technician accident scenarios were identified in 2010, there is no timeline for improvements to be incorporated into the safety basis. This conclusion is supported by observation 11 below.

The staff team noted 11 observations over the course of its review that support these conclusions:

1. Missing Specific Administrative Control (SAC) for Operators Applying Brakes on Testers—The W76 HAR identifies multiple events with credible IND and HEVR consequences that require safety class controls but are prevented by an initial condition. The initial condition is a safety management program (SMP) (i.e., Electrical Equipment Program for Testers). The SMP ensures that the design of electrical testers (e.g., PT3746 Preset Tester) precludes mechanical and electrical insults to the weapon. The initial condition in the HAR references Section 18.2.3 of the *Sitewide SAR*. The *Sitewide SAR*, page 18-16, states that testers are "[d]esigned to withstand the forces of a 95th percentile person falling into the tester without the tester tipping or moving the target" [7]. However, this analysis relies on the operator engaging a wheel locking device. Therefore, the design requirements contained in the SMP are insufficient as the lone control for this event. The operator action of engaging the wheel locking device is not protected by a SAC and is not marked as a critical step in the procedures. Additionally, the tester is not credited as a safety class design feature in the hazard analysis tables. The review team concludes the safety control set for these events does not meet DOE requirements. CNS generated a problem identification and evaluation (PIE) form (PIE-18-537) and issued a PISA following the onsite discussions. The PISA was followed by a positive USQ determination.

2. Analysis Supporting Adequacy of Safety Class Carts not Bounding—The W78 HAR includes events involving toppling of a preparation cart while carrying various items. The weight of the cart and items on top of it are assumed to impact a weapon configuration. This event results in the need for safety class controls since IND and HEVR are not screened by the design agency. The preventive control for this event is the design of the preparation cart. The HAR, Section 4.3.l.l.2, credits the preparation cart with the functional requirement to "...withstand the forces imparted by a 95th percentile Production Technician as well as the forces due to a PC-3 [performance category-3] seismic event without toppling into the unit." However, the assumed weight of the items on the cart in the HAR event exceeds the assumed weight in the supporting engineering analysis [8]. Therefore, the engineering analysis does not adequately demonstrate that the preparation cart is capable of fulfilling its safety functional requirements. CNS generated a PIE form (PIE-18-539) and issued a PISA following the staff team's onsite discussions. CNS followed the PISA with a positive USQ determination.

3. Missing Safety Class Controls for Impact and Electrostatic Discharge (ESD) Events—The W76 HAR identifies rolling impact and ESD events involving a weapon configuration that represents a general bin of 16 separate configurations. The rolling impact is caused by production technicians pushing "freestanding equipment" into the 16 different weapon configurations. Freestanding equipment is defined as equipment or tooling not attached to the facility and not hand carried. The rolling impact events require safety class controls since the design agency did not screen them for IND and HEVR. The ESD events are postulated from production technicians being in contact with freestanding equipment or the wrist strap checker. The documented safety analysis currently requires safety significant controls for these ESD events. The preventive control for the rolling impact and ESD events is a SAC (i.e., W76 Operations - Control of Equipment and Tooling). Among other requirements, this SAC prohibits freestanding equipment not required by the W76 process from being placed within 6.5 feet of any W76 configuration installed in the assembly stand, insertion cart, or assembly carts. Designating this SAC for these events as a preventive control results in several errors:

- The SAC does not include all freestanding equipment that could cause a rolling impact or ESD event (e.g., a tool box) to the weapon configurations. Therefore, this freestanding equipment excluded from the SAC represents an uncontrolled hazard.

- The ESD event involving a wrist strap checker credits the SAC as a preventive control, but the SAC does not include the wrist strap checker in the list of included equipment. Therefore, the wrist strap checker needs to be added to the SAC. The *Nuclear Explosive Operating Procedures* (NEOPs) and other technical procedures do include a safety requirement for production technicians to not bring the wrist strap checker near the weapon. However, this requirement does not flow down from this SAC.

- The SAC states that the 6.5-foot exclusion zone applies to W76 configurations installed in the assembly stand, insertion cart, or assembly carts. Although the majority of the 16 weapon configurations are processed in an assembly cart, the components that make up these configurations are processed on a bench or table. The SAC does not apply to operations on a bench or table.

- Some tools included in the list of freestanding equipment do not have wheels. Therefore, it is inappropriate to include these pieces of equipment in rolling impact events.

CNS generated a PIE form (PIE-18-536) and issued a PISA following the onsite discussions. The PIE form states: "A PISA was declared on 5/31/18, which resulted in pausing W76-0/1 Mechanical Assembly and Disassembly bay operations until operational restrictions were implemented." CNS followed the PISA with a positive USQ determination.

4. Non-Credited Administrative Controls/Training Used in Place of Safety Class Controls for ESD Hazards—The W76 HAR identifies multiple events with credible IND and HEVR consequences that are dispositioned by a "Category 2 Equipment Evaluation." These events require safety class controls since the design agency did not screen them for IND and HEVR. The hazard analysis tables contain a note that refers to equipment evaluations for the Overhoff monitor/hose and wrist strap checkers (i.e., EEE-06-0030 and EEE-06-0037, respectively) [9, 10]:

- EEE-06-0030 provides "General Requirements" that prescribe keeping the Overhoff more than 6.5 feet away from a nuclear explosive during "Radiation Safety Usage." During "Manufacturing Usage" the Overhoff may make contact with a nuclear explosive using a short hose, which has a credited insulator. CNS personnel explained that during "Manufacturing Usage" the production technicians hold the Overhoff in one hand while guiding the hose to the nuclear explosive with the other hand (within 1/4 inch of the nuclear explosive). The NEOPs do not include safety requirements, critical steps, warnings, cautions, or general notes that alert the production technicians to potential hazards associated with dropping the Overhoff onto the nuclear explosive. CNS personnel stated in onsite discussions that hazards involving the Overhoff are not credible due to its intended use and production technicians' "normal behavior" via training; thus no control is identified for this hazard.

- EEE-06-0037 prescribes a 6.5-foot standoff distance for the wrist strap checker from all explosives and nuclear explosives and references P7-2003, *Weapon Assembly/Disassembly Operations Requirements* (U) [11], as the implementing procedure. P7-2003 is a general use level procedure that implements the standoff distance requirement for the wrist strap checker via a boxed note. The staff team also reviewed the NEOPs that are critical-use-level procedures (higher level than general use). The staff team found that the NEOPs include a safety requirement to not carry the wrist strap checker to the unit. The production technicians are required to be familiar with the NEOP safety requirements, but they are not required to read them prior to performing NEOP steps. The NEOPs also do not specify a specific standoff distance (i.e., 6.5 feet). The wrist strap checker is secured to the wall in a bracket but may need to be removed for calibration. CNS personnel stated that production technicians and calibration technicians are trained to not bring the wrist strap checker within 6.5 feet of a nuclear explosive, referencing TABLE- 0068, *Safety Checklist*, which contains additional requirements for maintaining a 6.5-foot standoff distance to a nuclear explosive [12]. TABLE-0068, however, is not part of the technical safety requirements (TSR) for nuclear explosive operations.

The staff team finds that Pantex personnel ultimately rely on non-credited administrative controls and production technician training to implement safety class functional requirements for HAR events involving the Overhoff monitor/hose and wrist strap checkers. There are no credited safety class controls for these events. The review team concludes that this situation does not meet DOE requirements for identification of safety class controls for high consequence events, and as such represents a PISA. CNS has not declared a PISA regarding its controls for these hazards.

5. Missing Safety Class Controls for Production Technician Tripping Hazards—The W78 HAR identifies multiple events involving a production technician who trips and impacts the unit in various configurations. This event results in the need for safety class controls since IND and HEVR are not screened by the design agency. The hazard analysis tables do not identify controls specific to these events. Instead, the hazard analysis tables refer to Section 3.4.2.4 of the HAR, dedicated to evaluating impact hazards. Section 3.4.2.4 lists the identified controls for this hazard. After reviewing the list of controls, the most applicable control is a SAC (i.e., W78 Process - Tripping Hazards), designated in the HAR to perform functions equivalent to a safety-significant control. This SAC requires production technicians to check for tripping hazards once per shift.

The staff team traced the SAC requirement to NEOPs. The NEOPs do contain critical steps in their setups that require signature for ensuring tripping hazards have been removed. However, if this SAC is implemented to prevent the event (i.e., production technician trip), it would be an inadequate safety class preventive measure because it does not prevent the tripping hazards from accumulating during operations. As a result, the review team concludes that the events involving a production technician trip are uncontrolled. During onsite discussions, Pantex personnel agreed that they do not have adequate controls in place for tripping events identified in the HAR. However, CNS personnel stated that this is a known deficiency and CNS is developing a JCO.[2] Per 10 CFR § 830.203(g), CNS is required to enter the PISA process and implement operational restrictions prior to issuing a JCO. The review team concludes that this situation does not meet DOE requirements and as such represents a PISA. CNS has not declared a PISA regarding its controls for these hazards.

6. Drop Hazards—The W78 HAR identifies several drop events involving a shielded apron or various pieces of equipment, tooling, or materials impacting weapon configurations from a height of two or four feet. These events result in the need for safety class controls since the design agency did not screen them for high order consequences. A SAC (i.e., W78 Process - Hand Lifts) is one of the credited controls to prevent this event. The SAC flows down to safety requirements at the beginning of the NEOPs. The SAC justifies reliance on production technician training by stating:

> *With the training to the technicians on not lifting hand tools, tooling, and materials over the unit unless required for the process and to only lift the object as high as required for the operation, both the frequency of a drop that would impact the units [is] reduced, and the possible impact energy is reduced if a drop were to occur.…Based on the height of the unit being worked on, there would be no reason to lift the hand tooling 2 feet over the unit and it would be an unnatural act to do so. It is not considered credible that the tooling would be lifted more than 2 feet over the unit and dropped.*

Similarly, although not explicitly stated in the SAC, the NEOPs also cite a specific safety requirement for the shielded aprons to be relocated to staging cubicles or corridors out of direct line of sight of the cells when not in use. However, contrary to MNL-293084, *Pantex Writer's Manual for Technical Procedures*, the NEOPS do not provide critical steps or warnings when handling the specific equipment or materials, that when dropped, could initiate a high order consequence [13]. The staff team discussed the shielded apron and six different individual pieces of equipment considered in the HAR during the site visit. CNS stated that production technicians are sufficiently trained to not lift items more than 2 feet over the weapon. Given the high consequences, the SAC would be strengthened by adding additional specificity (e.g., do not lift equipment higher than a set height above the weapon). In addition, consistent with MNL-293084, the NEOPs should include critical steps or warnings when handling specific equipment or materials that could initiate a high order consequence if dropped.

7. Process for Discrepant As-Found Conditions—The site USQ procedure, approved by NPO, does not comply with the requirements of 10 CFR 830 or recommendations of DOE Guide 424.1-1B, *Implementation Guide for Use in Addressing Unreviewed Safety Question*

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[2] CNS issued the JCO titled, *Justification for Continued Operations for Legacy Issues Associated with Documented Safety Analyses at Pantex*, on June 29, 2018.

Requirements [14].[3] In situations when a "discrepant as-found condition" is observed for a TSR-related control, the procedure allows returning the system to the original condition as described in the documented safety analysis (DSA) within three days without having to declare a PISA, formally notifying DOE, performing an extent of condition review, or implementing any compensatory measures.

10 CFR § 830.203, *Unreviewed Safety Question Process*, requires the contractors to "establish, implement, and take action consistent with a USQ process that meets the requirements of this section." Paragraph (g) of this section states: "If a contractor responsible for a hazard category 1, 2, or 3 DOE nuclear facility discovers or is made aware of a potential inadequacy of the documented safety analysis, it must:

1. Take action, as appropriate, to place or maintain the facility in a safe condition until an evaluation of the safety of the situation is completed;

2. Notify DOE of the situation;

3. Perform a USQ determination and notify DOE promptly of the results; and

4. Submit the evaluation of the safety of the situation to DOE prior to removing any operational restrictions…."

CNS has prepared a USQ procedure, CD-3014, *Pantex Plant Unreviewed Safety Question Procedure* [15], approved by NPO, that does not comply with the requirements of 10 CFR 830. More specifically, Procedure CD-3014 allows the following:

> *If the discrepant as-found condition can be restored to be within the DSA in a matter of hours, not to exceed three business days, a <u>PISA does not exist</u> [emphasis added]. This is limited to conditions where 1) an SSC [structure, system, or component] does not conform to the documented design description and specifications, or 2) implementation/execution errors, for which any immediate actions taken would be to return the facility to conditions described in the DSA. When the determination is made that the discrepant as-found condition can be fixed in three business days or less, the affected operations are restricted until actions are completed to restore compliance.*

This contractor procedure and its NPO approval do not comply with the four fundamental elements of the USQ process as established by 10 CFR 830:

- The Pantex procedure restricts operations whereas 10 CFR 830 requires the contractor to place or maintain the facility in a safe condition.

[3] CNS has prepared, and NNSA has approved, a USQ procedure for the Y-12 National Security Complex that contains the same deficiency and inconsistency with the requirements of 10 CFR 830.

- The Pantex procedure does not require DOE to be notified of the discrepancy and actions taken. As a result, CNS may operate the facility up to three days outside the DOE approved safety basis without DOE's formal knowledge of the situation.

- The Pantex procedure states that a PISA does not exist when a discrepant as-found condition can be resolved within three business days, whereas following 10 CFR 830 would result in a PISA followed by a USQ determination.

- The Pantex procedure does not require an evaluation of the safety of situation for submittal to DOE prior to removing the self-established operational restrictions, whereas 10 CFR 830 requires DOE's acknowledgement of the safety of the situation prior to the contractor removal of the operational restrictions.

During the discussions at the site, CNS and NPO personnel referred to an approval memorandum received from the NNSA Chief of Defense Nuclear Safety (CDNS) for application of the three-day grace period for not issuing a PISA. The CDNS memorandum [16], however, refers to conditions that involve defense in depth or other non-safety SSCs because those SSCs "wouldn't have LCOs [limiting condition for operations] associated with them but will normally wear out, or may be non-conforming for some other reason." While the CDNS's concurrence with a situation that involves non-safety related controls may be justified, its extension by Pantex to safety-related and TSR controls is not permitted by DOE requirements of 10 CFR 830.

Additionally, Appendix C to CNS's USQ procedure, CD-3014, describes the PIE process that is a precursor to identification and declaration of a PISA. As part of the PIE process an inquiry is made [17]: "Does the situation indicate a directive action Specific Administrative Control (SAC) may not provide the safety function assigned to it within the DSA?" If the answer is "yes," a PISA is declared. The staff review team concludes that, consistent with DOE requirements, SACs perform a safety class or safety-significant function and are part of the TSRs of the facility. SACs should not be subject to the USQ or PISA process; however, the analysis that led to the derivation of the SAC may be subject to the USQ/PISA process if the analysis is found to be incorrect. Any change to a SAC in order to perform its intended safety function should be considered a TSR change, and DOE must approve it. 10 CFR § 830.205, *Technical Safety Requirements*, mandates contractors to "(2) Prior to use, obtain DOE approval of technical safety requirements and any change to technical safety requirements; and (3) Notify DOE of any violation of a technical safety requirement." This section of 10 CFR 830 is stand-alone and specific to the TSRs; it stands apart from the USQ process (i.e., Section 203 of 10 CFR 830). As such, the staff team concludes that 10 CFR 830 requires a TSR violation to be directly reportable to DOE, and outside the USQ process.

An example of mishandling safety-related controls by using the USQ procedure CD-3014 occurred when a piece of safety-related electrical equipment failed testing in accordance with the in service inspection (ISI) requirement of the TSR for its commercial grade dedication. CNS issued a PISA on March 10, 2017, followed by a USQ determination [18], which CNS determined was negative and did not submit for DOE approval. The USQ determination stated that the piece of equipment credited was "redundant" and that CNS at a later date would provide

DOE "a change to Chapter 4 of the Sitewide SAR to delete [this piece], add [another piece of equipment] as a reference, and delete the ISI to inspect from the TSRs…."

DOE Guide 424.1-1B identifies that a failure of a safety-related control, identified in Chapter 4 of the DSA and part of the TSRs, would be reportable to DOE upon verification under a positive USQ determination. Revision of the associated TSR for the failed equipment and replacement by the new piece are required to be completed and approved by DOE before lifting operational restrictions, and not at some later date when the DSA or the *Sitewide SAR* is revised. The staff review team notes that CNS has not successfully revised the Pantex *Sitewide SAR* via an annual update since 2014, and DOE has not approved the changes CNS has proposed in the last three years (including the change described above). Consequently, discrepancies exist between the approved *Sitewide SAR* and its associated set of controls (i.e., the failed equipment) and the contractor's set of controls relied on to support ongoing operations (i.e., the redundant equipment).

8. Long Term JCOs—Some JCOs last for several years without updating the relevant safety basis document, relying on compensatory measures without implementing rigorous controls (e.g., engineered design features). Section 7 of CD-3014 states that "[t]he purpose of a JCO is to make a temporary (i.e., less than one year) change to the facility safety basis that would allow the facility to continue operating...." This statement, however, is not codified to lead to closure of the JCOs within a certain period of time (i.e., less than one year) or incorporate the open JCOs into the next annual update of the safety basis documents, as required by DOE.

Per 10 CFR § 830.202, *Safety Basis*, the contractors are required to "(1) [u]pdate the safety basis to keep it current, and to reflect changes to the facility, the work and the hazards as they are analyzed in the documented safety analysis. (2) Annually submit to DOE either the updated documented safety analysis for approval or a letter stating that there has been no change in the documented safety analysis since the prior submission."

These requirements of 10 CFR 830 serve two purposes: (1) consolidate all positive USQs and JCOs prepared during the year into one safety basis document for DOE approval and (2) ensure that compensatory measures, and thus less reliable controls, implemented for temporary changes resulting from the JCOs do not become the permanent control for hazards.

CNS applies the JCO process to temporary changes as reflected in CD-3014, and to allow deviations from approved safety basis documents. The latter application has resulted in JCOs extending over several years for multiple Pantex operations without CNS integrating them into the annual update of the safety bases. Consequently, CNS has relied heavily on compensatory measures for long periods of time while the JCOs are in effect [19–21].

9. Maintenance of the DSA—CNS has struggled to complete and obtain NPO approval of the yearly updates required by 10 CFR § 830.202. Starting in 2015, NPO has not approved the annual updates CNS has submitted for the *Sitewide SAR*. In 2016, CNS was unable to meet the annual DSA update requirements for the *Sitewide* and *Transportation SARs* and the W76 and W78 HARs. As NPO rejected CNS's submittals, a backlog developed. This process culminated in three rejected submittals and five approvals total in 2017. Overall, this resulted in 11 of 16

SARs and HARs not being approved for annual updates in 2017. In particular, the *Sitewide SAR* has not been successfully updated and approved via the annual update process since 2014.

In lieu of completing the 2017 annual updates, CNS submitted, and NPO approved, a schedule to "rework" three previously submitted annual updates and catch up on the remainder with calendar year 2018 annual updates. If CNS successfully executes its plan to submit and obtain NPO approval of a full slate of 2018 annual updates, it will be back on course to meeting the DSA maintenance requirements.

10. Safety Basis Assessments—CNS has processes and procedures for performing management assessments and IVRs. The review team found sufficient evidence that management assessments of safety controls are being performed on a five-year schedule (i.e., 20 percent per year). While a few assessments have been missed, the review team's analysis indicates that CNS is generally holding to that schedule.

However, CNS performs IVRs when there is a new TSR or a change to an existing TSR. DOE Guide 423.1-lB, *Implementation Guide for Use in Developing Technical Safety Requirements*, specifies that IVRs should be conducted every three years for controls susceptible to the degradation of human knowledge (e.g., procedural controls) [22]. Therefore, CNS is not meeting the three-year guidance for re-verification of SACs. Furthermore, the review team's evaluation of the management assessments for SACs for the W76 and W78 indicated that these assessments rarely identify any strengths, weaknesses, findings, or observations. The Pantex DSAIP includes an effectiveness review for the management assessments, but CNS does not have a path forward to improve management assessments.

11. Action on Known Deficiencies—CNS currently is implementing a DSAIP to address several longstanding issues with the Pantex safety bases [23]. The DSAIP has existed since 2013 and is currently in its fifth revision. CNS personnel informed the staff review team that there has been steady progress on a number of items contained in the fifth revision of the DSAIP. Of the three items scheduled for completion in calendar year 2017, CNS completed two. Seventeen items are scheduled for completion in 2018.

In addition, the DSAIP lacks detail. The plan is only a list of titles of activities with a targeted year for completion. It does not provide any detail of the scope and objectives for each task, the criteria that should be met for satisfactory execution, or the resources required for completion. While CNS representatives informed the staff review team that they understand the items listed and the tasks involved, the DSAIP does not include detail sufficient to allow verification of the accomplishments. Consequently, the staff team cannot independently verify that the plan is comprehensive, achievable, and on-track to meet the schedule for 2018 and beyond.

Over several iterations of the DSAIP, CNS has committed to working down a set of "legacy" COAs that existed prior to the creation of NPO. Originally, there were 40 COAs in this category, and 5 currently remain open. The current iteration of the DSAIP includes a task in fiscal year 2018 to develop metrics for tracking progress in resolving the remaining five COAs. Actual closure dates for the five remaining COAs currently are not identified in the schedule.

APPENDIX 2 REFERENCES

1. DNFSB, Board Notational Vote #Doc#2018-300-098, RFBA by Board Member Roberson to Publicly Release Documents Associated with the Pantex Inquiry, September 2018

2. Code of Federal Regulations, Title 10, Part 830, *Nuclear Safety Management*, January 10, 2001.

3. Department of Energy, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, Change Notice 3, DOE Standard 3009-94, March 2006.

4. Department of Energy, *Hazard Analysis Reports for Nuclear Explosive Operations*, DOE Standard 3016, September 2016.

5. Consolidated Nuclear Security, LLC, *(U) W76-0/1 SS-21 Assembly, Disassembly & Inspection, and Disassembly for Life Extension Program Operations Hazard Analysis Report*, Revision 71, RPT-HAR-255023, November 2017.

6. Consolidated Nuclear Security, LLC, *(U) W78 Step II Disassembly & Inspection and Repair Hazard Analysis Report*, Revision 63, AB-HAR-319393, September 2017.

7. Consolidated Nuclear Security, LLC, *(U) Sitewide Safety Analysis Report (SAR),* Revision 288, AB-SAR-314353, January 2018.

8. Pantex Plant, *(U) Preparation Cart*, Revision 3, Engineering Analysis 000-2-0836-ANL-03, June 2007.

9. Pantex Plant, *(U) System Engineering Category 2 Electrical Equipment Evaluations*, EEE-06-0030, Issue No. 010, March 2014.

10. Pantex Plant, *(U) Category 2 Electrical Equipment Evaluation*, EEE-06-0037, Issue No. 010, October 2013.

11. Pantex Plant, *(U) Weapon Assembly/Disassembly Operations Requirements*, Issue P7-2003, AT, March 2013.

12. Pantex Plant, *Safety Checklist*, TABLE-0068, Issue No. 033.

13. Consolidated Nuclear Security, LLC, *Pantex Writer's Manual for Technical Procedures*, MNL-293084, Issue No. 12.

14. Department of Energy, *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements*, Change Notice 1, DOE Guide 424.1-1 B, April 12, 2013.

15. Consolidated Nuclear Security, LLC, *Pantex Plant Unreviewed Safety Question Procedure*, CD-3014, Issue No. 18.

16. Don Nichols (NNSA Chief of Defense Nuclear Safety) to James Goss (NNSA Y-12 Site Office), memorandum dated February 2, 2010.

17. Consolidated Nuclear Security, LLC, *Problem Identification and Evaluation Processing Form*, PX-4633, Issue No. 14.

18. Consolidated Nuclear Security, LLC, *Commercial Grade Dedication Testing of Delta Arresters*, PIE-18750, USQD-17-3434-A, February 24, 2017.

19. Consolidated Nuclear Security, LLC, *Justification for Continued Operation for W80 ESD*, PX-JCO-14-04, Revision 5, February 27, 2017.

20. Consolidated Nuclear Security, LLC, *Justification for Continued Operation for B61 ESD*, PX-JCO-14-05, Revision 5, October 4, 2016.

21. Consolidated Nuclear Security, LLC, *Justification for Continued Operation for W88 Uncased HE Operations*, PX-JCO-17-09, Revision 2, January 11, 2018.

22. Department of Energy, *Implementation Guide for Use in Developing Technical Safety Requirements*, DOE Guide 423.1-lB, March 18, 2015.

23. Consolidated Nuclear Security, LLC, *The Documented Safety Analysis Improvement Plan*, Revision 5, SB-MIS-941949, September 21, 2017.

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

October 17, 2018

The Honorable James Richard Perry
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Perry:

In September 2017, the Defense Nuclear Facilities Safety Board reviewed the special tooling program at the Pantex Plant. We identified five deficiencies within the special tooling program: (1) application of the *Special Tooling Design Manual*, (2) weld quality and application of non-destructive evaluation techniques, (3) pedigree of preventive maintenance and in-service inspection programs, (4) performance criteria within safety basis documentation, and (5) special tooling loading conditions. These deficiencies continue to exist within the special tooling program. Further information on each is provided in the enclosure.

Yours truly,

Bruce Hamilton

Bruce Hamilton
Chairman

Enclosure

c: Mr. Joe Olencz

Enclosure

Pantex Plant Special Tooling Program Review

This report details the deficiencies that the Defense Nuclear Facilities Safety Board's (Board) staff review team found within the special tooling program. Deficiencies exist in the application of the Pantex Plant (Pantex) *Special Tooling Design Manual* [1], assurance of weld quality and application of non-destructive evaluation (NDE) techniques, pedigree of preventive maintenance and in-service inspection (ISI) programs, utilization of performance criteria within safety basis documentation, and special tooling loading conditions. Based on these deficiencies, the National Nuclear Security Administration (NNSA) Production Office (NPO) and Consolidated Nuclear Security, LLC (CNS), have not demonstrated that the currently implemented process for design, fabrication, production usage, and maintenance of special tooling at Pantex assures that all special tooling can meet its required safety-related functions.

Background. Pantex utilizes special tooling to support and manipulate nuclear explosive components during operations at the plant. Special tooling functions as a passive design feature managed through the special tooling program, and is credited within the Pantex safety basis to meet minimum factors of safety. Adherence to these design criteria assures special tooling does not fail during normal and abnormal loading conditions. Failure of special tooling to meet its credited safety functions could lead to impacts to sensitive components of the nuclear explosive (e.g., dropping of unit or equipment impacts onto the unit), potentially resulting in high order consequence events. The requirements for the special tooling program are identified in the NPO-approved Pantex *Sitewide Safety Analysis Report* [2], and specifics are flowed down into the contractor-established *Special Tooling Design Manual*, the *General Requirements for Tooling Fabrication & Inspection* [3], and the *Special Tooling Operations* [4] manual.

During the onsite review and follow-up teleconference, the staff review team evaluated various aspects of the Pantex special tooling program, including safety basis integration; flow down of functional requirements; technical support documentation and analyses; preventive maintenance and ISI of special tooling; quality assurance requirements and processes; and corrective actions resulting from nuclear explosive safety (NES) evaluations, the CNS Special Tooling Top-Down Review [5], and the 2015 NPO Special Tooling Assessment [6].

The staff review team evaluated the special tooling program and its ability to ensure that credited pieces of special tooling are adequately designed, fabricated, and inspected, ensuring their ability to perform safety significant and/or safety class functions. During this review, the staff review team evaluated more than 75 special tooling designs, including a vertical slice of special tooling for the B61 program and a horizontal slice of common special tooling designs across weapon programs (e.g., vacuum lifting fixtures, lifting and rotating fixtures, and workstands). Evaluation of the B61 special tooling allowed the staff review team to examine some of the oldest and newest tooling designs that are currently authorized for use. The staff review team noted deficiencies, opportunities for improvement, and noteworthy practices, which will be described in further detail in the remainder of this report.

Content and Application of *Special Tooling Design Manual*. No consensus or industry standards currently govern the design, fabrication, inspection, and maintenance of special tooling, including factors of safety, weld inspections, and quality assurance practices. Because there are no standards specifically applicable to these aspects of special tooling, the guidance and requirements provided in the *Special Tooling Design Manual* frequently do not have documented or cited bases.

Deviations from Manual Guidance—The staff review team identified multiple instances where Pantex did not meet the requirements and guidance in the *Special Tooling Design Manual*. For example, Pantex currently does not perform NDE for special tooling welds with low factors of safety, which appears to be in direct conflict with the *Special Tooling Design Manual* (see following sections). In addition, the *Special Tooling Design Manual* specifies a minimum of 3:1 factor of safety to yield or 5:1 factor of safety to ultimate strength, as well as the 1.25:1 factor of safety to yield for rare events (i.e., seismic or falling man loads). The staff review team noted instances in which tooling does not meet the minimum factors of safety specified in the *Special Tooling Design Manual*:

- Workstand (061-2-0815) pieces 64 and 65 did not meet the 1.25:1 factor of safety at yield for rare events.

- Penetrator case sleeve (061-2-0738) did not meet the 3:1 factor of safety at yield.

- Assembly press (061-2-0841) did not meet the 3:1 factor of safety at yield.

Pantex personnel stated that designs that deviate from the *Special Tooling Design Manual* only require the same approval process as those designs adhering to the manual. As the *Special Tooling Design Manual* provides the means to satisfy the programmatic requirements set forth in the *Sitewide Safety Analysis Report*, the staff review team suggests elevating deviations for additional review and approval beyond the typical process.

Ambiguous Guidance—The *Special Tooling Design Manual* contains imprecise guidance and requirements allowing for multiple interpretations of certain sections. This has the unintended consequence of allowing deviations when implementing the manual. For instance, the section on weld inspection requirements recommends NDE for welds with a factor of safety less than 10:1 [1]. However, the manual does not clarify whether this is a factor of safety to ultimate or yield strength, and does not specify whether this stress analysis must be done for both yield and ultimate strength. The staff review noted instances in which Pantex personnel did not implement special tooling NDE because there was no analysis of the factor of safety to ultimate strength. Similarly, the special tooling engineer has latitude to evaluate for either 3:1 at yield or 5:1 at ultimate strength for normal loads at his or her discretion.

Basis for Rare Events Factors of Safety—The staff review team identified a concern with the minimum factors of safety for rare events, as recommended in the *Special Tooling Design Manual*. The choice of factors of safety for rare events (1.25:1 at yield strength and 1.5:1 at ultimate strength) does not represent the level of uncertainty in the tooling construction and abnormal loading parameters. For instance, welds in special tooling are currently not subject to NDE beyond visual inspection. The lack of NDE of welds introduces uncertainty regarding the material properties of special tooling. Moreover, as discussed in the 2013 Approved Equipment

Program Volume II NES Master Study (AEP Vol. II NESMS) [7], factors of safety from 1.25 to 1.5 are typically used in weight-sensitive applications and are appropriate only if there is a strong degree of certainty in the material properties, loads, and resultant stresses. The special tooling program does not include measures to provide additional assurance for the performance of tooling with low factors of safety, such as load testing to failure or higher maintenance frequency.

The closure package that Pantex submitted for the 2013 AEP Vol. II NESMS finding "Factor of Safety for Special Tooling Rare Event Analysis" discusses the level of uncertainty present in design and materials for special tooling. However, the closure package focuses on several key areas where uncertainty may be present without comprehensively analyzing all sources of uncertainty and variability in design, fabrication, and operation of special tooling [8]. For instance, weld quality, lack of in-house material certification, and damage (including material fatigue, wear, and handling damage) during operations may all introduce uncertainty and variability in performance. Moreover, the closure package provides only a qualitative assessment of uncertainty in the determination of factors of safety, and does not present a quantitative uncertainty analysis to demonstrate that the safety margins for rare event loading are appropriate.

Special Tooling Design–Ductile Versus Non-Ductile Systems—Due in part to the perceived low frequency of seismic events and falling man events—assumed to be analogous to seismic events in the *Special Tooling Design Manual*—Pantex employs less conservative factors of safety for rare event loads. Factors of safety for rare event loading are developed in the *Technical Basis for Safety Factors* [9], which supports the *Special Tooling Design Manual* and *Special Tooling Seismic Analysis* [10]. This technical basis document states that "criteria for tooling design packages are equivalent or more conservative" [9] than DOE Standard 1020-2002, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities* [11]. Part of this justification specifically focuses on not crediting the ability to use energy absorption factors to reduce seismic loads for ductile structural systems similar to building structures.

While the justification for rare event load paths states that ductile systems will use the factor of safety of 1.25:1 to yield, and non-ductile systems will use a 1.5:1 factor of safety to ultimate strength, there is no guidance in the *Special Tooling Design Manual* for what is classified as ductile behavior or materials to avoid in the design of ductile systems. The manual also does not incorporate the principles of capacity-based design or overstrength of critical elements of a load path that consensus seismic standards use. Furthermore, the *Special Tooling Materials Database* [12] employed by special tooling engineers contains examples of permitted materials with little or no ductility, such as plastics and high-performance alloys (where yield and ultimate strength can be within a few percent of each other). Without guidance for determining when systems can be considered ductile, special tooling engineers determine independently which safety factor should be used as an acceptance criterion and which materials are suitable for tooling subject to rare event loads. This use of engineering judgement could lead to variability in selected factors of safety and potentially result in a non-conservative special tooling design.

Special Tooling Design–Failure Probability—The ultimate goal of seismic design methods that meet DOE Standard 1020 is to achieve a certain probabilistic performance for structures, systems, and components (SSC). An SSC designed for PC-3 design loads using this standard has an input ground motion with an annual probability of exceedance of $4x10^{-4}$ but is designed with enough margin to have an annual probability of failure of less than 10^{-4}. In order to meet this performance, consensus standards such as American Society of Civil Engineers Standard 43-05, *Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities* [13], restrict certain types of materials, designs, or analysis techniques to ensure adequate ductility and quality. Lower performance SSCs, in turn, have smaller input forces and higher annual probabilities of failure, and are permitted to use less rigorous design methods and employ a wider variety of materials or structural types. The *Special Tooling Design Manual*, however, does not incorporate these principles, relying entirely on its rare event loading factors of safety.

Neither the *Special Tooling Design Manual* nor the *Special Tooling Seismic Analysis* address how the 10^{-4} annual probability of failure expected of PC-3 SSCs is ensured through their selection of safety factors. DOE Standard 1020 ensures this performance through the use of consensus standards built around estimates of SSCs' statistical margin to failure. Because special tooling is a class of custom-made design features, there is not the same statistical basis for their beyond design basis performance like other SSCs that DOE Standard 1020 was meant to address. Typically for seismic design, the approach to non-standard designs or structures is to not credit ductility and use the most conservative design factors to bound the uncertainty in a structure's beyond design basis performance, or to use overstrength factors to ensure the controlling failure modes are well-understood, ductile failures [14].

During the 2013 AEP Vol. II NESMS, a NES Study Group evaluated Pantex's special tooling program and noted this issue in a statistical analysis of performance for special tooling under rare-event loads. As described in section 3.3.2 of the Master Study report, the NES Study Group highlighted that probabilistic margin requires understanding not just the deterministic safety factors of the special tooling, but the hazard curves that determine the probability of exceedance for various intensities of ground motion [7]. In order to have sufficient design margin, the overstrength of special tooling (defined in this case by its factor of safety) has to be combined with the probability of both design basis and beyond design basis ground motions, as well as uncertainties in these two values. The NES Study Group also observed that factors of safety this low are normally associated with designs with high degrees of certainty in not just design and fabrication, but operating environment, rather than abnormal conditions such as a falling man or seismic event.

Pantex developed a white paper justifying its rare event loading approach that was formalized into the submitted closure package for the 2013 AEP Vol. II NESMS finding "Factor of Safety for Special Tooling Rare Event Analysis," and documented within the *Special Tooling Design Manual* [8]. The closure package qualitatively states that the conservative design practices, low probability of earthquakes, known material properties and operational environment for tooling, and the maintenance of special tooling create a conservative framework for use of these safety factors. In addition, this closure package states that "loads and resultant stresses are known with a high degree of certainty" [8] citing the *Special Tooling Seismic*

Analysis. However, this document provides only a high-level discussion and does not cite a probabilistic goal for tooling performance, relying instead on the tooling program as a whole to provide sufficient performance. The high degree of certainty in the demands to which tools are evaluated does not translate to low variability of potential seismic demands. There is no quantitative basis that the safety factors and other aspects of the special tooling program provide seismic margins comparable to equivalent safety SSCs.

Weld Quality and NDE of Welds. The *Special Tooling Design Manual* requires NDE of welds for the fabrication or modification of tooling in high-stress applications with factors of safety less than 10:1. Pantex personnel do not implement NDE beyond visual inspections done by a qualified weld inspector. However, per the Metals Handbook Volume 10, *Failure Analysis and Prevention* [15], while visual inspection can identify visible features such as cracks, weld mismatch, and bead convexity or concavity, the following subsurface features would not be identified through visual inspection, but may be identified through additional NDE: underbead crack, gas porosity, inclusions (slags, oxides, or tungsten impurities), incomplete fusion, and inadequate penetration. These subsurface features can result in a weld with lower strength or ductility. During the review, the staff review team identified three concerns:

- *Weld Performance*—As discussed previously and shown in Table 1 of Appendix A, the *Special Tooling Design Manual* specifies a minimum factor of safety to yield strength of 1.25:1 and a factor of safety to ultimate strength of 1.5:1 for rare event loadings, such as seismic and falling man loads. Special tooling engineers do not consider any reduction of weld performance due to poor weld quality through either joint efficiency factors (per American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section VIII [16] and American Petroleum Institute Standard 653 [17]) or more conservative safety factors (such as phi-factors used for American Institute of Steel Constructors (AISC) 360-10, *Specification for Structural Steel Buildings* [18]). Due to the low minimum factors of safety allowed by the *Special Tooling Design Manual* for rare event scenarios, a reduction in weld performance may challenge the special tooling's ability to perform its credited safety function. For example, ASME Boiler and Pressure Vessel Code Section VIII assumes a joint efficiency factor of 0.7 for a double welded butt joint without radiography or equivalent NDE. Applying the 0.7 joint efficiency factor to tooling designed to the minimum 1.25:1 factor of safety to yield strength (for rare event loading) results in a factor of safety of 0.875:1. Thus the tooling would be expected to yield during rare event loading.

- *Plastic Deformation*—There are instances where special tooling is anticipated to deform plastically in the course of meeting its design function during abnormal events (i.e., a deflection limit for dynamic load), rather than meeting more conservative factors of safety specified in the *Special Tooling Design Manual*. In cases of plastically deforming structures, higher weld quality and performance are necessary to ensure the structure performs as expected, as exemplified by demand-critical welds defined in AISC 341-10, *Seismic Provisions for Structural Steel Buildings* [14]. However, Pantex personnel do not perform NDE of welds subject to plastic deformation, such as the W76 swing arm (000-2-0831). Upon a dynamic impact, the

W76 swing arm is credited to deform no more than a certain distance vertically, such that the unit underneath will not be impacted. Without NDE verification of weld integrity, Pantex cannot ensure that such special tooling will meet its safety critical design function.

- *Vendor Quality Issues*—Pantex personnel provided the staff review team with vendor performance reports for past and present special tooling vendors [19]. The staff review team noted that several of these reports included instances of receipt refusal of procured tooling due to weld quality issues. Pantex personnel identified these quality issues during receipt quality control visual inspections. The staff review team noted that due to the nature of weld quality issues (e.g., weld penetration depth, heat-affected areas, pores, cracks, inclusions), visually identified weld quality issues could indicate the presence of additional weld quality concerns that cannot be identified through visual inspection alone, and may go undetected.

As part of the submitted closure package for the 2013 AEP Vol. II NESMS finding "Preventative Maintenance," Pantex personnel included additional information in the *Special Tooling Design Manual* detailing different types of NDE [20]. While this information includes the advantages and limitations of different techniques, it does not specify any NDE requirements, and thus does not address the concerns noted above.

Pedigree of Special Tooling Preventive Maintenance and ISIs. The staff review team noted three methods that Pantex used to ensure that special tooling—credited design features in the safety basis—can continue to meet its safety functions throughout its time in service: (1) as-built designs (e.g., inherently conductive special tooling fabricated out of stainless steel), (2) production technician inspections for damage prior to use, and (3) special tooling preventive maintenance and ISIs.

Based on observed preventive maintenance activities and subsequent discussions, the special tooling preventive maintenance and ISI programs lack the rigor expected for maintenance on and inspection of equipment with safety class and/or safety significant functions. For instance, in contrast to other safety-related SSCs, preventive maintenance and ISIs on special tooling are not performed per detailed written procedures. As a specific example of maintenance performed with sufficient rigor, during review of the maintenance and cognizant system engineering programs at Pantex in December 2017, the Board's staff observed preventive maintenance of ESD flooring—a design feature—in two nuclear explosive facilities. Workers conducted the preventive maintenance according to a detailed, written procedure (i.e., Technical Procedure TP-MN-06291, *ESD Flooring Resistance Measurements, Annual, Plant* [21]) and with an appropriate level-of-use (e.g., reader-worker practices). In contrast, the staff review team observed that for special tooling maintenance, Pantex relies heavily on worker knowledge and the skill of the craft to meet specifications that the special tooling engineer provides in the supporting data sheets. This practice could compromise the reproducibility of test results and prevent reliable testing of important features, given the potential variability in results.

Performance Criteria Assurance. The performance criteria for meeting the functional requirements for safety class and/or safety significant special tooling are absent from the safety basis and reside in supporting documents (i.e., design requirements documents, supporting data sheets, and analyses). Although the requirements for the special tooling program are governed by the NPO-approved *Sitewide Safety Analysis Report*, the performance criteria for program-specific special tooling are neither within Pantex safety basis documentation nor reviewed and approved by NPO. DOE Standard 3009-1994, Change Notice 3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, delineates expectations that the safety basis chapter on SSCs include "[i]dentification of the performance criteria necessary to provide reasonable assurance that the functional requirements will be met" [22]. The lack of NPO approval of the specific performance criteria conflicts with DOE Standard 3009-1994 expectations.

Special Tooling Loading Conditions. During its review, the staff review team noted the following deficiencies regarding special tooling loading conditions:

W76 Swing Arm—Pantex relies on the test results of a single (prototype) W76 swing arm [23] to validate that it will perform its safety basis function under analyzed loads. The staff review team identified several concerns with this testing, including the following:

- The test assessed whether the swing arm would perform its safety function in the case of dynamic loading (i.e., the special tooling would vertically deflect less than a certain distance during an impact scenario). However, Pantex performed only a single test, and Pantex personnel informed the staff review team that it was not performed with a high quality pedigree, such as in accordance with the quality assurance requirements of ASME NQA-1, *Quality Assurance Requirements for Nuclear Facility Applications* [24]. When coupled with the weld quality concerns and weld manufacturing variances noted above, it is unclear to the staff review team how Pantex can ensure that all swing arm copies will be able to perform their safety functions during an impact scenario (i.e., they will not deflect beyond the specified limit and potentially impact the unit).

- The staff review team identified an additional falling man scenario with the W76 swing arm that Pantex had not previously analyzed. As this impact scenario applies a load on a longer lever arm, there exists the possibility for a larger deflection of the swing arm than previously postulated, which would potentially defeat its safety function. Pantex personnel stated that they do not consider the scenario to be credible. However, the staff review team contends that during transient movements of the swing arm, production technicians have a direct pathway to apply load on the longer lever arm.

Falling Man Rare Event Loading—The staff review team noted non-conservative assumptions regarding placement and distribution of falling man rare event loading. Per the reviewed analyses, special tooling engineers typically apply the falling man loading to the center of gravity of the components supported by special tooling. This usually results in a symmetric distribution of loads. The staff review team questioned the appropriateness of this approach, postulating that it may be more conservative and bounding to assume an uneven distribution of loads, such as primarily loading one beam of a two-beam system rather than applying equal loading across both beams.

Specifically, for the B61 program, the staff review team identified non-conservative assumptions with the placement and distribution of falling man rare event loads involving a configuration between the support beam (061-2-0730) and support and alignment fixture (061-2-0860). In this configuration, the staff review team noted that falling man horizontal loads could impart a torsional load component to the support beam that Pantex had not analyzed. While this may be a robust piece of special tooling with respect to vertical loading, Pantex did not evaluate the factor of safety for torsional load. As justification, special tooling engineers noted that the angles from which production technicians can approach this configuration preclude this torsional loading. However, nuclear explosive operating procedures do not restrict approach angles to protect this assumption, and subsequent staff review team observations of B61 nuclear explosive operations revealed that a falling production technician could approach at the angles of concern and could impact this configuration to generate out-of-plane loadings not currently evaluated.

Loss of Special Tooling Design Function during Impacts—Functional requirements for special tooling include factors of safety based on static loading conditions. However, as observed during falling man studies performed at Virginia Polytechnic Institute and State University [25], special tooling, such as tooling employing a banjo plate configuration, had considerable elastic deformation during certain dynamic impact scenarios. Pantex does not typically consider how deformations under loading could render the special tooling incapable of performing its safety function throughout the loading cycle (e.g., a holding fixture deforming under impact and allowing a held component to be dropped).

Opportunities for Improvement. The staff review team identified several opportunities for improvement in the special tooling program.

- *Periodic Reevaluation of Analyses*—The staff review team noted that there currently is no requirement or guidance to Pantex personnel that requires the periodic reevaluation of special tooling engineering analyses. Such a program would allow opportunities for Pantex to self-identify incomplete or deficient conclusions, bolster the analysis methodology to include modern methods (e.g., finite element analysis software), and provide additional assurance in the conclusions of the special tooling analysis.

- *NES Study Concerns*—NNSA does not currently have near-term plans to redesign or upgrade B61, W76, and W87 special tooling to address outstanding NES Study concerns, including reducing the size of gas cylinder carts to eliminate/minimize hazards and discontinuing an electrical tester cart (i.e., for the PT3746) that is susceptible to toppling. NES Study Groups have identified aspects of special tooling associated with these weapon programs that do not meet the intent of Seamless Safety for the 21st Century, including the W76 program's continued use of a swing arm and the absence of an engineered control for potentially cracked high explosive and unnecessary unit lifts on the W87 program. Furthermore, the staff review team noted that when a NES Study Group identifies potential deficiencies in the special tooling design or implementation on one weapon program (e.g., elimination of a similar swing arm on the W78 program by introduction of a transfer cart), NNSA and the Pantex contractor do not consistently address the deficiency on other applicable weapon programs.

- *Validation Testing*—The staff review team identified that Pantex only performs limited testing of special tooling to validate engineering calculations. For example, the first destructive test of a piece of special tooling (i.e., the B61 support beam) was conducted in July 2017. This destructive test was used to confirm the conclusions of the associated engineering analysis. In case of special tooling with factors of safety lower than required by the *Special Tooling Design Manual*, additional testing would be valuable to eliminate uncertainty regarding whether the tooling will perform its design function.

- *Safety Catches*—The staff review team evaluated the use of W76 vacuum lifting fixtures and the 2015 issue in which cracks were identified in vacuum lifting fixture safety catches (see Figure 1). The safety catches are a secondary feature to prevent a drop of high explosive charges should vacuum fail on the lifting fixture. The staff review team is concerned that actions taken to-date may not prevent recurrence of cracking of safety catches. Pantex continues to rely on production technicians to identify cracking during routine prior-to-use inspections. The staff review team believes that application of an ISI or introduction of a specific step within the nuclear explosive operating procedure to check for safety catch damage prior to use would bolster the reliability of this check. Alternatively, the safety catches could be redesigned, substituting a material with a lower likelihood of cracking (e.g., appropriately coated metal).

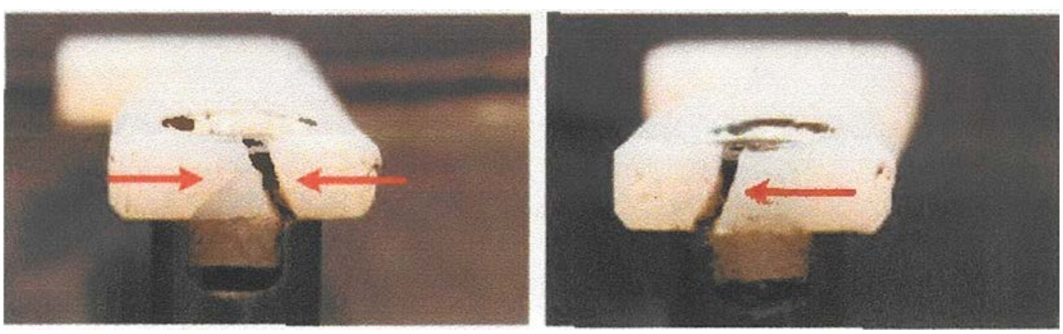

Figure 1. *Cracked Safety Catches in the W76 Aft Disassembly Fixture, 076-2-0382* [26].

- *Special Tooling Acceptance Process*—As discussed onsite, in one instance, Pantex delivered an incorrectly fabricated W88 lifting and rotating fixture (088-2-0377) to production for use, and technicians subsequently installed it in the facility and began operations. On this specific piece of special tooling, a component used to mate the tooling to the stand was out-of-tolerance. The component is designed with a slight bend; however, the bend angle was out-of-tolerance by approximately 10 degrees, preventing the component from interfacing properly with other special tooling during the operation. The bend angle is neither part of the receipt inspection for subcontracted tooling (as a recordable feature), nor part of the quality assurance inspections required before the tooling is released for production use. A NES Change Evaluation was ultimately required to authorize the use of a temporary procedure to remove the special tooling and continue operations. In light of this occurrence and other instances of special tooling used without all necessary reviews and approvals [27], the staff review team encourages improvements to the special tooling acceptance process.

Noteworthy Practices and Updates. The staff review team identified a number of noteworthy practices that Pantex has implemented that contribute to the improvement of the overall safety posture of special tooling program. In addition, the staff review team noted several ongoing initiatives.

Noteworthy Practices—The staff review team noted several practices that contribute to the safety posture of the special tooling program.

- **Sharing Lessons Learned.** Pantex has established methods for sharing lessons learned among special tooling engineers (e.g., use of "Design Tips" documentation). The staff review team specifically noted an example with the B61 presray plate (061-2-0761). Given incidents with this special tooling (e.g., loss of air pressure due to intrusion of foreign material through the supply air), Pantex took appropriate actions to apply in-line air filters to all special tooling requiring air pressure to perform its required functions.

- **Quality Assurance Consensus Standard Implementation.** As part of its 2016 approval of the combined Y-12 and Pantex *Quality Assurance Program Description* [28], NPO required Pantex to apply the quality assurance requirements of NQA-1 to the special tooling program [24, 29]. Historically, special tooling quality assurance has been governed by the NNSA Weapon Quality Policy (i.e., NAP-24), which establishes specific weapon and weapon-related product-focused quality requirements for designing, producing, and surveilling weapon products.

  As part of its extent of condition review, Pantex identified a large number (between 5,000 and 10,000) of special tooling designs that will require additional evidence to meet the commercial grade dedication requirements of NQA-1. Pantex is conducting a pilot study on six pieces of special tooling in order to inform NPO of the potential cost and timeframe for complete implementation of NQA-1 for special tooling. The tooling selected for the pilot study includes an assembly cart (000-2-1230), W76 lifting & rotating fixture (076-2-0365), assembly stand (000-2-0832), and a B83 vacuum fixture (083-2-0460).

- **Supplier Quality Control Improvements.** The staff review team identified some noteworthy practices by Pantex Supplier Quality. First, Pantex uses a risk-informed process to determine whether a given supplier requires additional Pantex oversight to ensure that the special tooling received from the supplier meets Pantex quality requirements. The staff review team notes that these risk-based surveillances occur in addition to the triennial Pantex re-evaluation. Second, Pantex has developed a *Supplier Quality Handbook for Special Tooling Suppliers* [30] that will help inform special tooling suppliers of many of the pitfalls encountered by Supplier Quality. Third, Pantex has demonstrated its willingness to remove suppliers who are routinely at risk from the Qualified and Approved Suppliers List until the supplier demonstrates compliance with Pantex Supplier Quality requirements.

Ongoing Initiatives—Pantex plans to make improvements to the *Special Tooling Design Manual*, as well as special tooling engineering analyses, including the following:

- **Clarification of Design Manual.** Pantex has revised the *Special Tooling Design Manual* to include clarifications and additional language to provide guidance on factors-of-safety requirements for special tooling and the use of backup features with friction-based special tooling. However, Pantex has not provided sufficient additional guidance for factors of safety for press assemblies. Pantex has clarified that either the factor of safety of 3:1 at yield or 5:1 at ultimate strength can be used in analysis, but does not provide guidance on the appropriateness of one value or the other.

- **Guidance for Deviations from Design Manual.** Pantex has updated the *Special Tooling Design Manual* to provide additional guidance regarding the approval process for special tooling designs that deviate from manual requirements. However, the approval process for deviations from the design manual does not require elevation beyond the normal approval chain.

- **Engineering Mentors.** Pantex has updated the *Special Tooling Design Manual* to implement a mentor system, in which senior special tooling engineers will be tasked with providing clarification and improvements to the design manual.

- **Updates to Special Tooling Analyses.** Pantex is updating several special tooling engineering analyses that were discussed during the staff review team's onsite review (e.g., the W76 swing arm (000-2-0831), B83 belly band (083-2-0476), W87 primary lifting fixture (087-2-0400), and B61 penetrator case sleeve (061-2-0738) analyses).

  Specifically for the W76 swing arm, the staff review team questioned whether the single dynamic loading test would bound the impact of a falling man scenario, as was indicated in the *W76 Hazard Analysis Report* [31]. Pantex personnel have updated the tooling analysis to defend its safety basis assumption that dynamic testing bounds the falling man scenario. Pantex personnel have updated their swing arm calculation to demonstrate that forces from the test exceed the current falling man load.

Appendix A
Special Tooling Safety Factors

The *Special Tooling Design Manual* presents factors of safety for custom special tooling within the anticipated load paths. These values do not apply to off-the-shelf components, such as casters or pressurized tubing. Non-pressurized off-the-shelf components are held to a factor of safety of 1:1 to working load or 5:1 to vendor-stated failure load. Pressurized off-the-shelf components are held to a factor of safety of 1:1 to working load or 4:1 to vendor-stated burst pressure. In addition, the *Special Tooling Design Manual* includes minimum factors of safety for several other types of special tooling, such as systems relying on vacuum or acting to restrain compressed air hoses; however, these are not discussed further in this report.

The factors of safety most relevant to this report are stated below:

Design Case	To Yield Strength		To Ultimate Strength
Minimum allowable design factors of safety for normal loading (e.g., weight of components, anticipated pressures)[1]	3:1	or	5:1
Minimum allowable design factors of safety for rare events (falling man and seismic)	1.25:1	or	1.5:1
Minimum factor of safety that does not require non-destructive evaluation of welds	N/A		10:1[2]

Table A-1. *Factor of Safety Requirements for Custom Special Tooling Components [1].*

Of note, special tooling does not require redundancy of load path elements in design [1]. As noted in the report, based on analyses reviewed by the staff review team, special tooling engineers typically apply the loading to the center of gravity of the components supported by special tooling. This usually results in a symmetric distribution of loads.

[1] Pantex personnel do not currently apply these minimum factor of safety requirements to special tooling that includes high-pressure press components; Pantex personnel plan to update the Special Tooling Design Manual to reflect slightly less conservative factor of safety requirements for this special tooling type.

[2] The current revision of the Special Tooling Design Manual does not state whether this factor of safety requirement is to yield strength or to ultimate strength; Pantex personnel indicated that it is intended to be to ultimate strength.

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[2] Consolidated Nuclear Security, LLC, *Sitewide Safety Analysis Report (U)*, AB-SAR-314353, Revisions 263 and 277.

[3] B.L. Ames, Consolidated Nuclear Security, LLC, Special Tooling & Tester Design, *General Requirements for Tooling Fabrication & Inspection*, Issue 14, May 15, 2014.

[4] Pantex Production Tooling Department, *Special Tooling Operations*, MNL-352164, Issue 11.

[5] Consolidated Nuclear Security, LLC, *Special Tooling Top-Down System Review System Improvement Project (SIP)*, Revision 2, January 21, 2015.

[6] National Nuclear Security Administration Production Office, *Assessment Results for the Independent Assessment of the Special Tooling Program*, December 22, 2015.

[7] Department of Energy Nuclear Explosive Safety Study Group, *Nuclear Explosive Safety Master Study of the Approved Equipment Program at the Pantex Plant, Volume II – Special Tooling (U)*, May 31, 2013.

[8] Consolidated Nuclear Security, LLC, *Closure Package*, *Finding 3.3.1: Factor of Safety for Special Tooling Rare Event Analysis, From the Nuclear Explosive Safety Master Study of the Approved Equipment Program at the Pantex Plant Volume II Special Tooling*, April 6, 2018.

[9] Pantex Engineering Analysis, *Technical Basis for Safety Factors*, ANL-13802, Issue 1, August 15, 2005.

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[19] Consolidated Nuclear Security, LLC, *Vendor Performance Report for Date Range 7/10/2016 to 7/10/2017*, July 11, 2017.

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[21] Pantex Technical Procedure, *ESD Flooring Resistance Measurements, Annual, Plant*, TP-MN-06291, Issue 10, October 20, 2015.

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[23] Pantex Engineering Analysis, *Swing Arm*, ANL-000-2-831, Issue 5, April 3, 2009.

[24] American Society of Mechanical Engineers, NQA-1, *Quality Assurance Requirements for Nuclear Facility Applications*, March 14, 2008.

[25] A.R. Kemper, S.M. Beeman, and D. Albert, *Evaluation of the Falling Man Scenario Part III: Crash Test Dummy Forward Fall Experiments*, Virginia Tech – Wake Forest University Center for Injury Biomechanics, May 31, 2015.

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[29] L.R. Bauer, Consolidated Nuclear Security, LLC, *Response to NPO Comments on Quality Assurance Program Description*, May 9, 2017.

[30] Consolidated Nuclear Security, LLC, *Supplier Quality Handbook for Special Tooling Suppliers*, Issue 1.

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Timeline (2018 - 2020)

2020

September 16, 2020
Response to Revised Recommendation 2019-1 Implementation Plan

June 5, 2020
DOE IP Rev. 1 Recommendation 2019-1

2019

October 28, 2019
October 28, 2019 – Board Response to September 2019 DOE Letter and Establishing Reporting Requirement for DOE to Confirm Briefing on Recommendation 2019-1 Implementation Plan

September 23, 2019
September 23, 2019 – DOE Response to August 2019 Board Letter and Offering Briefing to Board

August 22, 2019
August 22, 2019 – Board Response Letter to DOE's Implementation Plan and Reaffirming Recommendation 2019-1

July 16, 2019
July 16, 2019 – DOE Letter Transmitting the Implementation Plan for Recommendation 2019-1

May 13, 2019
May 13, 2019 – Federal Register Notice for DOE's Response to Recommendation 2019-1

April 16, 2019
April 16, 2019 – DOE Letter Accepting Recommendation 2019-1

March 19, 2019
March 19, 2019 – Federal Register Notice for Recommendation 2019-1

February 20, 2019
Recommendation 2019-1 Delivered to DOE

February 11, 2019
Draft Recommendation Delivered to DOE

January 28, 2019
DOE Response to Draft Recommendation

2018

December 27, 2018

Letter Requesting 30-day Extension to Respond to Draft Recommendation

Bruce Hamilton, Chairman
Jessie H. Roberson
Joyce L. Connery

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

June 11, 2019

The Honorable James Richard Perry
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Perry:

The Defense Nuclear Facilities Safety Board received the NNSA Administrator's response to Draft Recommendation 2019-1, *Safety of the Savannah River Tritium Facilities*, on April 10, 2019. The Board considered the NNSA Administrator's response and appreciates the actions DOE/NNSA is taking. The information contained in the NNSA Administrator's response, however, does not obviate the need for the Recommendation. The Board concludes that there remains an issue of adequate protection of public health and safety in the event of an energetic accident at the Tritium Facilities, comprising several defense nuclear facilities, at the Savannah River Site. On June 5, 2019, the Board, in accordance with 42 U.S.C. § 2286d(a)(3), approved Recommendation 2019-2, which is enclosed for your consideration along with all related findings, supporting data, and analysis.

After you have received this Recommendation, the Board will promptly make the Recommendation and any related Secretarial correspondence available to the public as required by 42 U.S.C. § 2286d(b). The Board believes that this Recommendation contains no information that is classified or otherwise restricted. To the extent that this Recommendation does not include information restricted by DOE under the Atomic Energy Act of 1954, as amended, please arrange to have this recommendation and any related Secretarial correspondence placed promptly on file in your regional public reading rooms. The Board will also publish this Recommendation in the Federal Register.

The Board will evaluate DOE's response to this Recommendation in accordance with the Board's Policy Statement 1, *Criteria for Judging the Adequacy of DOE Responses and Implementation Plans for Board Recommendations.*

Yours truly,

Bruce Hamilton

Bruce Hamilton
Chairman

Enclosures

c: Mr. Joe Olencz

RECOMMENDATION 2019-2 TO THE SECRETARY OF ENERGY

Safety of the Savannah River Site Tritium Facilities
Pursuant to 42 U.S.C. § 2286a(b)(5)
Atomic Energy Act of 1954, as Amended

Introduction. The Tritium Facilities at the Savannah River Site (SRS) consist of several defense nuclear facilities, including the 217-H Vault, Buildings 233-H and 234-H, and the Tritium Extraction Facility, used for processing and storing tritium. The Defense Nuclear Facilities Safety Board (Board) is concerned about adequate protection of the public health and safety in the event of an energetic accident at the Tritium Facilities.

The facilities' approved Documented Safety Analysis (DSA) and the November 2018 revision to the DSA awaiting approval by the National Nuclear Security Administration (NNSA) of the Department of Energy (DOE) both have analyzed several credible accidents that could result in very high doses, creating the potential for acute radiation sickness or fatality[1] in a significant number of individuals. These energetic accidents include building-wide fires due to a variety of initiating events, crane drops, and explosions with the potential to release large quantities of tritium.

The probability of such an event within the lifetime of the facility is not negligible. Assuming a 50-year lifetime for the facilities, the probability that an unlikely event could occur within that time period ranges from 0.5 percent to about 40 percent. Such an event could lead to a significant number of potentially exposed individuals, posing a significant challenge to both SRS's emergency management system and to local emergency and medical facilities.

The current situation at the Tritium Facilities does not adequately address either DOE's standards of care or standards of practice as defined by its own requirements. Consequently, adequate protection is not assured. The Board has concluded that DOE needs to take actions to improve the safety of the Tritium Facilities, upgrades to safety management programs and the implementation of robust controls to ensure adequate protection of public health and safety.[2]

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[1] Acute radiation-induced sickness and acute radiation fatality, as used in this report, refers to possible outcomes of the acute radiation syndrome. This syndrome is the result of an acute, or short duration, exposure to a very high level of ionizing radiation. In this context, the word acute does not imply immediate incapacitation or death, as the syndrome and its impact on a human body may take hours to months to progress to recovery or death.

[2] The Board has raised concerns regarding the safety posture at the Tritium facilities since 1992. The Board's concerns over the potential for energetic accidents with very high calculated dose consequences have been frequently communicated to DOE. DOE has routinely responded to the Board's concerns with improvements in the safety controls, only to allow those controls to be downgraded after a number of years. *(See the Attachment for a list of previous Board correspondence.)*

Recommendations. The Board recommends that DOE:

1. Identify and implement near-term compensatory measures at SRS to mitigate the potential for high radiological consequences to individuals who would be impacted by a release from the Tritium Facilities. (For example, potential near-term compensatory measures could include, but are not limited to reducing the material at risk (MAR) and/or limiting the number of potentially exposed individuals or other physical or administrative controls.)

2. Identify and implement long-term actions and controls to prevent or mitigate the hazards that pose significant radiological consequences to acceptably low values consistent with the requirements of DOE directives.

3. In parallel with the above recommendations, evaluate the adequacy of the following safety management programs and upgrade them as necessary to ensure that SRS can effectively respond to energetic accidents at the Tritium Facilities, and that it can quickly identify and properly treat potential victims:

    a. The staffing and training requirements for individuals expected to take specific actions in response to alarms, abnormal operations, and emergencies;

    b. The adequacy of the Emergency Preparedness programs in H-Area to account for all individuals in the vicinity and ensure that all potentially affected individuals understand their responsibilities and required actions in the event of a large tritium release from the Tritium Facilities and are prepared to implement them;

    c. The ability of the site's Fire Department to respond to fires, explosions, and other accidents at the Tritium Facilities that could lead to a large tritium release;

    d. The capability of the site-wide radiological protection and occupational medicine programs to respond to an accident and monitor a large number of people with potentially serious uptakes of tritiated water vapor; and

    e. The ability and preparedness of community emergency and medical resources to support the site in such situations.

Background.

Effects of Tritium Release: Much of the in-process tritium at the Tritium Facilities may be in the form of gas, and material in storage is either in pressure vessels or deposited on hydride beds. Exposure to tritium gas does not result in significant doses to individuals, as the gas is not retained by the human body after inhalation. However, any significant release of tritium gas during an energetic accident or upset condition has a high potential of resulting in a fire, even if a fire did not initiate the release. In the energetic accidents of concern to the Board, tritium, an isotope of hydrogen, may be ignited, converted into water by oxidation, and then dispersed as a vapor.

Tritiated water vapor represents a significant risk to those exposed to it, as its dose consequence to an exposed individual is 15,000 to 20,000 times higher than that for an equivalent amount of tritium gas.[3] As with normal water vapor, tritiated water vapor is quickly absorbed into the lungs and through the skin, and rapidly mixes with the water in the body. The target organ for the exposure is the whole body, with a biological half-life[4] of 10 days [1]. The combination of a rapid intake and a short biological half-life means a large fraction of the radiological dose is acutely delivered within hours to days rather than chronically delivered over many months to years. Tritium's chemical and radiological characteristics also create difficult challenges that complicate the approaches to responding to such accidents and providing medical assistance to exposed individuals. A tritium release becomes even more challenging when considering that hundreds of workers in the SRS H-Area occupy the defense nuclear facilities and other administrative and training buildings surrounding the Tritium Facilities.[5]

Emergency Preparedness: Since 2011 the Tritium Facilities have conducted several seismic and/or multi-facility drills and exercises. The Board's staff have observed these drills and exercises and found that they have improved communications and coordination among the tritium facilities, as well as coordination of protective actions with other nuclear facilities within the H-Area. However, neither DOE nor the site contractor, Savannah River Nuclear Solutions (SRNS), has conducted exercises involving the evacuation of large numbers of individuals from an area due to a large tritium release, nor have they planned for the related logistical issues or for monitoring large numbers of individuals to identify those who might be at risk of a significant tritium intake and would require immediate medical intervention. While reliance on the Emergency Preparedness programs is not a long-term solution, this program will be essential in mitigating the consequences of a significant tritium release until an adequate control set can be implemented.

Past Communication: During a June 16, 2011, public hearing in Augusta, Georgia, the Board raised concerns regarding high consequences due to a potential fire in the Tritium Facilities. The Board further communicated this concern to NNSA in an August 19, 2011, Board correspondence in which it identified a shift in the safety philosophy applied to the Tritium Facilities at SRS. The Board noted that downgrading of safety related controls at the Tritium Facilities has "weakened the safety posture, reduced the safety margin, and increased the potential for both the workers and the public to be exposed to higher consequences."

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[3] The ratio of the dose conversion factors for inhalation between tritiated water and tritium gas is a factor of 10,000; additionally, a factor of 1.5 is applied for the workers, and a factor of 2.0 is applied for the public, to account for tritiated water absorption through the skin [1].

[4] The biological half-life is defined as "the time required in a given radionuclide for its activity to decrease, by biological clearance and radiological decay, to half its original activity" [8]. This half-life is a function of the radiological half-life of the radioactive material and how rapidly it is removed from the body by metabolic processes.

[5] A training building with a cafeteria is about 300 meters from the Tritium Facilities; the building hosts a significant transient population.

The Deputy Administrator for Defense Programs replied to the Board's concerns on November 14, 2011, stating that NNSA would develop new analytical models to better understand the risk posed by the Tritium Facilities' operations, and at the same time NNSA would pursue "additional interim safety controls for Tritium Facilities, such as MAR segregation" to reduce the consequences of a potential accident. The attachment to the NNSA letter identified a series of analytical and administrative activities that SRNS would conduct and stated that, "A review of the control selection for the design basis events considering the new analysis will be performed. Emphasis will be placed on utilizing existing passive and active engineered controls vice administrative controls. Any changes to controls will be reflected in a future update to the Documented Safety Analysis."

A letter from SRNS to NNSA dated July 12, 2018 [2], indicates that SRNS is considering a number of engineering controls, but the Board is not aware of any formal actions or implementation of any near-term compensatory measures based on this strategy. SRNS's proposed strategy mainly consists of performing analyses. These analyses may result in SRNS proposing revisions to the Tritium Facilities DSA to credit existing engineered controls or may lead SRNS to pursue installation of new engineered controls. Any physical modifications or additions would likely take years to implement under SRNS's proposed strategy. Furthermore, the Board is not aware of any commitments made by NNSA to implement engineered controls based on the contractor's strategy.

Conclusion. The Board has concluded that adequate protection of public health and safety currently is not assured, should an accident, such as an earthquake or large fire, occur at these facilities and there continues to be a risk of exposure to significant radiological consequences in case of an energetic event at these facilities.

Bruce Hamilton
Chairman

Recommendation References

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Risk Assessment for Recommendation 2019-2
Safety of the Savannah River Site Tritium Facilities

In making its recommendations to the Secretary of Energy and in accordance with 42 U.S.C. § 2286a.(b)(5), the Board shall consider, and specifically assess risk (whenever sufficient data exists). Risk is generally defined as the quantitative or qualitative expression of possible loss that considers both the likelihood that an event will occur and the consequences of that event. For Recommendation 2019-2, *Safety of the Savannah River Site Tritium Facilities*, sufficient data does not exist to precisely determine the likelihood that an event will occur and the consequences of that event. However, the Board can use information from the Tritium Facilities' DSAs to develop a qualitative risk assessment.

The Tritium Facilities' DSAs use risk binning to estimate the frequencies of several of the energetic accidents discussed in the Recommendation to be *Unlikely*, which DOE Standard 3009, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, assigns a frequency range of 10^{-2} to 10^{-4} per year. Assuming a 50-year lifetime for the facility, and given the broad frequency range, the probability that an event could occur within that time period ranges from 0.5 percent to about 40 percent.

The large-scale release of tritium postulated for these accidents has a significant potential to result in acute injuries or fatalities. Such an event could lead to a significant number of potentially exposed individuals, resulting in a mass casualty situation that would pose a significant challenge both to the Savannah River Site's emergency management system and to local emergency and medical facilities.

Therefore, the Board has determined the qualitative risk at the Savannah River Site's Tritium Facilities is significant enough to require the Department of Energy to take action.

Findings, Supporting Data, and Analysis

Degradation of Safety Posture.

Introduction—In December 1991, Congress amended the Defense Nuclear Facilities Safety Board's (Board) enabling legislation, expanding its jurisdiction into defense nuclear facilities and activities involved in the assembly, disassembly, and testing of nuclear weapons. According to the Board's 1992 *Annual Report to Congress* [1]:

> As a consequence, additional technical activities were conducted at the following plants, sites and laboratories:
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> - Pantex Plant,
> - Oak Ridge Y-12 Plant,
> - Los Alamos National Laboratory,
> - Tritium Facilities at the Savannah River Site,
> - Building 991 at Rocky Flats,
> - Nevada Test Site,
> - Sandia National Laboratories (Albuquerque and Livermore),
> - Lawrence Livermore National Laboratory, and
> - Pinellas Plant

As part of these additional technical activities, in 1992 the Board and its staff began to review safety basis documents for Building 233-H (known at the time as the Replacement Tritium Facility, RTF) [2-9]. At that time the facility had been built but had not commenced operations. Later, the Board reviewed the design and safety basis of the Tritium Extraction Facility from the conceptual design stage to its final startup. In both cases, the Board identified safety issues that were remediated by design modifications or administration of operational limits to ensure that the public and the workers were adequately protected.

Since the Board's initial interactions with the Tritium Facilities in 1992, the Board's concerns over the potential for energetic accidents with very high dose consequences have been frequently communicated to the Department of Energy (DOE). A listing of those communications is provided in the Attachment. These communications and the DOE responses to them illustrate a pattern that, in itself, is a concern to the Board. The Board's early involvement in the safety of the Tritium Facilities prompted DOE to implement a range of safety improvements; however, those improvements either were downgraded or were found to be ineffective by 1999. After the Board's interactions with DOE in 1999, improvements were again identified and implemented. By 2011, those improvements had been downgraded and the Board found it necessary to raise the subject again. Today, the Board has determined that its concerns are such that a formal Recommendation is needed to ensure prompt action is taken and sustained.

As noted, in 2011 the Board identified a degradation in the facilities' safety posture that appears to have begun in the period between 1999 and 2011. The Board initially communicated those concerns in 2011, and the National Nuclear Security Administration (NNSA) responded on November 14, 2011, with a series of commitments that included updating the methodology and assumptions to meet current DOE requirements and expectations for conservative analyses, as reflected in Subpart B to 10 CFR 830 and its safe harbor methodology in DOE Standard 3009-

94. NNSA also stated that "A review of the control selection for the design basis events considering the new analysis will be performed. Emphasis will be placed on utilizing existing passive and active engineered controls vice administrative controls. Any changes to controls will be reflected in a future update to the Documented Safety Analysis (DSA)." The current Savannah River Site (SRS) contractor, Savannah River Nuclear Solutions LLC (SRNS), submitted that DSA update to NNSA's Savannah River Field Office (SRFO) in July 2017. SRFO requested and the contractor submitted a revised version of that DSA on November 2018, and it is currently undergoing DOE's review and approval process. Consequently, the currently approved safety bases still contain many of the weaknesses that concerned the Board in 2011.

The following discussions briefly describe some of the original activities and the controls applied to for Building 233-H. This building contains the majority of the process tritium inventory and poses the most unmitigated risk in case of an energetic accident.

Building 233-H's Past Safety Basis—The Board and DOE worked through several issues with the hazards analysis and control set in the original *Final Safety Analysis Report* (FSAR)[1] [2-9] during the early 1990s, prior to startup of Building 233-H. The fire event analyzed in the FSAR was based on 0.1 percent oxidation of the tritium released during the accident. The site contractor at the time, Westinghouse Savannah River Company[2] (WSRC) performed a conservatively bounding analysis assuming that 100 percent of the tritium would be oxidized in a facility fire and documented this analysis in an addendum to the FSAR. Furthermore, WSRC performed a seismic analysis that indicated that a stack would collapse on top of the tritium reservoir storage vault. DOE and WSRC designed and constructed more than a dozen safes known as HIVES (Highly Invulnerable Encased Safes) to protect the storage reservoirs from the impact load of a stack and vault roof collapse. The bounding scenario conservatively calculated the consequences of a seismic event that triggers a fire involving the entire inventory from the reservoirs and the process systems [9]. The maximum individual dose at the site boundary for a two hour exposure was estimated to be about 5.1 rem total effective dose equivalent (TEDE[3], an ionizing radiation dose unit in use at the time). The corresponding value for onsite dose was 328 rem TEDE. [This value was calculated prior to the issuance of DOE Standard 3009; the 1993 calculation used an older methodology and different assumptions than those currently accepted for safety analyses. Consequently the results cannot be compared to the values in the current safety bases.]

The FSAR control set ultimately established by WSRC was a mixture of administrative operational limits and engineered controls. An administrative control limited the total amount of tritium in the facility, including the reservoirs in the seismically qualified areas. Four limiting

[1] Final Safety Analysis Reports were a predecessor to the current Documented Safety Analysis documents.
[2] The current SRS contractor, Savannah River Nuclear Solutions assumed responsibility for the site in August 2008. The prior contractor at the site, Westinghouse Savannah River Company, assumed responsibility for the site in 1989. In 2005, Westinghouse Savannah River Company changed its name to Washington Savannah River Company.
[3] There are two basic components to an individual's radiation dose, the dose from internal emitters and the dose from external emitters. Prior to 2007, the dose from internal emitters such as tritiated water was measured in rem Committed Effective Dose Equivalent (rem CEDE); the dose from external radiation sources such as an X-ray machine was measured in rem Effective Dose (rem ED); and the sum of the two components was the Total Effective Dose Equivalent (rem TEDE). In 2007 the units were changed to committed effective dose (rem CED) and total effective dose (rem TED), but they are numerically equivalent to doses in rem CEDE and rem TEDE.

conditions for operations (LCO) limited the system pressure for the relief tanks, contaminated nitrogen tanks, and the Z-bed recovery tanks to sub-atmospheric conditions to protect their inventory from a system rupture. An additional three LCOs limited the inventory of the mix tanks, deuterium storage beds, and the tritium reservoirs, which were stored in non-seismically qualified areas [7]. WSRC classified the HIVES as safety related[4] to protect the reservoirs in the vault from impacts. Finally, WSRC used a tritium storage seismic detection and isolation system to further reduce the amount of tritium released during a seismic event. Over the years though, many of the above controls were eliminated or downgraded for various reasons. It is useful to review previously implemented controls for ideas on how the Board's current concerns might be addressed.

During a June 16, 2011, public hearing in Augusta, Georgia, the Board raised concerns regarding high consequences to co-located workers due to a potential fire in the Tritium Facilities. The Board further communicated this concern to NNSA in a Board correspondence dated August 19, 2011, in which the Board identified a shift in the safety philosophy applied to the Tritium Facilities at SRS. The Board noted that the downgrading of safety related controls at the Tritium Facilities has "weakened the safety posture, reduced the safety margin, and increased the potential for both the workers and the public to be exposed to higher consequences."

NNSA's Deputy Administrator for Defense Program sent a letter to the Board on November 14, 2011, that relayed the Tritium Facilities commitments to the Board for improving safety posture of those facilities. In the attachment to that letter, the field office manager stated that, "A review of the control selection for the design basis events considering the new analysis will be performed. Emphasis will be placed on utilizing existing passive and active engineered controls vice administrative controls. Any changes to controls will be reflected in a future update to the Documented Safety Analysis (DSA)." SRNS submitted that DSA update to SRFO in July 2017. As previously noted, correspondence between SRFO and the SRNS led to a revised DSA submitted in November 2018, which is currently in DOE's review and approval process.

Tritium Facilities' Current Safety Basis—The current safety basis of the Tritium Facilities is comprised of a DSA [10] and technical safety requirements (TSR) [11] that are derived from the DSA.[5] The DSA and TSR documents contain a set of controls that SRNS commits to maintain to assure adequate protection. The DSA is supported by a comprehensive hazard analysis documented in the Consolidated Hazards Analysis Process (CHAP) [12], which is not subject to NNSA's review and approval. The CHAP concluded that "[f]or some events, the mitigated consequences remained in the B1 or B region [consequence categories that require safety class controls for the public or safety significant controls for workers] because available controls either did not exist and/or were insufficient" to reduce the unmitigated dose consequences to the co-located workers for several high consequence accidents.

[4] The RTF startup activities preceded DOE's creation and issuance of Standard 3009-94. The terminology of "safety related" was meant for protection of the public and/or the workers.
[5] At the time of this writing the Tritium Extraction Facility (TEF) was operating under a separate safety basis, but SRNS combined the two safety bases in the DSA submitted in November 2018. However, TEF has a much smaller inventory than the main processing building so it is not discussed extensively in this section.

The calculated dose consequences supporting the current DSA were based on calculations performed in 2008. Those calculated dose consequences for the energetic accidents of concern in this Recommendation ranged up to 6,300 rem total effective dose (TED) to the co-located workers and about 2 to 13 rem TED to the offsite public [13-17]. While those calculations were based on methods and assumptions accepted at the time, they do not meet current DOE expectations for safety basis calculations. More recent analysis, completed by SRNS in 2013, concluded that, using current methodology and assumptions, the calculated dose consequences would increase by a bounding factor of 7.42 for the co-located worker and a bounding factor of 3.45 for the offsite public [18]. It should be noted that NNSA reduced the limit on the total amount of tritium that can be present within the Tritium Facilities by about half in 2011, as discussed in the November 14, 2011, letter to the Board, but that reduction has not been included in the bounding factors given above. These factors are bounding values because there will be some variation in the parameters specific to each accident scenario.

Feasible solutions to address concerns could consist of several controls, each providing layers of protection. Furthermore, solutions may require pursuing controls that dramatically reduce the probability of an initiator, but may not fully prevent an accident. For example, a seismic power cut off system may eliminate many, but not all, ignition sources present in a facility following a seismic event because some systems may be required to continue to function or may have stored energy. Similarly, the reliability of systems like fire suppression systems may be improved through upgrades and modifications or performance of additional surveillances and maintenance, but they may not be able to be fully qualified to protect individuals after all seismic events.

Mitigative controls, such as minimizing the number of non-essential personnel in close proximity to the Tritium Facilities; using readily available technologies to minimize humidity in the air of buildings used for sheltering in place; and having pre-approved plans for decreasing the biological half-life of tritium, could potentially reduce both the number of individuals with intakes and the severity of those intakes. The development of near- and long-term solutions may involve an integrated approach using multiple forms of controls.

Analysis of Emergency Preparedness at the Savannah River Site.

The attachment to the NNSA letter dated November 14, 2011, described improvements that would be made to the site Emergency Preparedness program to respond to a significant event at the Tritium Facilities. The Tritium Facilities conducted several seismic and/or multi-facility drills and exercises in subsequent years. The Board’s staff observed these drills and exercises and the planned improvements. The drills and exercises improved communications and coordination among the Tritium Facilities and helped improve coordination of protective actions with other nuclear facilities within H-Area. The Tritium Facilities also have made emergency preparedness drill and exercise scenarios more challenging by including deflagrations and stack collapses, and have tested their ability to respond to accidents during night shifts, when staffing is lower.

However, the Tritium Facilities Emergency Preparedness program has not prepared responses to the full range of credible accidents in the DSA and the Emergency Planning

Hazards Assessments (EPHA). The DSA includes credible scenarios with co-located worker doses reaching calculated dose consequences in the thousands of rem. The radiological consequences in the EPHAs [19, 20] are usually lower because of differences in the analytical methodologies and assumptions, but still range up to 700 rem TED for co-located workers and 62 rem TED for workers at the nearby central training facility (which also includes a cafeteria). However, the dose consequences to workers in the most challenging drills and exercises [21, 22] were less than 5 rem TED.

The default protective actions for the Tritium Facilities' Emergency Action Levels are to evacuate the immediate area, and for all others to remain indoors (as well as close all doors and windows, and turn off ventilation to the building) [23, 24]. During tritium drills and exercises, this usually involves having workers evacuate the affected process area and/or evacuate from the affected building to another nearby building within the Tritium Facilities. However, the EPHA has scenarios where the maximum distance for the Threshold for Early Lethality may extend up to 320 meters, beyond the Tritium Facilities fence line.

Part of the reason for the lower radiological consequences in the drills and exercises is that the assumed releases are much smaller because the Seismic Tritium Confinement System is assumed to function and confine the inventory during a seismic event. However, the DSA does not qualify this system to be credited during a seismic event. Additionally, the drills and exercises often limit explosions and fires to one room, rather than involving the entire building, as the DSA and EPHA assume. Because the radiological consequences in the drill and exercise scenarios are much lower than those in the DSA and EPHA, the drill and exercise scenarios assume that Tritium Facilities personnel can remain safely indoors indefinitely, that operators can perform their assumed response actions with little impact from the release, that those workers evacuating to another building within the Tritium Facilities do so without any adverse effects, and that the medical response is usually limited to injured workers with relatively minor contamination or intakes.

Using radiological consequences from the severe accidents in the DSA or EPHA, however, might drive the need to evacuate personnel at the Tritium Facilities, and possibly other nearby areas, to a safer location to avoid a significant intake. SRS does not have any procedural guidance or criteria for when workers should evacuate the Tritium Facilities area, and possibly other nearby areas, rather than remain indoors, due to the potential for acute radiological consequences [23-26]. Furthermore, SRS has not conducted exercises involving evacuation of a large number of workers from an area due to a radiological release, nor has the site planned for the related logistical issues such as evacuating or monitoring a large number of workers to determine which ones may be at risk of a significant tritium uptake and may require medical intervention.

Findings, Supporting Data, and Analysis References

[NOTE: The current SRS contractor, Savannah River Nuclear Solutions assumed responsibility for the site in August 2008. The prior contractor at the site, Westinghouse Savannah River Company, assumed responsibility for the site in 1989. In 2005, Westinghouse Savannah River Company changed its name to Washington Savannah River Company.]

1. Defense Nuclear Facilities Safety Board, *Annual Report to Congress*, April 1993.

2. Westinghouse Savannah River Company, *RTF Safety Analysis Report*, DOE Approval Copy, Rev.1, WSRC-SA-1-1, August 28, 1992.

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10. Savannah River Nuclear Solutions, LLC, *Tritium Facilities Documented Safety Analysis*, Rev. 23, WSRC-SA-1-2, Vol. 1 and 2, May 2017.

11. Savannah River Nuclear Solutions, LLC, *Tritium Facilities Technical Safety Requirements*, Rev. 28, WSRC-TS-96-17, May 2017.

12. Savannah River Nuclear Solutions, LLC, *Tritium Facilities Consolidated Hazards Analysis*, Rev. 11, WSRC-TR-2004-00163, May 2017.

13. Washington Savannah River Company, *Tritium Facilities Loss of Confinement Accident Analysis (U)*, Rev. 0, S-CLC-H-01127, February 2008.

14. Washington Savannah River Company, *Tritium Facilities Fire Accident Analysis (U)*, Rev. 0, S-CLC-H-01131, February 2008.

15. Washington Savannah River Company, *Tritium Facilities Explosion Accident Analysis (U)*, Rev. 0, S-CLC-H-01137, February 2008.

16. Washington Savannah River Company, *Tritium Facilities Natural Phenomena Plus Fire Accident Analysis (U)*, Rev. 0, S-CLC-H-01139, February 2008.

17. Washington Savannah River Company, *Tritium Facilities Natural Phenomena Plus Loss of Confinement Accident Analysis (U)*, Rev. 0, S-CLC-H-01144, February 2008.

18. Savannah River Nuclear Solutions, *Dispersion Modeling Project Implementation*, S-ESR-G-0033, Rev. 0, October 2013.

19. Savannah River Nuclear Solutions, LLC, *Emergency Planning Hazards Assessment for the Tritium Facilities (TF)*, Rev. 10, S-EHA-H-00006, March 2016.

20. Savannah River Nuclear Solutions, LLC, *Emergency Planning Hazards Assessment for the Tritium Extraction Facility (TEF)*, Rev. 2, S-EHA-H-00009, January 2016.

21. Savannah River Nuclear Solutions, LLC, *Savannah River Site 2012 Site Emergency Response Organization Emergency Preparedness Evaluated Exercise Multiple-Facility/Multiple-Contractor Seismic Event*, Rev. 03, F9640052.DRSC000103, April 2012.

22. Savannah River Nuclear Solutions, LLC, *Savannah River Tritium Enterprise 2017 Facility Emergency Preparedness Evaluated Exercise*, Rev. 00, F3040087.DRSC000100, July 2017.

23. Savannah River Nuclear Solutions, LLC, *Emergency Classification (EALs)*, Rev. 29 EPIP TRIT-001, IPC 1, May 1, 2017.

24. Savannah River Nuclear Solutions, LLC, *FEC Response Actions*, Rev. 35, EPIP TRIT-111, April 24, 2018.

25. Savannah River Nuclear Solutions, LLC, *Fire and Fire Alarm Response, Process Buildings*, Rev. 31, EOP TRIT-1468, May, 31, 2018.

26. Savannah River Nuclear Solutions, LLC, *Response to Severe Weather and Natural Disasters*, Rev. 21, AOP TRIT-6122, IPC-1, August 16, 2018.

Attachment
Summary of Board Correspondence concerning Safety at the Tritium Facilities

- **December 18, 1995**
- To: Assistant Secretary for Environmental Management
- Subject: Central Training Facility capability to respond to releases

- **March 18, 1999**
- To: Under Secretary of Energy
- Subject: Review of Draft Consolidated Tritium Safety Analysis Report

- **December 7, 1999**
- To: Assistant Secretary for Defense Programs
- Subject: Design review for Tritium Extraction Facility

- **July 19, 2002**
- To: National Nuclear Security Administration Deputy Administrator for Defense Programs
- Subject: Seismic safety at the Tritium Extraction Facility

- **July 16, 2010**
- To: NNSA Administrator and Assistant Secretary for Environmental Management
- Subject: Inclusion of controls concern at the Savannah River Site

- **August 19, 2011**
- To: NNSA Administrator
- Subject: Review of Safety Basis, Savannah River Site Tritium Facilities

- **August 7, 2014**
- To: NNSA Administrator
- Subject: Summary of Board views on current challenges faced by NNSA

- **January 7, 2016**
- To: NNSA Administrator
- Subject: Review of the Tritium Extraction Facility Documented Safety Analysis

- **June 4, 2018**
- To: Secretary of Energy
- Subject: Review of the Revised Documented Safety Analysis at Tritium Facilities

Supplemental Staff Analysis of Dose Consequences

The calculated dose consequences supporting the current DSA were based on calculations performed in 2008. Those calculated dose consequences for the energetic accidents of concern in this Recommendation ranged up to 6,300 rem total effective dose (TED)[1] to the co-located workers and about 2 to 13 rem TED to the offsite public [1-5]. Those calculations were based on methods and assumptions accepted at the time. More recent analysis, completed by the SRS contractor in 2013, concluded that using current methodology and assumptions would increase the calculated dose consequences by a bounding factor of 7.42 for the co-located worker and a bounding factor of 3.45 for the offsite public [6].[2] It should be noted that SRS lowered the limit on the total amount of tritium that can be present within the Tritium Facilities by about a factor of two in 2011, but that reduction has not been included in the bounding factors given above. These factors are bounding values because there will be some variation in the parameters specific to each accident scenario. The calculations supporting the revised DSA indicate that calculated dose consequences for the co-located worker could exceed 18,000 rem TED for some scenarios. [7]

According to the International Commission on Radiation Protection (ICRP), the threshold dose for a 1 percent incidence rate of fatality in an exposed population is 100 rad[3], and the threshold for a 50 percent incidence of fatality in an exposed population is 300 to 500 rad, assuming no medical intervention [8]. The onset of radiation-induced sickness generally coincides with the 1 percent fatality threshold. These thresholds are for acute exposures that are the result of external radiation sources at very high dose rates, such as those that occur during a criticality accident.

However, high protracted exposures that occur over periods of days to weeks can also result in injury or fatality, but with somewhat higher thresholds. ICRP reports that for exposures where the dose rate is about 20 rad/hour the thresholds may increase by about 50 percent, and if the dose is delivered over the period of a month the thresholds may double [8]. This increase in thresholds is due to the fact that for lower dose rates, the body has more opportunity to repair the damage, thus reducing the likelihood of injury or fatality. Therefore, protracted doses are evaluated by looking at both the accumulated dose and the rate at which the dose accumulates.

For internal exposures such as the situations addressed in this Recommendation, the dose to an exposed individual is cited as the committed effective dose, which is the total dose that has accumulated in the body until the radioactive material has either decayed away or been eliminated through biological processes. The accumulation time is dependent on the specific

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[1] There are two basic components to an individual's radiation dose, the dose from internal emitters and the dose from external emitters. Prior to 2007, the dose from internal emitters such as tritiated water was measured in rem Committed Effective Dose Equivalent (rem CEDE); the dose from external radiation sources such as an X-ray machine was measured in rem Effective Dose (rem ED); and the sum of the two components was the Total Effective Dose Equivalent (rem TEDE). In 2007 the units were changed to committed effective dose (rem CED) and total effective dose (rem TED), but they are numerically equivalent to doses in rem CEDE and rem TEDE.

[2] These multiplication factors only apply to the calculated radiological dose consequences for certain accident scenarios (depending on the input parameters). Other accident scenarios may have a smaller multiplication factor.

[3] The rad is a unit of absorbed dose, which is the quantity used for evaluating the potential for deterministic ionizing radiation effects such as acute injury or fatality. In the case of tritiated water vapor, the absorbed dose in rad is numerically equal to the committed effective dose.

radioactive material and its chemical form. Some materials such as tritium gas are not retained in the body for any significant amount of time; other materials, such as plutonium oxide, will be retained in the body for many years.

***Dose Consequences to Workers and Co-Located Workers*:** The behavior of tritiated water in the body can be modelled in a straightforward manner. For the doses evaluated here, it is assumed that the exposures occur within a 3-minute or 20-minute time period in accordance with the specific DSA scenarios, and that the biological half-life of tritiated water in the body is 10 days [9]. Although the intake is of a short duration, the rate at which the radiation from the decay of the tritium deposited in the body is determined by the biological half-life. Therefore, the doses from tritiated water in the body tend to be protracted doses, and must be compared against the ICRP's protracted dose thresholds. Given these conditions, the total dose and dose rates associated with an intake of tritiated water are inherently related to each other such that one can predict either parameter if the other parameter is known. This relationship allows one to directly determine the specific total dose and dose rate associated with each of the ICRP mortality thresholds discussed above.

Table 1 shows that a postulated total dose of about 18,000 rem TED will exceed the dose threshold for radiation-induced sickness within the first two hours, and a postulated dose of about 3,500 rem TED will exceed the onset of radiation-induced sickness within the first fifteen hours (the onset of radiation-induced sickness generally coincides with the 1 percent fatality threshold). Once the absorbed doses exceed the injury threshold, the onset of symptoms of radiation-induced sickness likely will occur within hours to a day. When these symptoms are observed, medical personnel would begin more aggressive life-saving interventions on those individuals.

Table 1. *Threshold Dose and Dose Rate Criteria with no medical intervention*

Threshold Criteria [8]				**Corresponding Tritium Total Dose***	
Criteria	**Threshold Dose Rate**	**Threshold Dose**		**Total Dose**	**Time to Threshold Dose**
Acute Threshold for 1% Mortality**	~50 rad/hr and up	100 rad		18,000 rem TED	2 hours
Upper Protracted Threshold for 1% Mortality	~10 - 30 rad/hr	150 rad		3,500 rem TED	15 hours
Lower Protracted Threshold for 1% Mortality	~0.3 rad/hr	200 rad		250 rem TED	28 days
Acute Threshold for 50% Mortality	~50 rad/hr and up	300-500 rad		18,000 rem TED	6 hours
Upper Protracted Threshold for 50% Mortality	~10 - 30 rad/hr	450-750 rad		3,500 rem TED	45 hours
Lower Protracted Threshold for 50% Mortality	~0.8 rad/hr	600-1000 rad		750 rem TED	31 days

* When a range of doses or dose rates is used in the threshold criteria, the corresponding tritium dose and time to threshold dose were determined using the lower values in order to identify the lowest total dose that would exceed the specified threshold dose.

** A 1 percent or 50 percent mortality threshold means that at the specified dose and dose rate values, fatalities could be expected in 1 percent or 50 percent of the exposed population, with no medical intervention.

Prior to the onset of radiation-induced sickness, early medical intervention for tritiated water intakes could be taken by aggressively increasing fluid exchange in the patient. This could reduce the biological half-life to as little as three days [10]. Such intervention would reduce the total dose by up to about 60 percent, but would have no impact on the dose already accumulated in the individual prior to the onset of treatment. However, tritium's chemical and radiological characteristics create difficult challenges that complicate the approaches to responding to such accidents and providing medical assistance to exposed individuals. For example, detection of tritium contamination in the field and assessment of potential intakes require specialized equipment, expertise, and most importantly, timely response.[4]

It must also be recognized that the dose to co-located workers is calculated at 100 meters from the release point or at the point of plume touchdown, whichever results in a higher dose. Doses within that first 100 meters could be much higher, depending on the release mechanism and plume travel path. However, current models cannot accurately estimate doses to individuals nearer than 100 meters, as the doses are very sensitive to the specifics of each release mechanism, the effects of building wakes, the location of the individual, and a variety of other parameters. Consequently, radiation-induced sickness or fatalities within the facility workers should be anticipated for all accidents where the 100-meter dose is above 100 rem TED.

Dose Consequences to the Offsite Public: While the facilities' DSAs estimate that the calculated dose consequences to individuals beyond the site boundary from these accidents are low enough to avoid immediate acute health effects, they do represent the potential for an increased likelihood of latent cancer fatalities in the exposed population [8]. In addition, the calculated dose consequences challenge DOE's evaluation guideline of 25 rem TED for safety-class controls. (The evaluation guideline is not to be viewed as an acceptable dose; it is a tool for determining the need for safety class controls.) However, the currently approved DSAs do not provide an adequate set of controls to prevent or mitigate some of these accidents.

It is no coincidence that the calculated dose consequences to the offsite public approach the evaluation guideline for the same accident scenarios that result in very high calculated dose consequences to facility workers and co-located workers. As discussed in the Board's Technical Report, *Protection of Collocated Workers at the Department of Energy's Defense Nuclear Facilities and Sites* [DNFSB/Tech-20, 1999], protection of the offsite public rests heavily on measures taken to protect co-located workers, and protection of co-located workers rests heavily on measures taken to protect the immediate facility workers. In other words, protection of the public begins with the protection of the workers.

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[4] The Board's staff does not have confidence that current field equipment can provide the ability to rapidly screen a large group of individuals for potential intakes. Given these circumstances, the onset of symptoms from acute radiation sickness may be the first signs of a significant tritium intake, which would preclude early medical intervention. Dealing with the large number of people who could be adversely affected by a significant release at the Tritium Facilities could severely strain or overwhelm local emergency response and medical resources.

REFERENCES

1. Washington Savannah River Company, *Tritium Facilities Loss of Confinement Accident Analysis (U)*, Rev. 0, S-CLC-H-01127, February 2008.

2. Washington Savannah River Company, *Tritium Facilities Fire Accident Analysis (U)*, Rev. 0, S-CLC-H-01131, February 2008.

3. Washington Savannah River Company, *Tritium Facilities Explosion Accident Analysis (U)*, Rev. 0, S-CLC-H-01137, February 2008.

4. Washington Savannah River Company, *Tritium Facilities Natural Phenomena Plus Fire Accident Analysis (U)*, Rev. 0, S-CLC-H-01139, February 2008.

5. Washington Savannah River Company, *Tritium Facilities Natural Phenomena Plus Loss of Confinement Accident Analysis (U)*, Rev. 0, S-CLC-H-01144, February 2008.

6. Savannah River Nuclear Solutions, *Dispersion Modeling Project Implementation*, S-ESR-G-0033, Rev. 0, October 2013.

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8. International Commission on Radiation Protection, *2007 Recommendations of the International Commission on Radiological Protection*, ICRP 103, Volume 37, No. 2-4., New York: Elsevier Ltd., 2007.

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10. Carbaugh, E H, et al. *Methods and Models of the Hanford Internal Dosimetry Program, PNNL-MA-860*, Pacific Northwest National Laboratory, Richland, WA, PNNL-15614, Rev. 1, September 2009.

Timeline (2019 - 2020)

2020

June 24, 2020
DOE FRN on Rejection of Recommendation 2019-2

January 3, 2020
DOE's Rejection of Recommendation 2019-2

2019

December 5, 2019
Reaffirmation of Recommendation 2019-2

October 10, 2019
Response to DOE's Rejection of Recommendation 2019-2

October 2, 2019
Federal Register Notice - Recommendation 2019-2

September 10, 2019
DOE's Response to Recommendation 2019-2, Safety of the Savannah River Site Tritium Facilities

August 5, 2019
DOE letter Granting 45-day Extension to Respond to Recommendation 2019-2

July 31, 2019
Department letter requesting a 45-day extension to provide the response for Recommendation 2019-2, Safety of the Savannah River Site Tritium Facilities

June 12, 2019
Recommendation Delivered to DOE

Bruce Hamilton, Chairman
Jessie H. Roberson
Joyce L. Connery

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

February 21, 2020

The Honorable Dan Brouillette
Secretary of Energy
US Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Brouillette:

On December 17, 2019, the Defense Nuclear Facilities Safety Board received and considered your response to draft Recommendation 2020-1, *Nuclear Safety Requirements*. On February 20, 2020, the Board—in accordance with 42 U.S.C. § 2286d(a)(3)—approved Recommendation 2020-1, which is enclosed for your consideration.

The Board reviewed your response carefully and strengthened several areas of the Recommendation. Notably, the Board decided to remove the fifth sub-recommendation regarding safety basis quality assurance and document control from this Recommendation.

Recommendation 2020-1 is intended to strengthen DOE's regulatory framework in its current form, including DOE's orders, standards, and implementation. The Board agrees with DOE that 10 CFR 830 requires an update, but believes that the Notice of Proposed Rulemaking would actually erode the regulatory framework. DOE's nuclear enterprise has grown since the original issuance of the rule; however, DOE's regulatory framework has not been updated to include requirements for key concepts and safety control strategies upon which your defense nuclear facilities rely. Specifically, the framework lacks sufficient requirements to ensure consistent and appropriate implementation across the complex for unreviewed safety questions, technical safety requirements, specific administrative controls, and the defense-in-depth construct.

The Board understands that DOE has a number of directives and program-specific initiatives to address aging infrastructure. However, DOE does not have a consistent formal process for identifying and performing infrastructure upgrades that are necessary to ensure that structures, systems, and components can perform their safety functions.

The Administrator of the National Nuclear Security Administration testified to the Subcommittee on Energy and Water Development Senate Committee on Appropriations on April 11, 2018, that "NNSA's infrastructure is in a brittle state that requires significant and sustained investments over the coming decade to correct. There is no margin for further delay in modernizing NNSA's scientific, technical, and engineering capabilities, and recapitalizing our infrastructure needed to produce strategic materials and components for U.S. nuclear weapons." We agree with the Administrator's statement, but believe that DOE must develop a formal process to address aging infrastructure systematically to ensure adequate protection across the DOE complex.

After you have received this Recommendation, and as required by 42 U.S.C. § 2286d(b), the Board will promptly make the Recommendation and any related Secretarial correspondence available to the public. The Board believes that Recommendation 2020-1, its supporting documentation, and risk assessment contain no information that is classified or otherwise restricted by DOE under the Atomic Energy Act of 1954, as amended. Please arrange to have this Recommendation and any related Secretarial correspondence placed promptly on file in your regional public reading rooms. The Board will also publish this Recommendation in the *Federal Register*.

The Board will evaluate DOE's response to this Recommendation in accordance with the Board's Policy Statement 1, *Criteria for Judging the Adequacy of DOE Responses and Implementation Plans for Board Recommendations*.

Yours truly,

Bruce Hamilton
Chairman

Enclosure

c: Mr. Joe Olencz

RECOMMENDATION 2020-1 TO THE SECRETARY OF ENERGY
Nuclear Safety Requirements
Pursuant to 42 U.S.C. § 2286a(b)(5)
Atomic Energy Act of 1954, As Amended

Dated: February 20, 2020

Introduction. The Department of Energy's (DOE) defense nuclear facilities and associated infrastructure are aging, but DOE will continue to use many of the facilities and much of the infrastructure for the foreseeable future. Consequently, the safety systems and features that were designed into the buildings or installed during construction are also aging. At the same time, DOE is proposing, designing, and building new defense nuclear facilities to support its continued mission. DOE needs to maintain a robust safety posture and strong regulatory framework to ensure that both its aging facilities and infrastructure and its new facilities provide adequate protection of public health and safety. DOE will need clear requirements and guidance for its staff to follow and enforce.

Background. DOE Policy 420.1, *Nuclear Safety Policy*, states, "It is the policy of the Department of Energy to design, construct, operate, and decommission its nuclear facilities in a manner that ensures adequate protection of workers, the public, and the environment." Title 10 Code of Federal Regulations (CFR) 830, *Nuclear Safety Management*, provides a foundation of requirements upon which DOE relies to ensure adequate protection of workers, the public, and the environment. With this rule, DOE has developed a robust regulatory framework—including orders, guides, and standards—to provide the requirements and guidance for the safe design, construction, operation, and decommissioning of its defense nuclear facilities.

10 CFR 830 captures the fundamental requirements for nuclear safety management to ensure contractors perform work "with the hazard controls that ensure adequate protection of workers, the public, and the environment." DOE provides additional requirements in orders and standards. These additional requirements may be imposed on contractors by reference in regulations or by contract. DOE also provides non-mandatory guidance in guides, handbooks, and manuals.

In its initial *Notice of Proposed Rulemaking* creating 10 CFR 830[1], DOE noted:

> *The [Price-Anderson Amendments Act of 1988], coupled with DOE efforts to improve the assurance of safety in its nuclear operations, led DOE to conclude that basic DOE nuclear safety requirements should be established through rulemaking. These requirements would revise and supplement the existing requirements, and in particular, establish specific requirements for applicable DOE nuclear facilities and provide a structured means for measuring the adequacy of the implementation and compliance on a facility-specific basis. Compliance would be measured against specific requirements and against provisions of programs required by these requirements and approved by DOE.*

As specified in its enabling legislation, the first function of the Defense Nuclear Facilities Safety Board (Board) is to "review and evaluate the content and implementation of the standards

[1] 56 FR 64316, December 9, 1991.

relating to the design, construction, operation, and decommissioning of defense nuclear facilities of the Department of Energy (including all applicable Department of Energy orders, regulations, and requirements) at each Department of Energy defense nuclear facility."[2] Since its creation, the Board has provided several recommendations that focus on creating a standards-based safety management system for DOE's defense nuclear facilities. DOE issued a notice of proposed rulemaking for 10 CFR 830 in August 2018. In this recommendation, the Board recommends to the Secretary of Energy specific measures that DOE should retain or adopt as requirements in its regulatory framework, including 10 CFR 830 and associated orders and standards, to include the implementation thereof, to ensure that public health and safety are adequately protected.

The Board notes a fundamental principle of responsibility and delegation in Recommendation 2004-1, *Oversight of Complex, High-Hazard Nuclear Operations*:

> *In any delegation of responsibility or authority to lower echelons of DOE or to contractors, the highest levels of DOE continue to retain safety responsibility. While this responsibility can be delegated, it is never ceded by the person or organization making the delegation. Contractors are responsible to DOE for safety of their operations, while DOE is itself responsible to the President, Congress, and the public*.[3]

DOE is responsible for designing, constructing, operating, and decommissioning its defense nuclear facilities in a manner that ensures adequate protection of the public. Therefore, DOE prescribes the requirements for its operating contractors to follow and implement, approves the facilities' safety bases,[4] and oversees compliance through line management and independent oversight.

Analysis.

***Aging Infrastructure*—**When DOE first issued 10 CFR 830, the majority of its defense nuclear facilities were already a few decades old, and DOE had launched an effort to construct new facilities to replace them. The Replacement Tritium Facility at the Savannah River Site (now known as Building 233-H) is an example. However, nearly three decades after construction and startup of the replacement facility, DOE continues to rely on some older facilities to support its tritium operations, and will continue to do so for the indefinite future.

Similarly, DOE has embarked upon the design and construction of the Uranium Processing Facility at the Y-12 National Security Complex, but intends to operate two associated 50-plus year old facilities for another several decades to support its production commitments for national security purposes. Also, the time from concept to startup of a new defense nuclear facility has increased dramatically in recent years, placing further emphasis on the need for continued operation of aging facilities.

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[2] 42 United States Code (USC) § 2286a(b)(1).
[3] Recommendation 2004-1, *Oversight of Complex, High-Hazard Nuclear Operations*. May 21, 2004.
[4] From 10 CFR 830.3, "Safety basis means the documented safety analysis and hazard controls that provide reasonable assurance that a DOE nuclear facility can be operated safely in a manner that adequately protects workers, the public, and the environment."

As facilities age, concerns develop over whether DOE can still safely operate and maintain them. Safety structures, systems, and components may degrade and not be able to reliably perform their safety functions. Older facilities continue to update their safety bases to comply with 10 CFR 830 without ensuring the reliability of safety systems, comprehensively evaluating the need for refurbishment or replacement of those systems, reconsidering the design or integrity of structures, or conducting a backfit analysis of equipment important to safety. Aging impacts are especially concerning for passive features (e.g., facility structures and fire walls) that are not required to be surveilled to ensure they can perform their safety function. While DOE performs some upgrades and retrofits at aging facilities, it lacks a formal, complex-wide regulatory structure for identifying and performing upgrades necessary for the adequate protection of public and workers.

In addition, as the infrastructure supporting safety systems (e.g., utilities and site services) ages, the supporting infrastructure may also degrade and impact the reliability of safety systems. DOE has taken action to address specific issues at particular sites, such as the Extended Life Program (ELP) at Y-12. However, the Board's concerns about aging infrastructure extend across the complex. Efforts such as the Y-12 ELP are laudable, but a much more systematic approach is required to address the needs across the complex. The Board has previously communicated its concerns regarding age-related degradation of infrastructure.

In a 2018 report[5], DOE's Infrastructure Executive Committee noted that deferred maintenance had increased by 25 percent between 2013 and 2017 to a total of $5.9 billion dollars for operational facilities. Also, the report noted that 17 of the Department's 79 core capabilities[6] were potentially at risk due to inadequate infrastructure, including 5 core capabilities related to defense nuclear facility infrastructure and operation.

The Administrator for the National Nuclear Security Administration (NNSA) recognized the challenges NNSA faces with regards to its aging infrastructure in her April 11, 2018, testimony to the Subcommittee on Energy and Water Development Senate Committee on Appropriations, "NNSA's infrastructure is in a brittle state that requires significant and sustained investments over the coming decade to correct. There is no margin for further delay in modernizing NNSA's scientific, technical, and engineering capabilities, and recapitalizing our infrastructure needed to produce strategic materials and components for U.S. nuclear weapons."

In addition to financial investment, a strong regulatory framework is needed to manage aging infrastructure investments and priorities. Accordingly, the Board believes that DOE needs to review its priorities and establish department-level policy and guidance for managing aging infrastructure.

***Hazard Categories*—**In 10 CFR 830, DOE applies a graded approach to the preparation of the safety basis for defense nuclear facilities, provides the criteria to be used for such gradation, and defines three Hazard Categories grouped by the significance of their

[5] *Annual Infrastructure Executive Committee Report to the Laboratory Operations Board*, March 27, 2018.
[6] Core capability is defined in DOE Order 430.1C, *Real Property Asset Management*, as the ability to conduct programmatic activities that would be degraded should the asset fail to perform as intended.

consequences to different receptors (i.e., offsite/public, onsite/collocated workers, and local/facility workers). In its proposed revision to 10 CFR 830, DOE proposes to delete the specific definitions of Hazard Categories and replace them with a generic definition in the future.

If it removes the Hazard Category definitions from 10 CFR 830 and the rulemaking process, DOE fundamentally undermines important nuclear safety processes established in the rule. Hazard categorization is an important aspect of 10 CFR 830 because the process determines what safety basis requirements are applicable to a facility. When combined with the lack of an aging management program, this could enable contractors to increase the radiological hazards present in an aging facility without an adequate understanding of the ability of the facility's safety structures, systems, and components to control the higher level of risk.

DOE Approvals**—**Both DOE and the Board have observed that the current requirement for updating a facility's documented safety analysis on an annual basis has been problematic at some defense nuclear facilities with complex activities. This is compounded when DOE and its contractors defer correcting known deficiencies until the next annual update instead of correcting the deficiencies within the current cycle. The Board also has observed situations where there have been multiple "review iterations" by the contractors and their DOE approval authorities. This could be a sign of disagreement between DOE and its contractor, or the lack of adequate technical quality or content in the safety basis documents submitted to DOE for approval. Difficulties in the annual update process also could indicate that DOE's contractors are not implementing the unreviewed safety question (USQ) process consistent with DOE requirements.

The Notice of Rulemaking does not provide an analysis of the problems that DOE is attempting to address, so it is not clear that DOE's proposed change to remove the requirement for DOE to approve annual documented safety analysis (DSA) updates is an effective solution. Removal of this requirement also complicates DOE's ability to ensure the configuration of the facility, the processes, and the documentation, and to evaluate the cumulative impact of temporary or permanent changes on the safety of the facility. The lack of an annual approval process could result in increasing latent risks as facilities and infrastructure age, due to the reduced frequency of DOE's approval of the evaluation of the reliability of their safety structures, systems, and components. As the Board noted in Recommendation 2004-1, "Contractors are responsible to DOE for safety of their operations, while DOE is itself responsible to the President, Congress, and the public."

Safety Basis Process and Requirements**—**10 CFR 830 captures the fundamental requirements for nuclear safety management to ensure contractors perform work "with the hazard controls that ensure adequate protection of workers, the public, and the environment." DOE provides additional requirements in orders and standards. These additional requirements may be imposed on contractors by reference in regulations or by contract. DOE also provides non-mandatory guidance in guides, handbooks, and manuals.

DOE uses a number of processes for implementing an approved safety basis. The USQ process determines the approval authority for proposed changes to DSAs. Technical safety requirements (TSR) ensure that important operating parameters are maintained, and that safety structures, systems, and components are available and able to perform their defined safety functions under all types of conditions. Specific administrative controls (SACs) are higher level administrative controls that have safety importance equivalent to engineered controls that would be classified as safety-class or safety-significant.

USQs, TSRs, and SACs are all very important aspects of implementing and maintaining the safety basis at defense nuclear facilities. However, DOE does not provide specific implementation requirements in its regulatory framework, including 10 CFR 830, for contractor implementation of USQs, TSRs, and SACs. Instead, DOE provides non-mandatory guidance for USQ and TSR implementation via guidance documents and some requirements for SACs via a standard.[7] This lack of implementation requirements leads to inconsistent implementation across the complex. Therefore, the Board concludes DOE should incorporate specific implementation requirements for USQs, TSRs, and SACs, in its regulatory framework, including 10 CFR 830.

The attached *Findings, Supporting Data, and Analysis* document provides the Board's supporting analysis for this recommendation.

Conclusion. DOE needs to have a robust regulatory framework that provides sufficient structure such that both aging and new defense nuclear facilities continue to provide adequate protection of workers and the public. This recommendation is intended to strengthen DOE's regulatory framework in its current form, including DOE's orders, standards, and implementation. The Board agrees with DOE that 10 CFR 830 requires an update, but believes that the Notice of Proposed Rulemaking would actually erode the regulatory framework. DOE's nuclear enterprise has grown since the original issuance of the rule; however, DOE's regulatory framework has not been updated to include requirements for key concepts and safety control strategies upon which its defense nuclear facilities rely.

Recommendation. To ensure adequate protection at defense nuclear facilities, the Board recommends that DOE revise its regulatory framework, to include requirements in 10 CFR 830, *Nuclear Safety Management*, associated orders and standards, and implementation thereof, as follows:

1. **Aging Infrastructure.**

    a. Develop and implement an approach including requirements to aging management that includes a formal process for identifying and performing infrastructure upgrades that are necessary to ensure facilities and structures, systems, and components can perform their safety functions.

2. **Hazard Categories**.

    a. Retain qualitative definitions of hazard categories in 10 CFR 830.

    b. Revise 10 CFR 830 to mandate use of a single version of Standard 1027 when performing facility hazard categorization.

[7] DOE Standard 1186-2016, *Specific Administrative Controls*, contains requirements; however, those requirements are only enforceable if Standard 1186-2016 is included in a contract.

3. **DOE Approvals.**

   a. Conduct a root cause analysis to identify the underlying issues prohibiting the current safety basis approval process from working efficiently and use the findings to improve DOE's approval process.

   b. Add language to the rule to explain that DOE's review of safety basis updates should consider the cumulative effect of changes to the safety basis.

   c. Revise the body of 10 CFR 830, Subpart B, to include formal DOE approval of justifications for continued operation and evaluations of the safety of a situation.

4. **Safety Basis Process and Requirements.**

   a. Conduct a root cause analysis to identify the underlying issues prohibiting contractors from developing and submitting a documented safety analysis on an annual schedule for DOE approval and use the findings to improve the submission process.

   b. While conducting the analyses in 3.a. and 4.a. above, retain the requirement for contractors to submit a documented safety analysis on an annual schedule for DOE approval.

   c. Specify what safety basis documentation a contractor must submit when seeking approval for an action involving a USQ (proposed 10 CFR 830.203(d)).

   d. Establish requirements for USQs and TSRs in 10 CFR 830 and/or orders, by elevating key guidance on USQs and TSRs to clearly identified requirements.

   e. Establish requirements for and incorporate the concept of defense-in-depth and SACs and add a discussion of defense-in-depth and SACs to 10 CFR 830 under safety structures, systems, and components.

Bruce Hamilton

Bruce Hamilton
Chairman

RECOMMENDATION 2020-1 TO THE SECRETARY OF ENERGY
Nuclear Safety Requirements
Risk Assessment for Recommendation 2020-1

This risk assessment supports the Defense Nuclear Facilities Safety Board's (Board) Recommendation 2020-1, *Nuclear Safety Requirements*. Board's Policy Statement 5, *Policy Statement on Assessing Risk*, states:

> *Risk assessments performed in accordance with the Board's revised enabling statute will aid the Secretary of Energy in the development of implementation plans focused on the safety improvements that are needed to address the Board's recommendations.*

This recommendation identifies deficiencies with the Department of Energy's (DOE) proposed *Nuclear Safety Management* rule, 10 CFR 830, and with the implementation of the current rule's requirements. Subpart B of the rule, *Safety Basis Requirements*, applies to the highest hazard defense nuclear facilities across the complex. The application of the changes DOE has proposed will have a far-reaching impact on those facilities posing the greatest risks to worker and public health and safety.

The Secretary of Energy is required to ensure adequate protection of the public. DOE established 10 CFR 830 as a fundamental part of the Secretary of Energy's ability to ensure adequate protection. Given the weaknesses in the existing rule and further weaknesses in DOE's proposed rulemaking, the Secretary of Energy cannot consistently ensure adequate protection. Therefore this recommendation is justified and necessary.

RECOMMENDATION 2020-1 TO THE SECRETARY OF ENERGY
Nuclear Safety Requirements
Findings, Supporting Data, and Analysis

Background. The Department of Energy (DOE) developed the first draft of Subpart B to 10 Code of Federal Regulations (CFR) Part 830, *Safety Basis Requirements*, in the mid-1990s using subject matter expertise from the Nuclear Regulatory Commission (NRC). DOE designed its format and contents similar to NRC's 10 CFR 50, *Domestic Licensing of Production and Utilization Facilities*. To that end, DOE created the concept of a safety basis, which is a series of documents comprising a documented safety analysis (DSA), a technical safety requirements (TSR) document, and a safety evaluation report (SER). DOE would review and approve the contractor developed DSA and TSR documents, and issue the SER to document its review and approval.

To maintain configuration control of the DSA while allowing some operational flexibility for the contractors, DOE established the unreviewed safety question (USQ) process so that contractors could make some changes to their activities as long as the changes were within the bounds of the DOE-approved DSA. Thus, three distinct sections were created in the main body of the rule, with the USQ process dedicated to the configuration control of the DSA; and any changes to the TSR document were to be submitted to DOE for approval prior to implementation. DOE Standard 1104, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents* established DOE's process for its review and approval activities and the development of the SER.

DOE provided additional details on these concepts in Appendix A to Subpart B as "DOE's expectations for safety basis requirements of 10 CFR 830, acceptable methods for implementing these requirements, and criteria DOE will use to evaluate compliance with these requirements." This concept was also modeled on NRC's issuance of appendices to "establish minimum requirements" that need to be met in order to comply with 10 CFR 50. For example, Appendix A to Part 50 provides the general design criteria and Appendix R provides fire protection requirements. Neither NRC nor DOE intended to consider the contents of an appendix to a Code of Federal Regulations section to be subject to the users' discretion. NRC provided additional detailed guidance in the regulatory guides that utilities use to comply with Part 50. Similarly, DOE provided a list of standards in Appendix A to Part 830 that contractors should use as acceptable methodologies for compliance with 10 CFR 830, Subpart B. These are known as the safe harbor standards.

Introduction. As part of the DOE's regulatory reform activities under Executive Order 13777, *Enforcing the Regulatory Reform Agenda*, DOE directed its Office of Environment, Health, Safety and Security[1], working with the Office of the General Counsel, to initiate a rulemaking to revise 10 CFR 830 to address the following areas (amongst others):

a. ***Regulatory Treatment of Hazard Category 3 Facilities****. Differentiate the treatment of Hazard Category 2 and Hazard Category 3 nuclear facilities by developing a new*

[1] Memorandum from Dan R. Brouillette, Deputy Secretary, to heads of elements, *Initiate a Rulemaking to Revise 10 CFR 830*, dated August 15, 2017.

subpart to 830 for Hazard Category 3 that provides an appropriate graded approach to the implementation of the requirements in 830 for both contractors and the Department.

b. ***Safe Harbor Standards.*** *Table 2 of Appendix A of 10 CFR 830, Subpart B, should be removed from the rule and become a separate standard (or other mechanism) referenced in the Rule.*

c. ***Standard 1027 (STD) Successor Document.*** *Add the term 'or successor document' to the 10 CFR 830 requirement to categorize nuclear facilities consistent with DOE STD 1027-92. The* [working] *Team recommends that DOE initiate a new revision to DOE STD 1027 (in addition to the existing 1027-92 revision effort) that updates the hazard categorization methodology and can be synched with the eventual revision to 830.*

d. ***Updates to Documented Safety Analyses (DSAs).*** *Increase the periodicity from the existing annual requirement to either 2 or 3 years; the current (arbitrary) annual requirement is problematic for complex facilities (e.g., the DOE review/approval can take several months and overlap with contractor delivery of the annual update for the subsequent year). In addition, appropriately scoped updates should not require DOE approval.*

f. ***Unreviewed Safety Question (USQ).*** *Set appropriate USQ approval levels, improving operational flexibility, and clarifying terminology.*

g. ***Limiting Analyses of Chemical Hazards.*** *Limiting the requirement for the analysis of chemical hazards in DSAs, unless the chemicals, for example, are an initiator to a nuclear event, or inhibit responses to nuclear events. [Note: chemical hazards are already addressed in 10 CFR 851, Worker Safety and Health Program.]*

These activities were to "result in significant improvements in efficiency and/or decrease in cost in Laboratory and DOE operations, while maintaining accountability and contractor performance standards [and] an appropriate level of DOE oversight."

Findings. DOE issued the notice of proposed rulemaking for 10 CFR 830 in August 2018. The following paragraphs provide the Board's findings and analysis of DOE's proposed changes to 10 CFR 830, Subpart B, *Safety Basis Requirements*, and its referenced documents.

1. Aging Infrastructure.

DOE's memorandum that initiated the rulemaking relied on input and proposals from a working group to "identify internal DOE reforms that could result in significant improvements in efficiency and/or decrease in cost…while maintaining accountability and contractor performance standards." From the working group's proposal, DOE identified several focus areas, including reform of 10 CFR 830, for further development of actions that may achieve the goal of improving efficiency and decreasing cost. This effort did not identify issues with the aging infrastructure, including lack of DOE guidance or requirements for maintenance, or the adequacy of safety posture for indefinite continued operation.

It is clear that as defense nuclear facilities age, their safety bases will become more complex. In some cases, DOE introduced new missions into old facilities, which are dependent upon dated technological infrastructure. Complexity has been shown to drive the contractors to heavily rely on administrative controls, instead of engineered features, to overcome the inherent difficulties involved in trying to comply with the requirements of 10 CFR 830, Subpart B.

At the time when 10 CFR 830 was crafted, the majority of defense nuclear facilities were only a few decades old, and DOE had launched an aggressive effort to construct new facilities to replace them. Facilities such as the Replacement Tritium Facility (RTF, now known as Building 233-H) at the Savannah River Site were examples of this vision in the early 1990s. However, three decades after the construction and startup of RTF, DOE continues to rely on some older facilities to support its tritium operations for the indefinite future. Similarly, DOE embarked upon design and construction of the Uranium Processing Facility at the Y-12 National Security Complex, but plans to continue to rely on operation of two other 50-plus year old facilities for another several decades to support its production commitments for national security purposes.

A significant number of defense nuclear facilities in the complex are now more than 50 years old and have surpassed their design life by decades. Concerns over whether facilities can still be operated and maintained safely develop as facilities age. Safety structures, systems, and components may degrade and be unable to perform their safety functions reliably. As the infrastructure supporting those safety systems (e.g., passive features, utilities, and site services) ages, it may also degrade and impact the reliability of those safety systems.

As facilities age, concerns develop over whether DOE can still safely operate and maintain them. Safety structures, systems, and components may degrade and not be able to reliably perform their safety functions. Older facilities continue to update their safety bases to comply with 10 CFR 830 without ensuring the reliability of safety systems, comprehensively evaluating the need for refurbishment or replacement of those systems, reconsidering the design or integrity of structures, or conducting a backfit analysis of equipment important to safety. Aging impacts are especially concerning for passive features (e.g., facility structures and fire walls) that are not required to be surveilled to ensure they can perform their safety functions. While DOE performs some upgrades and retrofits at aging facilities, DOE lacks a formal, complex-wide regulatory structure for identifying and performing upgrades necessary for the adequate protection of public and workers.

In addition, as the infrastructure supporting safety systems (e.g., utilities and site services) ages, the supporting infrastructure may also degrade and impact the reliability of safety systems. DOE has taken action to address specific issues at particular sites, such as the Extended Life Program (ELP) at Y-12. However, the Board's concerns about aging infrastructure extend across the complex. Efforts such as the Y-12 ELP are laudable, but a much more systematic approach is required to address the needs across the complex. The Board has previously communicated its concerns regarding age-related degradation of infrastructure. For example, in prior communications the Board has expressed concerns with age-related degradation in:

- General-service water distribution systems that provide water to safety-significant or safety-class fire suppression systems;

- General-service electrical distribution systems that could impact the reliability of safety-significant confinement ventilation systems; and

- Building structures and internal systems that cannot withstand the seismic loads required to meet their designated performance categories.[2]

In a 2018 report[3], DOE's Infrastructure Executive Committee noted that deferred maintenance had increased by 25 percent between 2013 and 2017 to a total of $5.9 billion dollars for operational facilities, and that 17 of DOE's 79 core capabilities[4] were potentially at risk due to inadequate infrastructure (see Table 1 for examples).

Table 1. *Core Capabilities Potentially at Risk Due to Infrastructure Deficiencies*[5]

Core Capability	Replacement Plant Value[6] assessed as Inadequate
Decontaminate and Decommission Facilities and Infrastructure	74%
Uranium	45%
Nuclear Material Accountability, Storage, Protection, and Handling	43%
Plutonium	40%
Weapons Assembly/Disassembly	36%

In recognition of the general situation of aging infrastructure in DOE and its potential impacts on the defense nuclear facilities, the Board is concerned that DOE needs to review its priorities and establish department-level policy and guidance for managing the aging infrastructure supporting those facilities.

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[2] See Board correspondence dated March 13, 2007; February 6, 2009; September 10, 2010*; September 30, 2011*; March 27, 2012; October 31, 2012*; February 25, 2013; October 30, 2013*; February 4, 2015; October 29, 2015; December 16, 2015; May 11, 2017; September 7, 2018; and July 2, 2019. The four dates with an asterisk are annual aging infrastructure reports the Board issued to Congress and forwarded to DOE. The dates are from the cover letter forwarding the report to DOE.
[3] *Annual Infrastructure Executive Committee Report to the Laboratory Operations Board*; March 27, 2018.
[4] Core capability is defined in DOE Order 430.1C, *Real Property Asset Management*, as the ability to conduct programmatic activities that would be degraded should the asset fail to perform as intended.
[5] Data is from Table C of *Annual Infrastructure Executive Committee Report to the Laboratory Operations Board*; March 27, 2018.
[6] Replacement Plant Value (RPV) is defined in DOE Order 430.1C, *Real Property Asset Management*, as the cost to replace the existing structure with a new structure of comparable size using current technology, codes, standards, and materials.

DOE has not conducted a comprehensive analysis of the difficulties facing its aging infrastructure at defense nuclear facilities. Without this analysis, DOE's efforts will not address the fundamental reasons for increased cost or other difficulties of maintaining old facilities in operational condition; nor will it assess the reduction in their margin of safety that may occur as the facilities age.

DOE needs to evaluate the state of its aging facilities, identify their required operational life to meet their mission needs, and develop an integrated plan for replacement or refurbishment of those facilities to maintain their safety posture and ensure adequate protection of the public, the workers, and the environment. DOE does not have any DOE-wide policies, directives, or requirements in place for implementing an effective aging management program. Accordingly, DOE needs to develop requirements and criteria for dealing with its aging infrastructure.

2. Hazard Categories.

***Definition of Hazard Categorization*—**In 10 CFR 830, DOE requires application of a graded approach to the preparation of DSAs and provides the criteria to be used for such gradation in Section 830.3 of Subpart B. Table 1 in Appendix A to Subpart B defines three hazard categories that are grouped by the significance of their consequences to different receptors (i.e., offsite/public, onsite/collocated workers, and local/facility workers).

In the proposed revision to 10 CFR 830, DOE deletes Table 1 and the specific definitions of hazard categorization, and states that it intends to provide a generic definition in the future that is not described at this time. DOE Standard 3009, safe harbor for preparation of a DSA, is formulated using the concept provided in Table 1 of the existing Subpart B. By removing the definitions of hazard categories from Part 830 and the rulemaking process, DOE's proposed revisions fundamentally undermine important nuclear safety processes established in the rule.

Hazard categorization is a fundamental element of the safety basis requirements of 10 CFR 830 because the process determines whether the safety basis requirements of Subpart B are applicable to a facility. Based on the definition of hazard categories provided in Table 1, DOE referred to Standard 1027[7] and mandated its use in Section 830.202 of the rule because "DOE want[ed] contractors to be consistent when determining the hazard classification for its nuclear facilities, hence we are requiring the consistent use of DOE-STD-1027 which has an established history for this purpose."[8] DOE's proposed action to delete Table 1, without any detailed discussion regarding hazard categorization, and deferring to a future document to be developed:

- Lacks the "established history" and a roadmap for preparation and implementation of the replacement approach;

[7] DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*; Change Notice 1, September 1997.
[8] Preamble to 10 CFR 830, Section III, *Response to Comments on the Interim Final Rule*, response to Comment N.

- Does not provide the rationale for such a significant change in approach, which has been practiced for more than two decades without known degradation or deficiencies in implementation of nuclear safety requirements;

- Creates an ambiguous and unclear domain of standards to be developed for compliance with nuclear safety requirements; and

- Undermines the fundamental principles of the graded approach and its implementation as described in the rule.

***Reference to Standard 1027 Within the Rule*—**DOE's memorandum to initiate the rulemaking recommended adding the phrase "or successor document" to 10 CFR 830.202(b)(3) and to "initiate a new revision [to Standard 1027] that updates the hazard categorization methodology."

DOE prepared Standard 1027 in 1992 to provide guidance on hazard categorization and on the performance of hazard analyses for preparation of safety bases for nonreactor nuclear facilities. It used the available technical information to develop screening criteria and grouping of the nuclear facilities based on their potential consequences to the immediate workers, site area, and offsite members of the public. DOE also based Standard 1027 on a survey of all DOE nuclear facilities and their potential hazards to arrive at a set of parameters that would realistically categorize those facilities based on their potential consequences. More updated technical information and recommendations by the International Commission on Radiological Protection (ICRP)[9, 10] has resulted in some changes to those parameters. It would be prudent, and technically justified, to use the most up to date information in a DOE standard that is fundamental for graded implementation of nuclear safety requirements at defense nuclear facilities.

This DOE action, combined with the deletion of Table 1 from the rule that defines hazard categories, and deferring a new definition to be provided outside the rulemaking process, will create an uncertain, ambiguous, and unclear methodology for implementation of 10 CFR 830 at the defense nuclear facilities; and consequently, a potential for eroding the level of protection currently provided by those facilities.

Additionally, both the existing version and the proposed revision of 10 CFR 830 state that a contractor must "categorize the facility consistent with" Standard 1027 rather than "in accordance with" Standard 1027. The words "consistent with" introduce flexibility in implementation to not actually follow the requirements in Standard 1027. This language has already led to the National Nuclear Security Administration (NNSA) issuing supplemental

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[9] ICRP 68, 1994, *Dose Coefficients for Intakes of Radionuclides by Workers*, Replacement of ICRP Publication 61, International Commission on Radiological Protection, Pergamon Press, Oxford, Great Britain.
[10] ICRP 72, 1995, *Age-Dependent Doses to Members of the Public from Intake of Radionuclides*, Part 5, Compilation of Ingestion and Inhalation Dose Coefficients, International Commission on Radiological Protection, Pergamon Press, Great Britain.

guidance to its facilities to use a modification[11] to Standard 1027 that is not cited by the rule and, therefore, not used by the Office of Environmental Management; resulting in an inconsistent gradation of defense nuclear facilities in the complex.

The safety basis requirements in Subpart B apply to Hazard Category 1, 2, or 3 nuclear facilities. With DOE's proposed revisions, 830 would not include any language that defines these terms, and DOE can change the definitions of these terms outside the rulemaking process.

3. Submission and Approval of Safety Bases.

***Need for Root Cause Analysis and DOE Approval of Annual Updates to the DSA*—**The DOE memorandum that initiated the rulemaking directed DOE elements to "increase the periodicity from the existing annual requirement to either two or three years; the current (arbitrary) annual requirement is problematic for complex facilities. In addition, appropriately scoped updates should not require DOE approval." In accordance with the memorandum, the notice of proposed rulemaking deletes the requirement for DOE review and approval of the annual updates to the DSAs. This DOE action weakens the safety basis construct created by DOE in establishing Subpart B. DOE required the preparation of safety basis for nuclear facilities to ensure that adequate protection of the public and the workers is implemented through compliance with its safe harbor standards. It also weakens the USQ process, which ensures that the safety bases are maintained under a defined configuration control program.

The Board has noted that some defense nuclear facilities with complex activities have difficulty meeting the annual update commitments. Although this was not anticipated by DOE at the time when 10 CFR 830 was issued in January 2001[12], some sites rely on inter-related documents that comprise their safety bases and it might be difficult to ensure that the various elements of their safety bases are updated consistently in the allowed time.[13]

The Board has also observed situations where there have been multiple "review iterations" by contractors and their DOE approval authorities. This could be a sign of disagreement between DOE and its contractor, or the lack of adequate technical contents of the DSAs submitted to DOE for approval. Difficulties in submitting an annual update also could indicate that DOE's contractors are not implementing the USQ process consistent with the requirements.

DOE's notice of rulemaking does not identify the problems that DOE is attempting to address, so it is not clear that DOE's proposed change is an appropriate solution. It would be prudent for DOE to evaluate the reasons why contractors and DOE experience significant challenges implementing the annual requirement. DOE needs to conduct a root cause analysis to determine why DOE and its contractors are having difficulties managing the review and approval

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[11] NNSA Supplemental Guidance 1027, *Guidance on Using Release Fraction and Modern Dosimetric Information Consistently with DOE STD 1027-92, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports.*

[12] 66 FR 1810, DOE response to Comment JJ, Section III of the final Rule, 10 CFR 830: "If the USQ process has been followed properly, the annual approval of the documented safety analysis should require minimal effort."

[13] For example, the Board has corresponded on PF-4 at LANL, Pantex, and the Tritium Facilities at the Savannah River Site among others.

of annual updates, and use the results of that analysis to fix the underlying problems. While conducting the analysis, DOE should retain the requirement for contractors to develop and submit safety bases on an annual schedule for DOE approval.

In the revised Appendix A to Subpart B, DOE proposes language to clarify that it will continue to review the DSA updates in some cases, and may even approve the annual update in some cases. The proposed language states, "DOE will review each documented safety analysis…if DOE has reason to believe a portion of the safety basis has substantially changed." Another relevant new sentence is: "If additional changes are proposed by the contractor and included in the annual update that have not been previously approved by DOE or have not been evaluated as a part of the USQ process, DOE must review and approve these changes." DOE's notice of rulemaking does not include a detailed discussion of these changes, and therefore they do not alleviate concerns with removing DOE's approval of the annual update.

Temporary Authorization of Activities—10 CFR 830.202(g)(3) *requires* contractors to "Submit the evaluation of the safety of the situation to DOE prior to removing any operational restrictions initiated to meet [safe condition]" of the facility. Those operational restrictions (or other compensatory measures) may continue to be required for a long period of time. Per DOE Guide 424.1-1B, *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements*, the vehicle for operating under restrictions for "an extended period of time" until the next annual update of the DSA is issued, is the justification for continued operations (JCO), which is a "temporary change to the facility safety basis." The DOE guide states that the contractor should submit the JCO to DOE for approval. However, the rule does not formally require DOE's approval of a JCO.

In some cases, contractors eventually incorporate the operational restrictions and accompanying analyses (or some revised version of them) into the DSA via the annual update. In other cases, JCOs continue to be a stand-alone part of the safety basis for several years. With DOE's proposed revision to the rule, i.e., not requiring DOE approval of the annual updates to the DSA, there will be important changes to the safety basis with no requirement for their approval by DOE.

Instead of a JCO, contractors may prepare an evaluation of the safety of the situation (ESS) that includes operational restrictions. DOE Guide 424.1-1B states that DOE should approve ESSs for potential inadequacies of the safety analysis (PISAs) that represent a positive USQ; however, the rule does not require DOE approval for this situation. Under DOE's proposed revision to the rule, the ESS can represent a mechanism for the contractor to make important changes to the safety basis without any requirement for DOE approval.

4. **Safety Basis Process and Requirements.**

Fundamental Elements of Safety Bases—Unlike the safe harbors for DOE nonreactor nuclear facilities and nuclear explosive facilities for compliance with the DSA requirements of the rule, the rule does not provide any standards for compliance with USQs or TSRs; instead, it refers to DOE guides on those subjects, DOE Guide 424.1-1B and DOE Guide 423.1-1B, *Implementation Guide For Use In Developing Technical Safety Requirements*, respectively.

DOE guides, however, "describe[s] acceptable, non-mandatory means for meeting requirements." As a result, contractors' implementation at the sites are diverse and inconsistent. The Deputy Secretary identified this issue in his memorandum as one to be addressed in the proposed rule. The Board has made similar observations that include lack of uniformity of implementation, and in some cases, inconsistency of implementation with the requirements of the rule.

Requirements Regarding the USQ Process—DOE Guide 424.1-1B provides an example of guidance on USQs that should be examined for elevation to a requirement and inclusion in Subpart B. The guide includes expectations on the timeliness with which contractors process PISAs:

> *It is appropriate to allow a short period of time (hours or days but not weeks) to investigate the conditions to confirm that a safety analysis is potentially inadequate before declaring a PISA….If it is immediately clear that a PISA exists, then the PISA should be declared immediately*[14].

This timeliness is important for safety, as it causes the contractor to formally declare a PISA and take actions to place the facility in a safe condition. Contractors do not always perform this step in a timely manner (i.e., within hours or days, but not weeks). This leads contractors to delay implementing the necessary compensatory measures to place or maintain the facility in a safe condition that provides adequate protection of the public. There are instances where contractors have delayed a PISA declaration beyond hours or days because they deemed the information to be not yet mature enough to merit that action. The DOE guidance quoted above already addresses this situation, saying that the contractors may take hours or days to investigate, but not weeks. It should be noted that a similar statement was made in resolution of comments received for the final rulemaking of 10 CFR 830: "the contractor's USQ procedure should define the period for performance of a USQ determination related to a PISA and that time period should be on the order of days, not weeks or months." However, not all contractors' procedures comply with this expectation.

DOE should formalize this guidance on timeliness into a requirement, to ensure that contractors place facilities into safe conditions when they discover PISAs. If DOE believes it is necessary to make some allowance for delaying action because the new information is immature, DOE should provide the criteria for defining "information maturity." Declaring the information as "immature" and not declaring a PISA should be exceptional and subject to compliance with DOE criteria. Such criteria, however, do not exist and need to be developed.

Additionally, the Board has observed that some contractors allow themselves a "grace period" to take action and return the facility into compliance with their safety bases without declaring a PISA.[15] As a result, the facility would be operating outside of its approved safety basis for the duration of the grace period without DOE knowledge or approval of the situation,

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[14] DOE Guide 424.1-1B, Section C.2.

[15] Board Recommendation 2019-1, *Uncontrolled Hazard Scenarios and 10 CFR 830 Implementation at the Pantex Plant*, February 20, 2019.

and without having to take safety precautions to put the facility in a safe configuration. Section 830.202, Subpart B, does not allow this action, which may result in unsafe operation of defense nuclear facilities and a lack of adequate protection of the public.

Several of the USQ procedures approved by DOE lack any requirements for training and qualification of USQ screeners. These individuals are the first line of defense against lack of compliance with the requirements of the rule, and their knowledge of the facility and its safety basis, as well as the USQ process, is of utmost importance. While preparation of safety bases throughout the complex has created a wealth of knowledgeable subject matter experts that the contractors rely on, implementation of USQ procedures and USQ screening sometimes relies on available personnel, making their training and qualification an important aspect of the safety of operations.

The definition of USQ in the rule also warrants clarification. The proposed (and also existing) definition for USQ in Section 830.3 uses the term “equipment important to safety.” This term is not defined in 10 CFR 830, though it is defined in DOE Guide 424.1-1B. Proper and consistent implementation would be better achieved if the definition from the guide were also included in the rule.

Finally, 10 CFR 830 does not specify what documentation a contractor is required to submit to DOE prior to obtaining approval for planned actions involving a USQ. Specifically, section 830.203(d) states, “A contractor responsible for a Hazard Category 1, 2, or 3 DOE nuclear facility must obtain DOE approval prior to taking any action determined to involve a USQ.” This section does not specify whether a contractor must submit planned changes to the safety basis, a description of planned changes, or if no documentation is required and a verbal explanation would suffice. Accordingly, when DOE approves contractor action, it is not clear that DOE is specifically approving any planned changes to the safety basis.

Requirements Regarding TSRs—DOE Guide 423.1-1B includes some aspect of the content of TSR documents that should be considered for elevation to the rule. In Appendix C to the Guide, DOE combines the Section 830.201 requirement for the contractor to “perform work in accordance with the DOE-approved safety basis” with the quality assurance requirements in Subpart A of the rule. From these two portions of the rule, DOE derives a need for the contractor to “independently confirm the proper implementation of new or revised safety basis controls.” This is an important concept for ensuring safe operation of the facility, and should be directly included in the rule.

One area of difficulty for contractors preparing TSRs has been in the determination of “completion times.” TSRs typically define actions the contractor will take when safety structures, systems, and components (SSC) do not meet their limiting conditions for operation. This scenario can occur intentionally due to a maintenance outage, or unintentionally due to degradation of a safety-related SSC. TSRs define the required times (completion times) by which the contractor must take temporary actions to compensate for the loss of safety SSCs, or by which the contractor will restore SSCs. According to the guide, when developing completion times, the contractor should consider “the safety importance of the lost safety function” and “the risk of continued operations.” In practice, some completion times appear excessively long, with no documented consideration of safety risk for DOE's review and acceptance. DOE should revise Appendix A to Subpart B to include the concept that safety risks should be considered when developing completion times.

Similarly, some contractors have prepared TSR documents that the action to be taken, when a safety SSC is inoperable or found to be unavailable, is simply to submit to DOE a "recovery plan." Some of these recovery plans are open-ended, without any completion date or compensatory measures in place to achieve an equivalent level of safety as provided in the TSR. As a result, some defense nuclear facilities could be operating outside the bounds of their approved safety basis, relying on an approved "recovery plan" to be completed by some unspecified date. Such situations warrant explicit requirements in the rule to prevent nuclear facilities from operating with less than adequate levels of safety.

Fundamental Nuclear Safety Principles—10 CFR 830 provides the requirements for identification and analysis of hazards, identification of controls, and the quality assurance that must be applied to all stages of nuclear facility operations. However, it does not require implementation of the most fundamental nuclear safety principle, defense-in-depth, to ensure that no one layer of control is solely relied on for safety.

In a letter to the Deputy Secretary of Energy, dated July 8, 1999, the Board stated:

> *Current requirements for nuclear safety design, criticality safety, fire protection and natural hazards mitigation are set forth in DOE Order 420.1, Facility Safety. This Order (Section 4.1.1.2), when contractually invoked, requires that:*
>
> *'Nuclear facilities shall be designed with the objective of providing multiple layers of protection to prevent or mitigate the unintended release of radioactive materials to the environment.'*
>
> *This "defense-in-depth" approach is the hallmark of nuclear facility and process designs.*

DOE Order 420.1C, *Facility Safety*, includes an expanded discussion of what the defense-in-depth concept entails. However, the requirements of Order 420.1C are not applied to the operation of existing defense nuclear facilities unless DOE's contract with the management and operating contractor has specifically identified and stipulated its application. As a result, DOE does not routinely implement the defense-in-depth concept to ensure safe operation of nuclear activities. The controls identified in DSAs for existing facilities are usually a compilation of the existing controls, and rarely have led to the identification of new controls for ensuring that multiple layers of protection exist to defend against the release of radioactive materials. This weakness is more common when contractors rely on SACs to compensate for the lack of a safety-related engineered feature to prevent or mitigate an event.

10 CFR 830, Subpart B, needs to require the defense-in-depth construct to ensure that all nuclear facilities and activities meet this fundamental nuclear safety construct, and provide

adequate protection of the public and the workers such that no one failure of a layer of protection would lead to the release of radioactive materials.

Specific Administrative Controls—DOE created the concept of the SAC in response to the Board's Recommendation 2002-3, *Requirements for the Design, Implementation, and Maintenance of Administrative Controls*. To provide guidance on this topic, DOE created a new standard, *Specific Administrative Controls*, and revised several other standards and guides to ensure consistency. SACs are a higher level administrative control that have safety importance equivalent to engineered controls that would be classified as safety-class or safety-significant. For this reason, SACs are an important tool for DOE to ensure adequate protection

Although DOE created a new standard for SACs, DOE did not revise 10 CFR 830 to reflect the concept of implementing SACs as an equivalent TSR control. As a result, the discussion in 10 CFR 830 on safety controls is incomplete and does not fully reflect current DOE terminology and practice. Accordingly, DOE should include the concept of SACs within the requirements of 10 CFR 830, Subpart B.

Timeline (2019 - 2020)

2020

February 21, 2020
Recommendation Delivered to DOE

2019

October 16, 2019
Draft Recommendation Delivered to DOE

March 13, 2019
Federal Register Notice - Recommendation 2020-1

<u>DEFENSE NUCLEAR FACILITIES SAFETY BOARD</u>

FISCAL YEAR 2021 WORK PLAN

August 2020

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FISCAL YEAR 2021
OGM STRATEGIC PROJECTS LIST

OGM Planned Discretionary Work for FY 2021

Strategic Cross-Cutting Work
- Finalize Human Capital Plan
- Explore agency-wide knowledge management solutions
- Update five-year IT strategic plan
- Request Congressional Research Service conduct a 30 Year In Review of DNFSB

Board Operations
- Improve external communications with the interagency, Congress and Interest Groups
- Regularly review Board policies and procedures (update 1 Directive or Operating Procedure per quarter)
- Enhance agency-wide communications (through regular updates or All-Hands)
- Develop agency-wide guidelines for written work products
- Continue migration of OGM and OGC intranet content to SharePoint

Facilities
- Phase 1 DNFSB Space Re-configuration
    - Modernize Office Furniture
- Cyclical carpet and wall coverings refresh spring 2021
- Update Occupant Emergency Plan

Security
- Complete Security SharePoint site
- Complete Personnel Security Handbook
- Complete Physical Security Handbook
- Annual Review of COOP Plan (FEMA)
- Complete Facility Security Plan for Limited Area
- Develop Monthly Security Newsletter
- Compete Security SharePoint site

Operations & Administration
- Develop and/or revise 20% of out-of-date directives and operating procedures
- Develop OGM Customer Service Standards
- Develop OGM and/or DOS (weekly/Bi-weekly/Mthly) Administrative Newsletter

Acquisitions & Procurements
- Develop Contract Office Representative (COR) Training
- Develop and implement Acquisition training plans
- Develop and/or revise internal controls (as identified in August 2020 Grant Thornton review)
- Phase 1 & 2 of Automated Acquisition Processes

Human Resources
- Achieve and maintain floor of 110 full-time equivalent employees

IT Upgrades & Governance

- Complete laptop rollout by December 2020
- Finalize migration from Windows 7 to Windows 10
- Migrate from Skype for Business to Microsoft Teams
- Resolve all backlogged authorizations to operate by March 2021

Training and Employee Engagement

- Award training and mentoring contract and initiate training classes
- Provide agency-wide training to focus on strengthening internal communications

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Office of the General Counsel

FISCAL YEAR 2021
OGC STRATEGIC PROJECTS LIST

Introduction. The Office of the General Counsel (OGC) provides direct legal support to the Board in the conduct of its oversight role. OGC supports the Technical Director and General Manger and their staff in the execution of the Board functions to provide oversight of Defense Nuclear Facilities. OGC is the repository of legal resources for the agency and manages the agency's compliance with all legal requirements. The majority of work handled by OGC is to provide responsive legal support to the Board and the other two offices within the agency. OGC also has the lead on several important cross-cutting agency functions.

Overview. OGC is currently staffed with a General Counsel, an Acting Deputy General Counsel, and two staff attorneys. The office relies on contracted support to cover administrative functions within the office, including workload intake and processing, record processing, document preparation, and other administrative matters. The majority of the work OGC traditionally performs is non-discretionary, i.e., it is required by law or necessary for agency operation, or high priority, which includes direct mission work and Board-directed work. This plan does not identify the non-discretionary work planned for Fiscal Year 2021. Rather, this plan provides a list of discretionary work that OGC will spearhead to achieve organizational improvement – e.g., business process enhancements and office practices not required by law or regulation and not driven by Board direction.

<u>OGC Planned Discretionary Work for FY 2021</u>

Item	Description
Safety Allegations	Develop and implement a comprehensive Safety Allegations Program. This will include an internal Directive and Operating Procedure articulating how DNFSB will process such allegations, as well as an outward-facing resource (webpage and/or guidance document) informing the public how to report a safety allegation. Once these documents are in place, OGC will conduct appropriate training for Board Members and staff.
Sunshine Act	Develop regulations and procedures governing "nonpublic collaborative discussions" by the Board, if the Atomic Energy Act is amended to allow such discussions.
Ethics	Develop and implement an Operating Procedure on processing Board Member nominations.

<u>DEFENSE NUCLEAR FACILITIES SAFETY BOARD</u>

Office of the Technical Director

FISCAL YEAR 2021
OTD WORK PLAN

Introduction. The Office of the Technical Director (OTD)[1] developed the Fiscal Year (FY) 2021 OTD Work Plan based on the Defense Nuclear Facilities Safety Board's (Board) strategic plan and nuclear safety oversight mission. The plan discusses the oversight approach and planning for principal reviews and other high priority work.

Uncertainties. Uncertainties associated with the work plan are largely tied to Department of Energy (DOE) schedule changes, emerging work activities, and the potential for technical staff attrition. Historically, DOE schedule changes tend to result in delays, which may delay oversight activities throughout the year. Board direction and emergent DOE activities also drive the need to adjust the work plan.

Additionally, due to potential uncertainties in travel and site personnel availability as a result of the on-going pandemic, OTD management encouraged oversight plan owners to consider various methods to complete the interaction phase with DOE and contractor personnel when scoping proposed reviews. Each proposed review interaction was categorized by oversight plan owners. This is discussed further in the results section.

During FY 2021, OTD leadership will adjust schedules and work activities as needed to reflect the Board's priorities and maintain the quality of each review.

Approach. The FY 2021 approach involved development of oversight plans and proposed review activities by oversight plan owners, with input from subject matter experts and other interested technical staff. OTD management provided direction to the technical staff based on the Board's strategic plan. Specifically, OTD management focused on Strategic Objective 1.1 – completing timely, high-quality safety reviews that identify and analyze safety issues and best practices, and search for similar challenges complex-wide. Therefore, as in prior years, OTD emphasized identification of staff reviews that have the potential to identify cross-cutting issues and support complex-wide analysis.

OTD management reviewed and approved the oversight plan strategies and reviewed the proposed review activities. From the initial set of proposed reviews, OTD management down-selected based on priority and resource constraints, and ensured each oversight plan area included appropriate coverage. All technical staff were then given the opportunity to volunteer as review leads and/or review team members for any new review activities they were interested in, and submit a prioritized list of these activities to their supervisors. OTD management finalized review team leads and members based on this staff input.

Principal Reviews. For FY 2021, OTD staff identified a set of potential principal reviews. Principal reviews are defined as reviews that are high priority and require significant staff resources due either to the proposed depth or breadth of the activity. The potential principal reviews are distributed across the three technical groups and include scope in operating facilities, design and construction projects, and complex-wide programs. Of these reviews, six are carryover reviews from FY20. During the course of the fiscal year, OTD management will further down-select from the list of remaining potential principal reviews to a final list, depending on DOE progress and travel restrictions. OTD management will prioritize these

[1] Acronyms are defined in Appendix B.

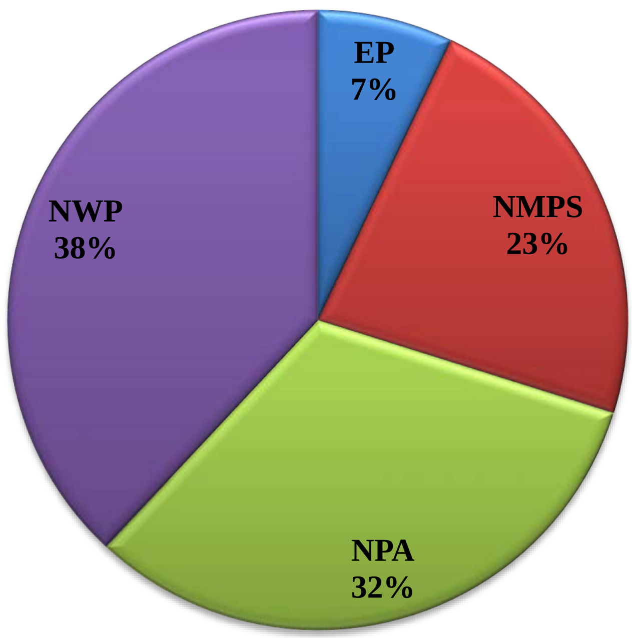
reviews for completion, and will provide additional management support and oversight, as needed. The list of potential principal reviews is provided in the results section.

Engineering Performance (EP). The work plan includes six staff activities in the EP mission area. These activities will be performed by employees across OTD. They capture OTD activities that focus on improving OTD management controls, updating procedures, and implementing staff training to achieve the Board's mission efficiently and effectively.

Results. The proposed FY 2021 OTD work plan includes 64 new reviews and 55 FY 2020 carry-over reviews[2] turned on to start the year, including non-discretionary (ND) activities.

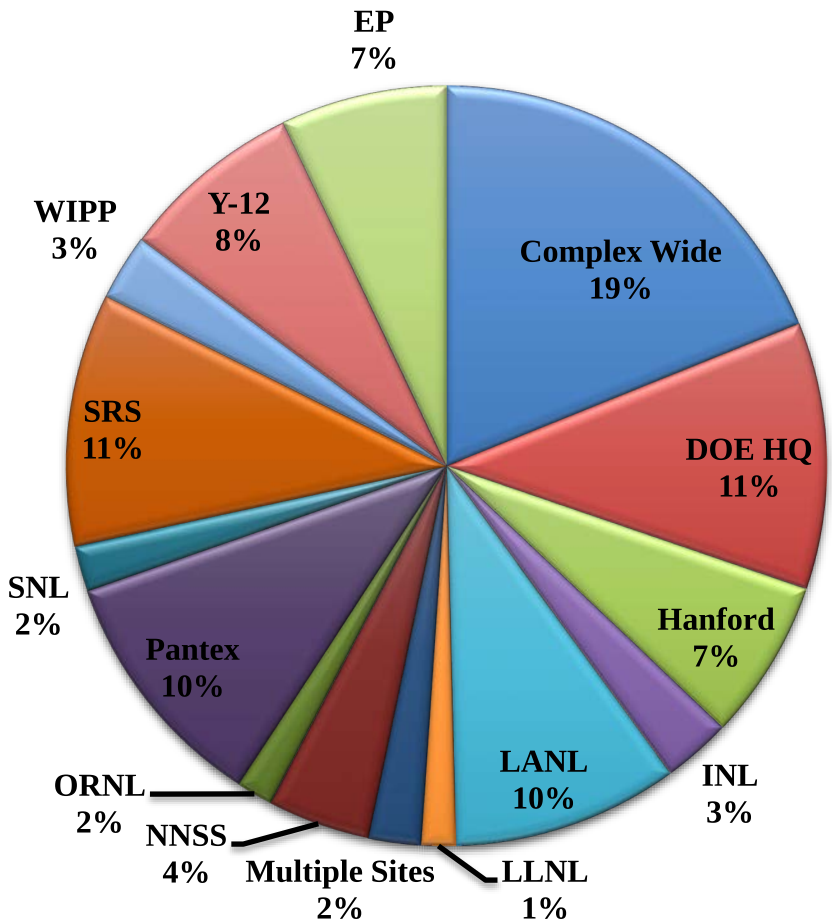
Figure 1 provides an estimate of resources required for the reviews by OTD group, and Figure 2 shows a breakdown by site. Table 1 provides the complete list of potential principal reviews, and Table 2 discusses the breakdown of reviews by interaction type. The next three sections provide the planned reviews for each OTD group, organized by site and/or oversight plan area.

Figure 1. *Work Plan Resource Loading by Technical Group*



[2] Carry-over reviews are reviews that were started in FY20 for which some level of effort will continue into FY21.

Figure 2. *Work Plan Resource Loading by Site*[3]



[3] DOE HQ reviews are reviews that include interactions primarily with DOE HQ staff, and the majority of these reviews are DOE Directives reviews.

Complex-wide reviews are reviews which include interactions at the majority of DOE sites, and/or focus on implementation of a particular area across the complex (e.g., Management of Aging Infrastructure).

Multiple site reviews are reviews which include interactions at two or three DOE sites (e.g., Safety Management Programs Review at Y-12 and Pantex).

Table 1. *Potential Principal Reviews*

Group	Review Title	Site	FY20 Carryover
NWP	LANL Adequacy of Safety SSCs	LANL	Yes
NPA	Assessment of DOE Oversight Effectiveness	Complex Wide	Yes
NPA	Draft DOE Standard 5506, *Preparation of Safety Basis Documents for Transuranic Waste Facilities*	DOE HQ	Yes
NPA	DOE Handbook 3010-94, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*	DOE HQ	Yes
NPA	Safety Management Programs Review at Y-12 and Pantex	Multiple Sites	Yes
NPA	Management of Aging Infrastructure	Complex Wide	No
NPA	Quality of Field Office Review and Approval of Documented Safety Analyses	Complex Wide	No
NMPS	WTP-DFLAW Integration of Safety Bases Review	Hanford	Yes
NMPS	WTP-HLW Preliminary Design Review	Hanford	No

Table 2. *Review Activities by Interaction Type*

Interaction Type	# of Review Activities
On-site essential	39
On-site preferred	27
Remote	47
N/A	6

"On-site essential" review activities indicate that at least part of the interaction phase of the review (e.g., on-site discussions, walkdowns, or field observations) will be required to occur on-site to complete the review activity. "On-site preferred" indicates the preference of the staff to complete all or part of the interaction phase on-site; however, if there are travel restrictions, the staff will be able to complete the entire review activity remotely, using teleconferences. Review activities with a "remote" interaction type represent reviews that, even in a typical year with no travel restrictions, the staff would complete remotely, with interactions held via teleconference if necessary. Finally, the six review activities marked "N/A" represent EP activities that are internal activities requiring no interaction with DOE or contractor personnel.

Nuclear Weapon Programs (NWP).

OTD's NWP group performs independent and timely oversight of the safety of operations involving maintenance of the nuclear weapons stockpile and of weapons-related research, development, and testing. NWP also conducts safety oversight of National Nuclear Security Administration (NNSA) design and construction projects in accordance with the Board's Policy Statement-6 (PS-6). In FY 2021, NWP will conduct effective safety oversight through formal, well-planned reviews at NNSA defense nuclear facilities. In the course of these activities, NWP will assist the Board in notifying NNSA of potential safety items at NNSA defense nuclear facilities and in nuclear explosive operations, while maintaining a near-continuous oversight presence at Los Alamos National Laboratory (LANL), the Y-12 National Security Complex (Y-12), and the Pantex Plant. Tables 3 through 9 identify all NWP reviews turned on in the work plan (principal reviews shown in bold).

Table 3. *LANL Reviews*

Priority	Review Title	FY20 Carryover
1	**LANL Adequacy of Safety SSCs**	**Yes**
2	PF-4 Leak Path Factor Upgrade Supporting Calculations Review	Yes
2	PF-4 Seismic Performance Assessment	No
2	Aqueous Nitrate Restart Activities	No
2	Conduct of Operations and Training	No
2	PF-4 Updated Atmospheric Dispersion Analysis Review	No
2	Glovebox Glove Integrity Program	No
3	Onsite Transportation Safety	No
3	RLUOB Safety Basis	Yes

Table 4. *LLNL Reviews*

Priority	Review Title	FY20 Carryover
2	LLNL Building 332 Seismic Safety Review	Yes
2	LLNL Recovery Glovebox Line - Building 332 DSA/TSR Review	No

Table 5. *NNSS Reviews*

Priority	Review Title	FY20 Carryover
ND	ECSE PDSA Review	No
2	DAF SSI Analysis Review	Yes
2	LANL NCERC Operations Criticality Safety Program Review	Yes
2	DAF & NCERC Safety Basis Review	No

3	RWMC Safety Basis Review	Yes

Table 6. *Pantex Reviews*

Priority	Review Title	FY20 Carryover
ND	Evaluation of Recommendation 2019-1 Implementation Plan Deliverables	Yes
ND	Pantex Concerns Review	Yes
1	Evaluation of Pantex Planned Improvements	Yes
2	Electrical Tester Equipment Review	Yes
2	Fire Protection Program Review	Yes
2	Known State Operations Startup	No
2	Controls for Natural Phenomena Hazard Events	No
3	W78 Operational Safety Review	Yes
3	Welding Program Review	No
3	W87 Operational Safety Review	No
3	W76 Operational Safety Review	No
3	W80 Operational Safety Review	No

Table 7. *SNL Reviews*

Priority	Review Title	FY20 Carryover
1	Review of EP&R at SNL	Yes
3	SNL Weapon Response Technical Basis Review	Yes
3	Conduct of Operations Review at ACRR	No

Table 8. *SRS-NNSA*

Priority	Review Title	FY20 Carryover
ND	Savannah River Plutonium Processing Facility CD-1 Review	Yes
ND	Tritium Finishing Facility CD-1 Review	Yes
3	SRS Tritium Safety Management Programs	No
3	SRS' Corrective Actions on Sub-Rec 3 of Recommendation 2019-2	No
4	SRS Tritium Facilities Electrical Systems Review	Yes
4	SRS Tritium Stack Analysis	No

Table 9. *Y-12 Reviews*

Priority	Review Title	FY20 Carryover
1	Y-12 Fire Protection Programmatic Review	No
2	Review of Y-12 Facilities with Enduring Missions	Yes
2	Y-12 Criticality Safety Program Follow-up Review	Yes
2	Conduct of Maintenance Review	No
3	UPF Equipment Procurement and Installation Review	Yes
3	Building 9215 DSA Review	No
3	Out-of-Service Equipment Holdup Review	Yes
3	UPF Factory Acceptance Testing	No
3	Safety Basis Implementation Review	No

Nuclear Materials Processing and Stabilization (NMPS).

The NMPS group performs independent and timely oversight ensuring that the health and safety of the public are adequately protected as DOE disposes of excess radioactive materials, cleans up surplus defense nuclear facilities, and begins operation of new facilities. NMPS also conducts safety oversight of Environmental Management (DOE-EM) design and construction projects in accordance with PS-6.

NMPS will conduct effective safety oversight through formal, well-planned safety reviews at DOE-EM defense nuclear facilities. In the course of these activities, NMPS will assist the Board in notifying DOE of potential safety items at DOE defense nuclear facilities, while maintaining a near-continuous oversight presence at Savannah River Site (SRS) and the Hanford Site. Tables 10 through 16 identify NMPS reviews turned on in the work plan (principal reviews shown in bold).

Table 10. *Hanford Reviews*

Priority	Review Title	FY20 Carryover
2	WTP Safety Management Programs	Yes
2	**WTP-DFLAW Integration of Safety Bases Review**	**Yes**
2	Building 324 Remediation (Radiological Control – Conduct of Operations)	Yes
2	**WTP-HLW Preliminary Design Review**	**No**
2	SWOC/CWC DSA Review	Yes
3	Tank and Pipeline Integrity	No
3	CWC Hazard Controls	Yes

Table 11. *INL Reviews*

Priority	Review Title	FY20 Carryover
3	IWTU DOE Readiness Assessment Prior to Confirmatory Run	No
3	ARP/AMWTP TRU Waste Characterization, Storage, and Handling Operations	No
4	Calcine Retrieval Project	No

Table 12. *LANL-EM Reviews*

Priority	Review Title	FY20 Carryover
3	Area G Safety Basis	No

Table 13. *ORNL Reviews*

Priority	Review Title	FY20 Carryover
2	SWSA-5 PDSA Review	No
2	SWSA-5 Readiness Activities Review	No
3	Building 2026 Readiness Activities Review	No

Table 14. *SRS Reviews*

Priority	Review Title	FY20 Carryover
ND	SRS Public Hearing	Yes
ND	Building 235-F Revised Implementation Plan Review	Yes
1	H-Canyon DSA/TSR Rev 14 Review	Yes
2	H-Canyon Exhaust Tunnel Structural Analysis	Yes
3	DOE-STD-3013 Surveillance and Monitoring Program Annual Review	No
3	Surplus Pu Disposition Conceptual Design Review	No
3	SWPF Sustained Operations	No
3	K-Area Safety Basis Review, DSA Rev 16	No
3	SRNL Safety Basis Implementation	No

Table 15. *WIPP Reviews*

Priority	Review Title	FY20 Carryover
3	WIPP SSCVS Procurement/Construction Review	No
3	WCS Waste Disposition	Yes
3	700C Fan Startup Review	No
4	Safety Instrumented Alarm System Failure Review	Yes
4	WIPP UG Air Flow Direction	Yes
4	FY2021 National TRU Program Users Group Meeting	No
4	CBFO Certification of LANL Nitric Acid/Cheesecloth Waste	Yes

Table 16. *Multiple NMPS Sites Reviews*

Priority	Review Title	FY20 Carryover
3	DOE-EM Design and Construction Projects Baseline Review	No
4	NTP Certified Program Oversight	No

Nuclear Programs and Analysis (NPA)

The NPA group performs independent and timely oversight of the development, implementation, and maintenance of DOE regulations, requirements, and guidance for providing adequate protection of public health and safety at defense nuclear facilities, and the establishment and implementation of safety programs at defense nuclear facilities.

NPA is responsible for complex-wide programmatic review efforts addressing topics such as nuclear criticality safety, facility aging management, DOE oversight, and emergency management. Several planned NPA activities will interface with and provide input to site-specific reviews contained in the NWP and NMPS oversight plans. NPA also leads OTD review of DOE directives. Tables 17 through 20 identify NPA reviews turned on in the work plan (principal reviews shown in bold), as well as the EP activities for FY2021.

Table 17. *Directives Reviews*

Priority	Review Title	FY20 Carryover
ND	MOU Development Support	No
1	**Draft DOE Standard 5506, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities***	**Yes**
1	DOE Guide 424.1-1B, *Implementation Guide for Use in Addressing USQ Requirements*	No
1	DOE-HDBK-1224, *Hazard and Accident Analysis Handbook*	No
1	Recommendation 2020-1 response follow-up	Yes
2	**DOE Handbook 3010-94, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities***	**Yes**
2	DOE Standard 1228-2019, *Preparation of Documented Safety Analysis for Hazard Category 3 DOE Nuclear Facilities*	Yes
2	DOE Standard 1027-2018, *Hazard Categorization of DOE Nuclear Facilities*	Yes
2	DOE Order 425.1D, *Verification of Readiness to Startup or Restart Nuclear Facilities*	No
2	DOE-STD-1020, *Natural Phenomena Hazards Analysis and Design Criteria for DOE Facilities*	No
2	DOE-STD-1066, *Fire Protection*	No
3	Draft DOE-STD-1195, *Design of SS SIS Used at DOE Nonreactor Nuclear Facilities*	Yes
3	DOE-HDBK-1169-YR & DOE-STD-1269-YR, *Air Cleaning Systems in DOE Nuclear Facilities*	Yes

Table 18. *Safety Management Program Reviews*

Priority	Review Title	FY20 Carryover
ND	**Assessment of DOE Oversight Effectiveness**	**Yes**
ND	Maintenance and Reliability of Safety-Related SSCs	Yes
1	Complex-wide Criticality Safety Evaluation	Yes
1	**Quality of Field Office review and approval of DSAs**	**No**
1	**SMP reviews at Y-12 and Pantex**	**Yes**
1	Emergency Exercise Observations	No
1	DOE Corporate Operating Experience Program Implementation	No
1	DOE COVID-19 Response	Yes
2	Staff Analysis of DOE Criticality Safety Annual Metrics	No
3	Review of EP&R and Assurance at major DNFs (Hanford)	Yes
3	Pantex Dosimetry	No

Table 19. *Nuclear Safety Topical Studies Reviews*

Priority	Review Title	FY20 Carryover
1	**Management of Aging Infrastructure**	**No**
2	Implementation of Defense-In-Depth	Yes
2	Reactive Nuclear Materials	Yes
2	Dispersion Modeling	Yes
2	Status of PSHAs cited in DSAs	Yes
3	Confinement Approaches for HC-2 Facilities	No
3	Review of DOE's Safety Software Registry	No
3	Categorization of HC-3 and Below HC-3 Facilities	No
3	Qualification of batteries used in SS/SC systems	No
4	Maintenance of Underground Cabling	Yes
6	Criticality Safety Benchmark Evaluation	Yes

Table 20. *EP Activities*

Priority	Review Title	FY20 Carryover
EP	OTD Procedures	No
EP	Technical Staff Training	No
EP	Internal Control Assessments	No
EP	External Interface	No
EP	OTD Work Plan and Reports	No
EP	Recruiting and Performance Reports	No

Appendix A. Acronyms

Acronym	Full Name
AMWTP	Advanced Mixed Waste Treatment Project (INL)
ACRR	Annular Core Research Reactor (SNL)
ARP	Accelerated Retrieval Project (INL)
CBFO	Carlsbad Field Office
CD	Critical Decision
CFR	Code of Federal Regulations
CWC	Central Waste Complex
DAF	Device Assembly Facility (NNSS)
DFLAW	Direct Feed to LAW (Hanford)
DNF	Defense Nuclear Facility
DOE	Department of Energy
DOE-EM	DOE Environmental Management
DOE-HQ	DOE Headquarters
DSA	Documented Safety Analysis
DWPF	Defense Waste Processing Facility (SRS)
ECSE	Enhanced Capabilities for Subcritical Experiments (NNSS)
EP	Engineering Performance
EP&R	Emergency Planning and Response
FY	Fiscal Year
GSTR	Generator Site Technical Review
HC	Hazard Category
HDBK	Handbook
HEPA	High Efficiency Particulate Air
HEUMF	Highly Enriched Uranium Materials Facility (Y-12)
HLW	High Level Waste
HPFL	High Pressure Fire Loop
INL	Idaho National Laboratory
IP	Implementation Plan
IWTU	Integrated Waste Treatment Unit (INL)
LANL	Los Alamos National Laboratory
LAW	Low Activity Waste
LLNL	Lawrence Livermore National Laboratory
NCERC	National Criticality Experiments Research Center (NNSS)
ND	Non-discretionary
NMPS	Nuclear Materials Processing and Stabilization
NNSA	National Nuclear Security Administration

Acronym	Full Name
NNSS	Nevada National Security Site
NPA	Nuclear Programs and Analysis
NTP	National Transuranic Waste Program
NWP	Nuclear Weapon Programs
ORNL	Oak Ridge National Laboratory
ORR	Operational Readiness Review
OTD	Office of the Technical Director
Pantex	Pantex Plant
PDSA	Preliminary Documented Safety Analysis
PF-4	Plutonium Facility (LANL)
PS-6	Policy Statement 6
PSHA	Probabilistic Seismic Hazard Analysis
RLUOB	Radiological Laboratory Utility Office Building (LANL)
RWMC	Radioactive Waste Management Complex (NNSS)
SC	Safety Class
SMP	Safety Management Program
SNL	Sandia National Laboratory
SRNL	Savannah River National Laboratory
SRPPF	Savannah River Plutonium Processing Facility
SRS	Savannah River Site
SS	Safety Significant
SSC	Structures, systems, and components
SSCVS	Safety Significant Confinement Ventilation System (WIPP)
SSI	Soil Structure Interaction
STD	Standard
SWOC	Solid Waste Operations Complex (Hanford)
SWPF	Salt Waste Processing Facility (SRS)
SWSA	Solid Waste Storage Area (ORNL)
TAPI	Tank and Pipeline Integrity
TEF	Tritium Extraction Facility (SRS)
TRU	Transuranic
TSR	Technical Safety Requirement
TWF	Transuranic Waste Facility (LANL)
UPF	Uranium Processing Facility (Y-12)
USQ	Unreviewed Safety Question
WCS	Waste Control Specialists (Andrews, Texas)
WESF	Waste Encapsulation and Storage Facility (Hanford)
WIPP	Waste Isolation Pilot Plant

Acronym	Full Name
WTP	Waste Treatment & Immobilization Plant (Hanford)
Y-12	Y-12 National Security Complex

FY 2021
Congressional Budget Request

FY 2019
Annual Performance Report

Defense Nuclear Facilities Safety Board

February 19, 2020

GOVERNMENT PERFORMANCE AND RESULTS ACT (GPRA) MODERNIZATION ACT

GPRA Strategic Planning Reporting Requirements

The GPRA Modernization Act of 2010 requires each agency to make available on its website a strategic plan establishing general strategic goals and objectives for a period of not less than four years. The Defense Nuclear Facilities Safety Board's (Board) Strategic Plan for Fiscal Years (FY) 2018–2022 (revised December 2019) is available on the Internet at www.dnfsb.gov. In addition, agencies are required to develop an Annual Performance Report (APR) that provides information on the agency's progress achieving the goals and objectives described in the Strategic Plan and Annual Performance Plan (APP). The Board's FY 2019 APR, based on the original plan, and the FY 2021 APP, based on the revised plan, are included in this Budget Request in accordance with the requirements of the Office of Management and Budget Circular A-11.

Contents

PROPOSED APPROPRIATIONS LANGUAGE

Salaries and Expenses

For expenses necessary for the Defense Nuclear Facilities Safety Board in carrying out activities authorized by the Atomic Energy Act of 1954, as amended by Public Law 100-456, section 1441, $28,836,000, to remain available until September 30, 2022.

FY 2021 REQUEST EXECUTIVE SUMMARY

The Board requests $28,836,000 and 114 full-time equivalents (FTEs) to carry out its mission in FY 2021. This is a seven percent decrease from the agency's FY 2020 appropriation level of $31,000,000.

The Board's foundation is built on the expertise of its Board members and its staff in support of the Board's mission, and approximately two-thirds of the Board's annual budget is dedicated to salaries and benefits. The Board will be executing an aggressive staffing plan for FY 2020 and FY 2021 focused on hiring highly skilled engineers, scientists, and professionals to support the agency's mission. These hiring levels will significantly reduce the carryover funding in FY 2021.

The Board's FY 2021 request also includes maintaining cybersecurity, physical security, and secure communications. The Board will also continue to focus on employee engagement and strategic planning. These investments enable the staff to do mission-critical work more efficiently and effectively.

Operating Expense Summary

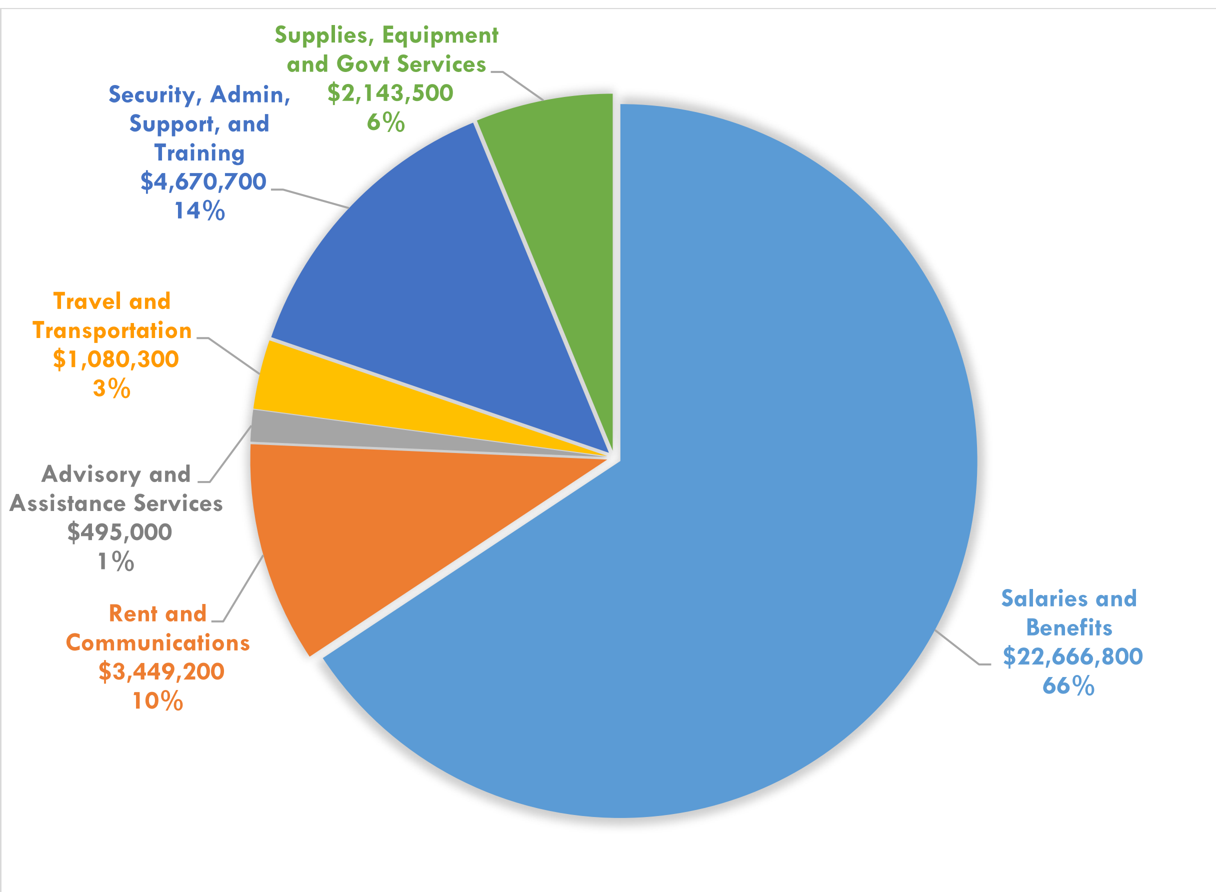
	FY 2019 Actual	FY 2020 Plan	FY 2021 Request
Budget Authority	31,000	31,000	28,836
Obligations	28,362	31,487	34,505
Outlays	26,007	29,598	32,435

Numbers in thousands

Personnel Summary

	FY 2019 Actual	FY 2020 Plan	FY 2021 Request
Statutory Personnel (FTE) Ceiling	130	130	130
On-Board	87	113	116
FTE Usage	87	100	114

FY 2021 Projected Obligations by Major Category



THE MISSION

Mission Statement

The mission of the Board shall be to provide independent analysis, advice, and recommendations to the Secretary of Energy to inform the Secretary, in the role of the Secretary as operator and regulator of the defense nuclear facilities of the Department of Energy, in providing adequate protection of public health and safety at such defense nuclear facilities, including with respect to the health and safety of employees and contractors at such facilities.

42 U.S.C. § 2286a(a)

The Board's Legislative Mandate

The Board's specific functions are delineated in its enabling statute at 42 U.S.C.§ 2286a(b):

- The Board shall review and evaluate the content and implementation of the standards relating to the design, construction, operation, and decommissioning of defense nuclear facilities of the Department of Energy (including all applicable Department of Energy orders, regulations, and requirements) at each Department of Energy defense nuclear facility. The Board shall recommend to the Secretary of Energy those specific measures that should be adopted to ensure that public health and safety are adequately protected. The Board shall include in its recommendations necessary changes in the content and implementation of such standards, as well as matters on which additional data or additional research are needed.
- The Board shall investigate any event or practice at a Department of Energy defense nuclear facility that the Board determines has adversely affected, or may adversely affect, public health and safety.
- The Board shall have access to and may systematically analyze design and operational data, including safety analysis reports, from any Department of Energy defense nuclear facility.
- The Board shall review the design of a new Department of Energy defense nuclear facility before construction of such facility begins and shall recommend to the Secretary, within a reasonable time, such modifications of the design as the Board considers necessary to ensure adequate protection of public health and safety. During the construction of any such facility, the Board shall periodically review and monitor the construction and shall submit to the Secretary, within a reasonable time, such recommendations relating to the construction of that facility as the Board considers necessary to ensure adequate protection of public health and safety. An action of the Board, or a failure to act, under this paragraph may not delay or prevent the Secretary of Energy from carrying out the construction of such a facility.
- The Board shall make such recommendations to the Secretary of Energy with respect to Department of Energy defense nuclear facilities, including operations of such facilities, standards, and research needs, as the Board determines are necessary to ensure adequate protection of public health and safety. In making its recommendations, the Board shall consider, and specifically assess, risk (whenever sufficient data exists), and the technical and economic feasibility of implementing the recommended measures.

FY 2018 – 2022 Strategic Plan

The Board published an updated FY 2018–2022 agency Strategic Plan that established these strategic goals and objectives in December 2019. The FY 2019 Annual Performance Report provided herein is aligned with the goals and objectives established in the original FY 2018–2022 agency Strategic Plan, not the updated plan summarized on this page. The original FY 2018–2022 agency Strategic Plan is summarized on page 13.

Strategic Goal 1
Provide proactive and independent oversight of the defense nuclear complex.

Strategic Objective 1.1 – Complete timely, high-quality safety reviews that identify and analyze safety issues and best practices, and search for similar challenges complex-wide.
Strategic Objective 1.2 – Develop and issue advice and recommendations designed to ensure safety and employ best practices within the defense nuclear complex.
Strategic Objective 1.3 – Provide robust field oversight of facilities and projects across the defense nuclear complex.

Strategic Goal 2
Enhance transparency of ongoing Agency initiatives and the state of safety within the defense nuclear complex.

Strategic Objective 2.1 – Proactively sustain sound working relationships with relevant government and non-governmental entities.
Strategic Objective 2.2 – Improve timely dissemination of information about the Board priorities and conclusions regarding the state of safely at Defense Nuclear Facilities.

Strategic Goal 3
Develop and maintain an outstanding workforce to achieve the Agency's mission.

Strategic Objective 3.1 – Cultivate an agile workforce with the skills necessary to meet the mission.
Strategic Objective 3.2 – Use professional development and training to efficiently and effectively accomplish the mission.

Strategic Goal 4
Maximize the DNFSB's performance by pursuing excellence in our Agency culture and operations.

Strategic Objective 4.1 – Pursue efficiency through continuous improvement of internal policies and procedures through testing and evaluation.
Strategic Objective 4.2 – Establish and maintain a culture that encourages teamwork and innovation across the Agency in accordance with core values.
Strategic Objective 4.3 – Strengthen operational performance by modernizing Agency processes and associated infrastructure.

ORGANIZATIONAL STRUCTURE

The five-member Board[1] leads the agency in accomplishing its mission and determines actions regarding the safety aspects of the design, construction, operation, and decommissioning of the Department of Energy's (DOE) defense nuclear facilities.

CHAIRMAN

Mr. Bruce Hamilton

Board Member

Ms. Jessie Hill Roberson

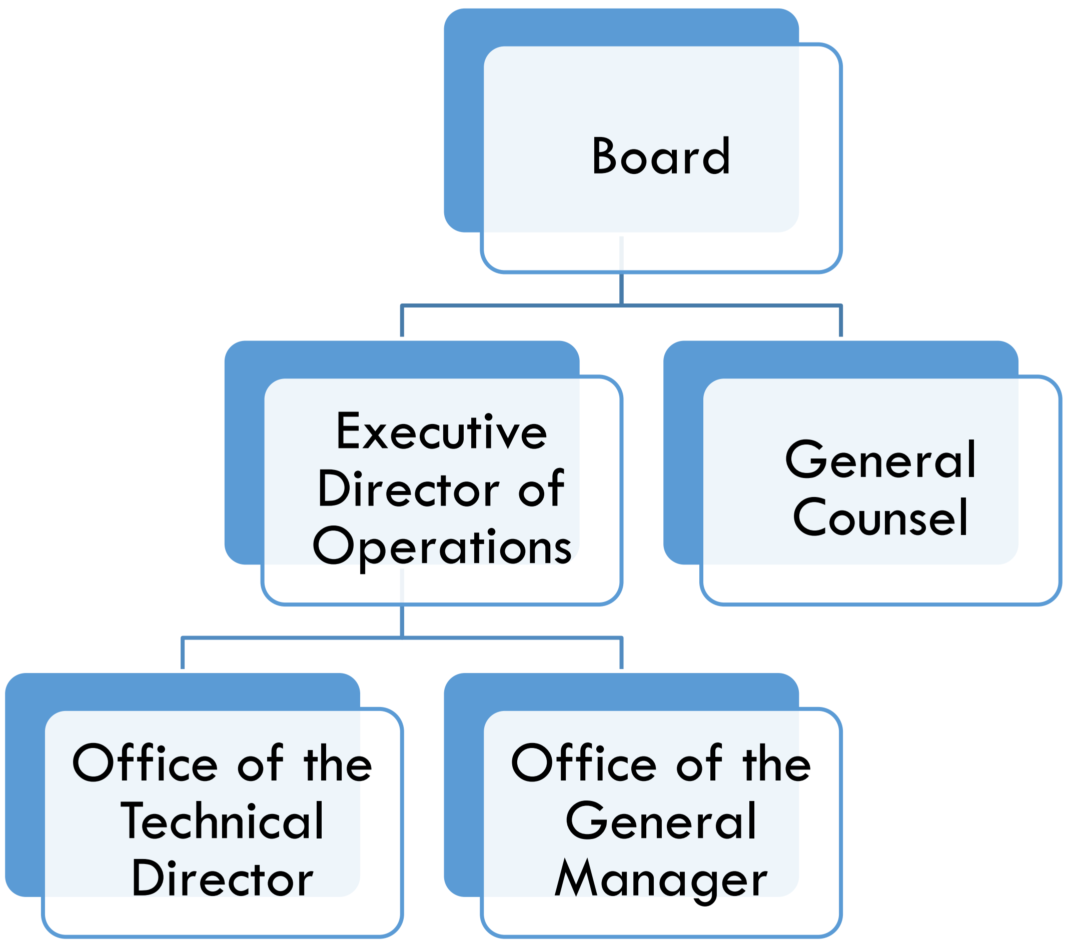
Board Member

Ms. Joyce L. Connery

[1] There are currently two vacancies on the Board.

Organizational Chart

The Board is statutorily capped at 130 federal FTEs and is currently arranged in three offices under the five-member board. The majority of FTEs are assigned to the Office of the Technical Director (OTD), where they directly carry out the mission of the Board, supported by the Office of the General Manager (OGM) and the Office of the General Counsel (OGC). The National Defense Authorization Act for FY 2020 included direction that the Chairman delegate the administrative functions of the Board, appointment and supervision of employees other than the General Counsel, and other specified business functions to an Executive Director of Operations. The Board intends to fill this executive position during FY 2020.



FY 2021 BUDGET RESOURCE REQUEST SUMMARY

Obligations by Fiscal Year

Budget Account – OC	FY 2019 Actual	FY 2020 Financial Plan	FY 2021 Budget Request
PERSONNEL SALARIES -- (11)	12,537,300	14,786,800	17,048,000
PERSONNEL BENEFITS -- (12)	4,111,600	4,856,700	5,618,800
BENEFITS FOR FORMER PERSONNEL -- (13)	-	-	-
TRAVEL -- (21)	710,900	1,026,000	1,026,000
TRANSPORTATION OF THINGS -- (22)	54,800	54,300	54,300
RENTAL PAYMENTS TO GSA -- (23.1)	2,998,500	3,086,800	3,102,200
COMMUNICATIONS & UTILITIES (23.3)	157,400	347,000	347,000
PRINTING & REPRODUCTION -- (24)	26,800	29,100	29,100
ADVISORY & ASSISTANCE SERVICES -- (25.1)	151,700	495,000	495,000
OTHER SERVICES -- (25.2)	5,464,200	4,297,100	4,507,200
GOVERNMENT SERVICES -- (25.3)	1,054,600	1,392,900	1,453,700
OPERATION & MAINT. OF FACILITIES -- (25.4)	4,100	27,000	27,000
OPERATION & MAINT. OF EQUIPMENT -- (25.7)	22,400	107,400	107,400
SUPPLIES & MATERIALS -- (26)	216,600	323,800	323,800
ACQUISITION OF ASSETS -- (31)	850,600	657,000	366,000
TOTAL OBLIGATIONS	28,361,500	31,486,900	34,505,500
NEW BUDGET AUTHORITY	31,000,000	31,000,000	28,836,000
UNOBLIGATED BALANCE - PREV. FY	5,144,000	8,115,500	8,171,600
RECOVERY OF PRIOR YEAR OBLIGATIONS	333,000	543,000	300,000
TOTAL BUDGETARY RESOURCES	36,477,000	39,658,500	37,307,600
EST. UNOBLIGATED BAL. - CUR. FY	8,115,500	8,171,600	2,802,100
OUTLAYS	26,007,000	29,597,700	32,435,200
STAFF & BOARD MEMBERS (FTE)	87	100	114

FY 2021 Budget Request Justification Highlights

Salaries and Benefits (OC 10)

The FY 2021 request includes funding of $22,666,800 to support the projected salary and benefit costs for 114 FTEs. The funding for salaries and benefits represents 66 percent of the Board's FY 2021 estimated obligations. In calculating the projected salary and benefits needs of the Board, the following federal pay adjustment and benefits factors for executive branch employees are used:

- Civilian pay increase of 1 percent in January 2021
- Employee benefits of 33 percent of salaries

Note: personnel benefit (OC 12) costs also include other costs (e.g., change of station, public transit subsidies).

In establishing the Board, Congress sought to bring the best talent available to focus on health and safety oversight associated with the design, construction, operation, and decommissioning of DOE's defense nuclear facilities. The recruitment and retention of scientific and technical staff with outstanding qualifications are the key components in the Board's human capital strategy. The Board has assembled a small and highly talented technical staff with extensive backgrounds in science and engineering disciplines, such as nuclear-chemical processing, conduct of operations, general nuclear safety analysis, conventional and nuclear explosive technology and safety, storage of nuclear materials, nuclear criticality safety, and radioactive waste management. Most of the technical staff have technical master's degrees, and many hold doctoral degrees. Many of the Board's technical staff members possess practical nuclear experience gained from duty in the U.S. Navy's nuclear propulsion program, the nuclear weapons field, or the civilian nuclear power industry. In order to accomplish the Board's highly technical mission, it is of paramount importance that the Board receives funds to meet the salary and benefit requirements of the staff.

The Board maintains a cadre of 10 resident inspectors that provides a cost-effective means for the Board to closely monitor DOE activities and to identify health and safety concerns promptly by conducting first-hand assessments of nuclear safety management at five priority sites. Resident inspectors regularly interact with the public, union members, congressional staff members, and public officials from federal, state, and local agencies. Staff may be temporarily assigned to sites for a period of weeks or months to augment Resident Inspectors and/or as a development tool. The Board has authorized three more resident inspector positions consistent with the Board's nuclear safety oversight priorities at the Savannah River Site, Hanford, and Los Alamos National Laboratory.

Travel (OC 21)

The Board requests $1,026,600 to support the official travel of Board members and staff. Extensive travel to the various DOE defense nuclear facilities located throughout the United States is necessary for Board members and staff to conduct first-hand assessments of operations and associated health and safety issues. In order to fulfill its mission, the Board assigns technical staff teams to near-continuous monitoring of major startup, testing, restart, or other activities at various DOE sites.

Travel funds are also used to pay for expenses associated with public hearings and meetings at or near DOE sites, where any interested persons or groups may present comments, technical information, or data concerning health and safety issues under the Board's purview.

Transportation of Things (OC 22)

The Board has included $54,300 in its FY 2021 Budget Request for the shipment of household goods for employees relocating to/from the Washington, D.C. area and/or becoming Resident Inspectors at DOE facilities.

Rental Payments to GSA (OC 23.1)

The Board requests funds totaling $3,102,200 to reimburse the U.S. General Services Administration (GSA) for projected office rental costs based on the rent estimate received from GSA. This overhead expense represents approximately 9 percent of the Board's FY 2021 estimated obligations. The Board entered into a 10-year lease in March 2016 for its headquarters in Washington, D.C.

Communications and Utilities (OC 23.3)

The Budget Request includes $347,000 for projected communications support costs. Funds in this account will be used for voice over internet protocol telephone service, smartphone services, Internet access charges (both at the Board's headquarters and its alternate continuity of operations (COOP) location), postage and overnight delivery costs, and special messenger services. The physical COOP space is located at a DOE facility, and all costs necessary for maintaining the readiness of the alternate location are included under this OC.

Printing and Reproduction (OC 24)

The Budget Request includes $29,100 for reimbursing the U.S. Government Publishing Office for publication of required legal notices in the Federal Register.

Advisory and Assistance Services (OC 25.1)

The Budget Request includes $495,000 for training of the Board's engineers and scientists, as well as technical service contracts.

Other Services (OC 25.2)

The Budget Request includes $4,507,200 to fund a wide range of recurring information technology and administrative support needs of the Board in FY 2021 in such areas as physical and cyber security, information technology, administrative support, recruiting, and training of the Board's professional and administrative staff, including members of the Senior Executive Service.

Government Services (OC 25.3)

The Budget Request includes $1,453,700 for reimbursable support agreements with other Federal agencies and increases in other government service provider costs. The Board uses cross-servicing arrangements for physical security, accounting and payroll processing services, health unit, employee background investigations for security clearances, and Employee Assistance Program services.

Operation and Maintenance of Facilities (OC 25.4)

The Board requests $27,000 for maintaining the Board's facilities (e.g., heating, ventilation, and air conditioning maintenance; building alterations; and plumbing repairs outside the scope of the building lease).

Operation and Maintenance of Equipment (OC 25.7)

The Board requests $107,400 for maintaining and repairing Board equipment (e.g., information technology (IT) systems, copier maintenance agreements, repair of office equipment) and for storage of household goods associated with a permanent change of station.

Supplies and Materials (OC 26)

The Board requests $323,800 for continued access to numerous technical standards databases, legal research services, IT system components, and general office supplies and materials.

Acquisition of Assets (OC 31)

The Board requests $366,000 in acquisition of assets, primarily for IT equipment and software supporting the Board's operations, such as investment to enhance secure communications, minor enhancements to existing software systems, and replacement of end-of-life office equipment.

FY 2019 ANNUAL PERFORMANCE REPORT / FY 2021 ANNUAL PERFORMANCE PLAN

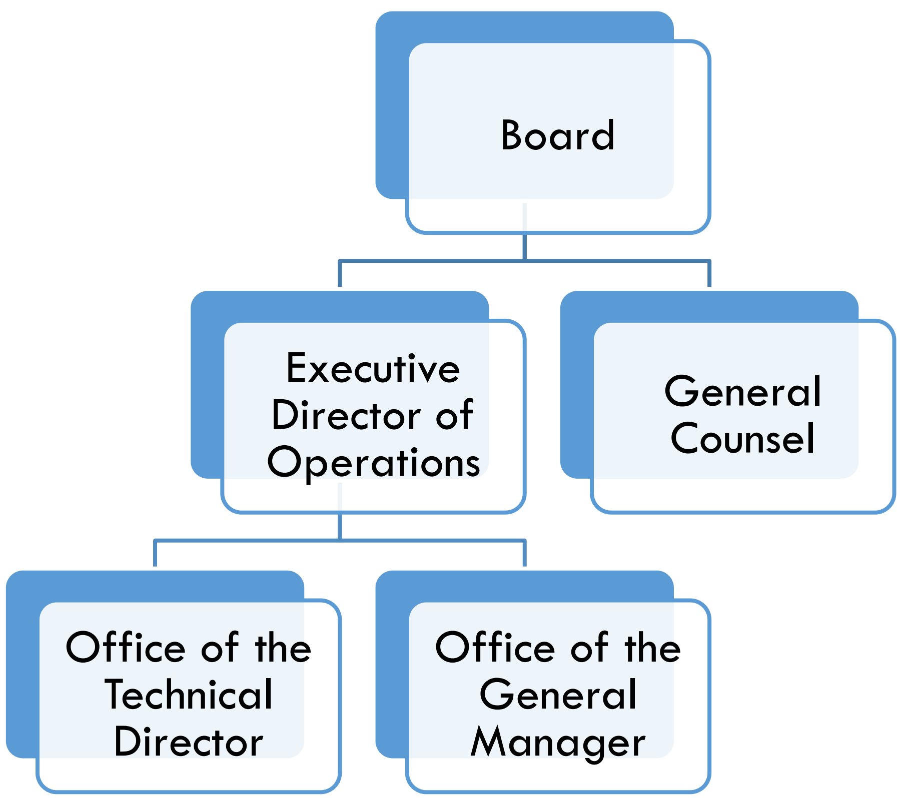
Overview

The Board published an updated FY 2018–2022 agency Strategic Plan that established revised strategic goals and objectives in December 2019. The Board's FY 2019 APR is aligned with the goals of the original FY 2018–2022 Strategic Plan in place during FY 2019. The Board's FY 2020 APP has been updated to align with the goals defined in the Board's updated Strategic Plan. The Board's FY 2021 APP was developed to align with the updated Strategic Plan.

Mission Statement

The mission of the Board shall be to provide independent analysis, advice, and recommendations to the Secretary of Energy to inform the Secretary, in the role of the Secretary as operator and regulator of the defense nuclear facilities of the Department of Energy, in providing adequate protection of public health and safety at such defense nuclear facilities, including with respect to the health and safety of employees and contractors at such facilities.

Organizational Structure[2]



[2] The National Defense Authorization Act for FY 2020 included direction that the Chairman delegate the administrative functions of the Board, appointment and supervision of employees other than the General Counsel, and other specified business functions to an Executive Director of Operations. The Board intends to fill this executive position during FY 2020.

Strategic Goals and Strategic Objectives (FY 2019 APR)

The Board's Strategic Plan for FYs 2018–2022 sets forth a broad vision of how the Board will fulfill its statutory mission to "provide independent analysis, advice, and recommendations to the Secretary of Energy to inform the Secretary, in the role of the Secretary as operator and regulator of the defense nuclear facilities of the Department of Energy, in providing adequate protection of public health and safety at such defense nuclear facilities, including with respect to the health and safety of employees and contractors at such facilities." The FY 2019 APR is aligned with the strategic goals and objectives defined in the Board's original Strategic Plan for FY 2018–2022:

GOAL 1
Independent Review of content and implementation of Standards relating to the design, construction, operations, and decommissioning of defense nuclear facilities.

> Strategic Objective 1.1—Perform independent oversight of the development of nuclear safety standards by the Secretary of Energy in providing adequate protection of public health and safety at defense nuclear facilities.
>
> Strategic Objective 1.2—Perform independent review of the implementation of DOE regulations, requirements, and guidance for providing adequate protection of public health and safety at defense nuclear facilities through observing, monitoring, and assessing implementation of standards in all phases from design and construction, to operations, to decommissioning of defense nuclear facilities.
>
> Strategic Objective 1.3—Perform cross-cutting analysis of the effectiveness of DOE standards, regulations and guidance across the complex to ensure the adequate protection of public health and safety.

GOAL 2
Investigation of any event or practice at defense nuclear facilities which adversely affects or may adversely affect public health and safety. The purpose of the Board investigation shall be to:

> Strategic Objective 2.1—Ensure adequacy of standards implementation.
>
> Strategic Objective 2.2—Ascertain information concerning circumstances of an event or practice and implications for public health and safety.
>
> Strategic Objective 2.3—Ascertain the extent of events and practices at defense nuclear facilities that could impact health and safety.

GOAL 3
Systematic analysis of design and operational data.

> Strategic Objective 3.1—Independently conduct systematic analysis on design and operational data, including safety analysis reports, from defense nuclear facilities to identify practices and patterns that may indicate designs or operations that, as implemented, may adversely affect public health and safety.
>
> Strategic Objective 3.2—Independently obtain and analyze data related to the safe operations.

GOAL 4

Timely Review of design of new defense nuclear facilities before construction and periodically, thereafter.

Strategic Objective 4.1—Independently review the design of a new defense nuclear facility before construction begins and recommend, within a reasonable time, such modifications as the Board considers necessary to ensure adequate protection of public health and safety.

Strategic Objective 4.2—Periodically review and monitor the construction of defense nuclear facilities and submit information to the Department of Energy the Board considers necessary for the Department to ensure adequate protection of public health and safety.

GOAL 5

Proposal of Recommendations to the Secretary of Energy when determined necessary to ensure adequate protection of health and safety.

Strategic Objective 5.1—When determined as necessary to ensure adequate protection, high-quality Recommendations will be prepared that are technically sound with sufficient risk analysis and technical and economic feasibility of implementation provided.

GOAL 6

Achievement of mission in a manner that is accountable and transparent to the public and achieves the mission efficiently and effectively.

Strategic Objective 6.1—Apply management controls to achieve the Board's mission efficiently and effectively. Apply them in a manner consistent with the Board's enabling statute with respect to the duties of the Board as a whole, the Chairman, and individual Board Members. Such duties include maintaining adequate human resources, physical infrastructure, information technology systems, financial management, acquisition procedures, and legal support to advance program mission goals while providing sufficient and effective security for personnel, facilities and information.

Strategic Objective 6.2—Align human capital strategies with agency mission, goals, and objectives through analysis, planning, investment, measurement, and management of human capital programs.

Strategic Objective 6.3—Communicate effectively and transparently with the Board's stakeholders on Board safety issues in DOE's defense nuclear complex, on the Board's operations, and all Board Member views.

FY 2019 Performance Summary

Goal 1—Nuclear Safety Standards	**FY 2019 Target**	**FY 2019 Results**
Independent reviews of nuclear safety standards.	3	3
Independent reviews of the implementation of nuclear safety standards.	12	19
Cross-cutting analyses.	2	2
Goal 2—Investigations		
Capability to conduct investigations.	1	N/A
Board and technical staff site visits.	80%	84%
Goal 3—Systematic Analysis		
Resident inspectors' weekly reports and cognizant engineers' monthly reports.	90%	96%
Independent analyses based on modeling.	2	3
Goal 4—New Facility Design and Construction		
Independent oversight at specified and logical points in the design and construction of new defense nuclear facilities.	1	2
Goal 5—Recommendations		
Timely, high-quality recommendation products provided to the Board.	90%	90%
Timely, high-quality evaluation of implementation plan deliverables.	90%	100%
Goal 6—Achieve Mission (accountable, transparent, efficient, effective)		
Evaluation to simplify and refocus internal procedures.	1	2
Executive Committee on Internal Controls meetings.	3	3
Board budget updates.	6	7
Board approved agency staffing plan.	1	N/A
Board interactions with external stakeholders.	10	13
Board public meetings or hearings.	6	7

FY 2019 Performance Detail

GOAL 1
Independent review of content and implementation of standards relating to the design, construction, operations, and decommissioning of defense nuclear facilities.

Fiscal Year	Performance Goal	Target	Result
2019	**Performance Goal 1.1** Conduct reviews based on independent evaluation of the content of nuclear safety standards. **Indicator** Number of reviews and associated reports completed for nuclear safety standards. Reviews will evaluate whether appropriate nuclear safety requirements are identified in the standard.	FY 2019 Target: 3	Achieved FY 2019 Result: 3

Discussion
The Board completed the following reviews to meet the above objective of independently evaluating the content of nuclear safety standards. The Board accomplished its FY 2019 goal of completing at least three reviews of nuclear safety standards.

1. DOE regulation 10 C.F.R. Part 830, *Nuclear Safety Management*. On October 5, 2018, the Board transmitted a letter to the Secretary of Energy noting concerns with the proposed revision to the *Nuclear Safety Management* Rule.

2. DOE Standard 1158-2010, *Self-Assessment Standard for DOE Contractor Criticality Safety Programs*. On June 5, 2019, the Board transmitted a letter to the Secretary of Energy on concerns with the cancellation of this standard.

3. Draft DOE Order 452.2x, *Nuclear Explosive Safety*. The Board completed a review of this draft directive in July 2019.

Fiscal Year	Performance Goal	Target	Result
2019	**Performance Goal 1.2** Conduct independent reviews that focus on implementation of nuclear safety standards at defense nuclear facilities. **Indicator** Number of reports provided to the Board that include evaluation of standards implementation.	FY 2019 Target: 12	Exceeded FY 2019 Result: 19

Discussion
The Board completed the following reviews to meet the above objective of evaluating implementation of nuclear safety standards at defense nuclear facilities. The Board's staff accomplished this FY 2019 goal by providing the Board with at least 12 reports that included evaluation of standards implementation. The FY 2019 target was exceeded by 58 percent.

1. Pantex Plant Special Tooling Program Review, October 2018. On October 17, 2018, the Board transmitted a letter including the results of this review to the Secretary of Energy.

2. Savannah River Site H-Canyon Exhaust Tunnel Fragility Analysis Review, October 2018. On December 7, 2018, the Board transmitted a letter including the results of this review to the Secretary of Energy.

3. U1a Complex Safety Basis Review at the Nevada National Security Site, October, 2018. On December 19, 2018, the Board transmitted a letter including the results of this review to the Secretary of Energy.

4. Federal Readiness Assessment for the Restart of the Annular Core Research Reactor at Sandia National Laboratories, November 2018.

5. Nevada National Security Site Device Assembly Facility Seismic Hazard Review, November 2018. On March 21, 2019, the Board transmitted a letter including the results of this review to the Secretary of Energy.

6. Sludge Transport and Storage Container Loading, Inerting, Shipping, and Handling Operations Review at Hanford, December 2018.

7. Warhead Measurement Campaign Nuclear Explosive Safety Study, January 2019.

8. Cognizant System Engineering and Nuclear Maintenance Program Review at the Pantex Plant, February 2019.

9. Y-12 National Security Complex Criticality Safety Review, February 2019. On July 25, 2019, the Board transmitted a letter including the results of this review to the Secretary of Energy.
10. Pantex Plant Bays and Cells Nuclear Explosive Safety Master Study, February 2019.

11. Review of Hanford Site Electrical Infrastructure, March 2019. On July 2, 2019, the Board transmitted a letter with the results of this review to the Secretary of Energy.

12. Los Alamos National Laboratory Radioassay and Nondestructive Testing Facility Safety Basis Review, April 2019. On May 22, 2019, the Board transmitted a letter to the Secretary of Energy noting that, based on this review, the previous Board issues with the facility's safety basis have been resolved.

13. Waste Treatment and Immobilization Plant High Level Waste Facility Technical Issues, April 2019. On May 9, 2019, the Board transmitted a letter with the results of this review to the Secretary of Energy.

14. Evaluation of Change in Safety Controls Associated with Red Oil Formation in the Secondary Extraction Process at Y-12 National Security Complex, Building 9212, April 2019.

15. Pantex Plant Special Purpose Facilities Nuclear Explosive Safety Master Study, May, 2019.

16. Review of Electrical Infrastructure at Sandia National Laboratories, Technical Area V, May 2019.

17. Review of the Draft Area G Safety Basis, June 2019.

18. Review of the Lawrence Livermore National Laboratory Plutonium Facility, Building 332, Confinement Ventilation System, July 2019.

19. Effectiveness of Actions to Improve Waste Treatment and Immobilization Plant Safety Culture, July 2019.

Fiscal Year	Performance Goal	Target	Result
2019	**Performance Goal 1.3** Conduct cross-cutting analyses. **Indicator** Number of reports provided to the Board that are supported by multiple reviews.	FY 2019 Target: 2	Achieved FY 2019 Result: 2

Discussion
The Board completed the following reviews to meet the above objective to conduct cross-cutting analyses. The Board's staff accomplished this FY 2019 goal by providing at least two documents to the Board that were supported by analyses at multiple sites.

1. Safety Management of Waste Storage and Processing at Defense Nuclear Facilities. On June 20, 2019, the Board conducted a public hearing on this topic which included analysis of hazards, controls, and DOE oversight of waste storage and processing across multiple sites.

2. Survey of Safety Class Instrumented Systems for Cross Cutting Review of Surveillance Procedures. On September 10, 2019, the Board's staff provided a report to the Board that analyzed safety bases documents from multiple facilities to identify those facilities that contained elements of safety class instrumentation and control systems.

GOAL 2
Investigation of any event or practice at defense nuclear facilities that adversely affects or may adversely affect public health and safety.

Fiscal Year	Performance Goal	Target	Result
2019	**Performance Goal 2.1** Demonstrate capability to investigate events or practices at defense nuclear facilities that could adversely affect public health and safety. **Indicator** Conduct an investigation directed by the Board or audit of staff capability to conduct an investigation.	FY 2019 Target: 1	FY 2019 Result: N/A

Discussion
The Board Members elected to evaluate events and practices at defense nuclear facilities using non-investigatory methods during FY 2019, and did not exercise the staff's capability to perform an investigation pursuant to the DNFSB regulation on investigations. As a result, the performance target for investigations was not exercised; however, the Board remains prepared to carry out investigations.

Fiscal Year	Performance Goal	Target	Result
2019	**Performance Goal 2.2** Maintain Board and management cognizance of potential events or practices at defense nuclear facilities. **Indicator** Percentage of sites with defense nuclear facilities that have been visited by a Board Member or manager.	FY 2019 Target: 80%	Exceeded FY 2019 Result: 84%

Discussion
Board Members, technical staff management, and resident inspectors continue to maintain cognizance of potential events or practices at the sites with defense nuclear facilities. The FY 2019 goal was to accomplish Board Member or manager visits for 80 percent of the sites with DOE defense nuclear facilities. This goal was exceeded, with visits by a Board Member or manager accomplished for 84 percent of the sites during FY 2019. The following sites received at least one such visit:

1. Savannah River Site
2. Y-12 National Security Complex
3. Hanford Site
4. Pantex Plant
5. Los Alamos National Laboratory
6. Lawrence Livermore National Laboratory
7. Sandia National Laboratories
8. Nevada National Security Site
9. Idaho National Laboratory

GOAL 3
Systematic analysis of design and operational data.

Fiscal Year	Performance Goal	Target	Result
2019	**Performance Goal 3.1** Maintain oversight presence and cognizance of potential events or practices at defense nuclear facilities. **Indicator** Percentage of completed cognizant engineer monthly reports and resident inspector weekly reports provided to the Board.	FY 2019 Target: 90%	Exceeded FY 2019 Result: 96%

Discussion
The Board's staff continues to produce resident inspector weekly and site monthly reports and provide them to the Board. At the five sites with resident inspectors (Los Alamos National Laboratory, Y-12 National Security Complex/Oak Ridge National Laboratory, Pantex Plant, Hanford Site, and Savannah River Site), resident inspectors provided a report to the Board and posted it to the Board's public website for most of the weeks in FY 2019. For the five sites without resident inspectors (Idaho National Laboratory, Lawrence Livermore National Laboratory, Nevada National Security Site, Sandia National Laboratories, and the Waste Isolation Pilot Plant), the cognizant engineers provided a report to the Board and posted it to the Board's public website for each month in FY 2019. In FY 2019, 96 percent of the total number of available resident inspector and cognizant engineer reports were completed and provided to the Board, exceeding the goal of 90 percent.

Fiscal Year	Performance Goal	Target	Result
2019	**Performance Goal 3.2** Demonstrate capability to independently analyze nuclear safety information. **Indicator** Number of independent analyses based on modeling (e.g., criticality safety, structural, fluid dynamics, and electrical calculations) required to support mission work or evaluate staff capability to conduct independent analyses.	FY 2019 Target: 2	Exceeded FY 2019 Result: 3

Discussion
The Board completed the following calculations to meet the above objective. The Board accomplished its FY 2019 goal of completing at least two independent analysis based on modeling. The FY 2019 target was exceeded by 50 percent.

1. Potential for Acute Health Effects from Exposure to Tritiated Water Vapor, December 2018. Scope: Derive and implement a set of equations to convert committed effective dose into its characteristic absorbed-dose rate for human exposure to tritiated water.

2. Los Alamos National Laboratory Area G Mobile Loading Vehicle Impact and Fuel Pool Fire Accident Analysis, November 2018. Scope: Calculate the dose consequences due to a vehicle impact with subsequent fuel pool fire accident during mobile loading operations at Area G.

3. Salt Waste Processing Facility Tank Explosions, January 2019. Scope: Evaluate how higher tank temperatures at the Salt Waste Processing Facility affect the calculated tank explosion dose consequence for workers.

GOAL 4
Timely Review of design of new defense nuclear facilities before construction and periodically thereafter.

Fiscal Year	Performance Goal	Target	Result
2019	**Performance Goal 4.1** Execute independent oversight by performing reviews with defined scope and durations at specified and logical points in the design and construction of new defense nuclear facilities. **Indicator** Number of formal reports to the Board for design and construction of a new facility (e.g., Conceptual Design, Final Design, Construction, and Commissioning of new facilities that are initiated).	FY 2019 Target: 1	Exceeded FY 2019 Result: 2

Discussion
The Board completed the following reviews to meet the above objective to execute independent oversight by performing reviews with defined scope and durations at specified and logical points in the design and construction of new defense nuclear facilities. The Board's staff accomplished this FY 2019 goal by providing at least one formal report to the Board for design and construction of a new facility. The FY 2019 target was exceeded by 50 percent.

1. Oak Ridge National Laboratory Building 2026 Preliminary Documented Safety Analysis, May 2019.
2. Y-12 National Security Complex Electrorefining Final Design Review, January 2019.

GOAL 5
Proposal of Recommendations to the Secretary of Energy when determined necessary to ensure adequate protection of health and safety.

Fiscal Year	Performance Goal	Target	Result
2019	**Performance Goal 5.1** Communicate to the Secretary of Energy in a timely manner on safety items that the Board determines challenge adequate protection. **Indicator** Percentage of timely Recommendation products delivered to the Board. Timeliness targets will be established for specific Recommendation products based on scope and available resources.	FY 2019 Target: 90%	Achieved FY 2019 Result: 90%

Discussion
In FY 2019, the Board's staff provided ten Recommendation products to the Board, which included proposed Recommendation outlines, draft Recommendations, and final Recommendations. Nine of these Recommendation products met the established timeliness target. Therefore, the Board accomplished its FY 2019 goal for timely delivery of Recommendation products.

Fiscal Year	Performance Goal	Target	Result
2019	**Performance Goal 5.2** Timely evaluation of the effectiveness of Implementation Plan deliverables in addressing safety objectives identified in Recommendations.	FY 2019 Target: 90%	Exceeded FY 2019 Result: 100%

Fiscal Year	Performance Goal	Target	Result
	Indicator Percentage of timely effectiveness reports for Implementation Plan deliverables. Timeliness targets will be established for specific Implementation Plan deliverables based on scope and available resources.		

Discussion
In FY 2019, the Board reviewed two Implementation Plan deliverables (annual reports delivered in accordance with the implementation plans for Recommendations 2012-1 and 2012-2), both of which met the established timeliness target. Therefore, the Board accomplished its FY 2019 goal for timely evaluation of Implementation Plan deliverables.

GOAL 6
Achievement of mission in a manner that is accountable and transparent to the public and achieves the mission efficiently and effectively.

Fiscal Year	Performance Goal	Target	Result
2019	**Performance Goal 6.1** Simplify and refocus directives and supplementary documents on necessary requirements and internal controls. **Indicator** Have external third-party conduct an effectiveness review, identify corrective actions, and begin implementation of corrective actions focused on improvements to simplify and refocus procedures and improve internal controls.	FY 2019 Target: 1	Exceeded FY 2019 Result: 2

Discussion
The agency contracted with two external third-party reviewers to review business-related functions and controls during FY 2019. The independent reviewers evaluated processes for budget formulation and execution in accordance with Office of Management and Budget Circular A-123 and processes for implementation of information security in accordance with the Federal Information Security Modernization Act of 2014. The reviewers found the processes to be in compliance with applicable requirements but identified opportunities for improvement, particularly in process documentation. Efforts to make improvements in accordance with the reviewers' recommendations are well underway.

Fiscal Year	Performance Goal	Target	Result
2019	**Performance Goal 6.2** Formal assessment, accountability, and corrective actions for the Board's significant work processes that are presented at meetings of the Executive Committee on Internal Controls. **Indicator** Number of ECIC periodic meetings to evaluate office level assessments and corrective actions.	FY 2019 Target: 3	Achieved FY 2019 Result: 3

Discussion
The Executive Committee on Internal Controls achieved this goal by holding three strategic work sessions.

Fiscal Year	Performance Goal	Target	Result
2019	**Performance Goal 6.3** Improve the transparency and tracking of the agency budget. **Indicator** Number of budget briefings provided to the Board throughout the fiscal year.	FY 2019 Target: 6	Exceeded FY 2019 Result: 7

Discussion
This goal was exceeded, with seven briefings to Board Members and senior management on the budget during FY 2019.

Fiscal Year	Performance Goal	Target	Result
2019	**Performance Goal 6.4** Board approved agency staffing plan. **Indicator** Board approval of an agency staffing plan.	FY 2019 Target: 1	FY 2019 Result: N/A

Discussion
In FY 2019, staff leadership prepared an agency staffing plan used as a target for hiring staff, but it was not approved by the Board.

Fiscal Year	Performance Goal	Target	Result
2019	**Performance Goal 6.5** Board member interactions with external stakeholders. **Indicator** Number of Board level external interactions with stakeholders such as Congress; federal, state, and local agencies; and other organizations.	FY 2019 Target: 10	Exceeded FY 2019 Result: 13

Discussion
The Board exceeded this goal by holding 13 interactive sessions with external stakeholders during FY 2019. These sessions provided vital information to the Congress, other Federal agencies, advocacy groups, and the public.

Fiscal Year	Performance Goal	Target	Result
2019	**Performance Goal 6.6** Conduct Board public meetings or hearings. **Indicator** Number of Board public meetings or hearings.	FY 2019 Target: 6	Exceeded FY 2019 Result: 7

Discussion
The Board exceeded this goal by holding three public hearings and four public meetings in FY 2019.

FY 2021 Performance Plan[3]

STRATEGIC GOAL 1
Provide proactive and independent safety oversight of the defense nuclear complex.

Strategic Objective 1.1: Complete timely, high-quality safety reviews that identify and analyze safety issues and best practices, and search for similar challenges complex-wide.

Performance Goals:

1.1.1: Prioritize and execute reviews to maximize impact on safety.

1.1.2: Conduct cross-cutting as well as site specific reviews, identifying safety concerns and best practices in work products.

Performance Measures:

1.1.1: Completion of high priority reviews while demonstrating flexibility to address emerging issues.

1.1.2: Work products provided to the Board within specified timeliness metric.

Strategic Objective 1.2: Develop and issue advice and recommendations designed to ensure safety and employ best practices within the defense nuclear complex.

Performance Goals:

1.2.1: Provide timely, technically accurate, compelling information to the Secretary of Energy.

1.2.2: Ensure the Secretary of Energy has enhanced awareness of complex-wide safety issues.

Performance Measures:

1.2.1: Identification and inclusion of both site-specific and complex-wide safety concerns and best practices in products developed through routine oversight and reviews.

1.2.2: Encouragement provided to the Department of Energy to share best practices as well as safety concerns.

Strategic Objective 1.3: Provide robust field oversight of facilities and projects across the defense nuclear complex.

Performance Goals:

1.3.1: Identify site-specific safety challenges and analyze for commonalities across the complex.

1.3.2: Provide timely information to the Board, acting quickly on emerging issues.

[3] The Board has revised the Performance Goals and Performance Measures for FY 2020 comprehensively to align with the updated FY 2018–2022 Strategic Plan.

Performance Measures:

1.3.1: Oversight presence sustained at an appropriate level.

1.3.2: Internal procedures ensure consistency of field oversight.

1.3.3: Field experience is shared throughout the agency.

STRATEGIC GOAL 2
Enhance transparency of ongoing Agency initiatives and the state of safety within the defense nuclear complex.

Strategic Objective 2.1: Proactively sustain sound working relationships with relevant government and non-governmental entities.

Performance Goals:

2.1.1: Maintain effective communications with the Department of Energy at all organizational levels.

2.1.2: Maintain effective communications with Congress.

2.1.3: Maintain effective communications with relevant state, local, and tribal governments.

2.1.4: Maintain effective communication with the public, including relevant advocacy groups and organizations.

Performance Measures:

2.1.1: Periodic engagement at the Board and senior staff level with relevant senior DOE officials.

2.1.2: Periodic briefings conducted to relevant Congressional Members and committees.

2.1.3: Periodic outreach conducted to relevant state, local, and tribal governments at both Board and staff level.

2.1.4: Periodic outreach conducted to the public, including relevant advocacy groups and organizations.

Strategic Objective 2.2: Improve timely dissemination of information about the Board priorities and conclusions regarding the state of safety at Defense Nuclear Facilities.

Performance Goals:

2.2.1: Improve transparency through timely posting of Agency communication and public engagement.

2.2.2: Ensure Board work products are made available to Congress through proactive outreach.

Performance Measures:

2.2.1: Timely publication of weekly/monthly/annual reports.

2.2.2: Routine conduct of business meetings, Public Hearings, or Board visits.

2.2.3: Timely notification to interested parties of Public Hearings, meetings, reports, and Recommendations.

STRATEGIC GOAL 3

Enhance transparency of ongoing Agency initiatives and the state of safety within the defense nuclear complex.

Strategic Objective 3.1: Cultivate an agile workforce with the skills necessary to meet the mission.

Performance Goals:

3.1.1: Establish a multi-year, forward-looking Staffing Plan to inform budget requests.

3.1.2: Hire well-qualified, motivated individuals to fill vacant positions and to enable effective succession planning.

3.1.3: Ensure redundancy in key functions in order to reduce mission vulnerabilities due to projected staff attrition.

Performance Measures:

3.1.1: Human Capital Plan that includes succession planning, work force development, career pathing and values diverse talents.

3.1.2: Key functions requiring redundancy are identified along with requirements and cross-training needs.

Strategic Objective 3.2: Use professional development and training to efficiently and effectively accomplish the mission.

Performance Goals:

3.2.1: Establish career path options and encourage professional development tailored to employee goals.

3.2.2: Provide new employees at all levels with resources needed to have an impact as soon as practicable upon entering the workforce.

Performance Measures:

3.2.1: Training and development for career pathing options identified and implemented.

3.2.2: A comprehensive, Agency-wide onboarding plan is developed and executed.

3.2.3: Formal mentoring and coaching for staff.

STRATEGIC GOAL 4

Maximize the DNFSB’s performance by pursuing excellence in our Agency culture and operations.

Strategic Objective 4.1: Pursue efficiency through continuous improvement of internal policies and procedures through testing and evaluation.

Performance Goals:

4.1.1: Establish Policy Statements that lead to mission outcomes consistent with Strategic Goals and Objectives.

4.1.2: Ensure Board Procedures are consistent with Strategic Goals and Objectives.

4.1.3: Ensure internal procedures and processes reflect Policy Statements.

Performance Measures:

4.1.1: Policy Statements revised to reflect Strategic Plan and Policy Statements for selected management practices developed.

4.1.2: Board Procedures reflect Agency personnel and processes.

4.1.3: Streamlined internal procedures reflective of Board Policy Statements.

4.1.4: Work planning that is informed by annual feedback and lessons learned.

Strategic Objective 4.2: Establish and maintain a culture that encourages teamwork and innovation across the Agency in accordance with core values.

Performance Goals:

4.2.1: Institutionalize core values in all phases of employee experience.

4.2.2: Foster open discussions across the agency on important technical and non-technical topics.

4.2.3: Maintain a culture respectful of diverse points of view.

Performance Measures:

4.2.1: Core values are promoted in on-boarding, training and performance processes.

4.2.2: An awards program that emphasize agency values.

4.2.3: Periodic open forums to discuss Agency and related issues that may impact mission or staff.

Strategic Objective 4.3: Strengthen operational performance by modernizing Agency processes and associated infrastructure.

Performance Goals:

4.3.1: Improve efficiency through increased information accessibility and common platforms, where possible.

4.3.2: Be responsive to user needs and/or support requests across all agency functions.

Performance Measures:

4.3.1: Up-to-date platforms, systems, and software with interoperability, where possible.

4.3.2: Knowledge transfer programs and information management that support archiving and retrieving information essential to mission and mission support.

4.3.3: Updated employee guidance on processes and infrastructure that enables them to access systems and people needed to accomplish the mission and mission support across all agency functions.

Other information

Major Management Priorities and Challenges

The Board is continuing to pursue several agency-wide initiatives in FY 2020 and FY 2021 to address identified challenges and efficiently carryout its mission. These initiatives include pursuing the goals and objectives of the updated agency FY 2018–2022 Strategic Plan in order to improve the agency's internal processes and procedures, strategically align resources, and effectively manage change, both internal and as a result of changes in the DOE nuclear complex. The agency is also expected to fill several vacant staff positions to mitigate the impact of a loss of institutional knowledge and skills due to retirements and personnel transfers, as well as anticipating changes to DOE's activities. Preserving the Board's access to information, facilities, and personnel at DOE's defense nuclear facilities will remain an area of emphasis during FY 2020 and 2021.

Evidence Building/Data Validation and Verification

As a small agency in the executive branch, the Board does not maintain organizational components dedicated to research or evaluation. The Board tracks progress toward meeting its technical performance goals on a quarterly basis by evaluating its progress toward the target for each goal. The Board's staff compiles the records of accomplishment, compares the information in the records of accomplishment to the established target metrics, and develops a report for the Board's management to provide the status of meeting performance goals.

To complete the records of accomplishment, Associate Technical Directors use data sources that include publicly available reports and correspondence as well as internally available papers such as staff reports and group progress reports; these reports and papers document the activities performed by the Board's staff throughout the year. The Board makes all these documents readily available to its staff, and the Board employs a robust review process, including factual accuracy checks, for its public reports and internal papers. Therefore, the review process ensures the accuracy of the data.

The Board formally assesses significant work processes each year and presents results to the Executive Committee on Internal Controls. In determining what significant work processes to assess, the Executive Committee on Internal Controls uses the following factors considered cumulatively: work processes that have a higher risk of impact to mission or for fraud and abuse; the frequency of assessment of the work processes; results of previous internal control reviews; results of external audits (i.e., Office of the Inspector General and Government Accountability Office); and cost of the assessment versus the benefit gained. The Executive Committee on Internal Controls ensures the Board assesses internal work processes and communicates any deficiencies noted with those work processes.

Strategic Plan

Defense Nuclear Facilities Safety Board
2018 – 2022 (revised)

Table of Contents

Message from the Board

The enclosed Strategic Plan for the Defense Nuclear Facilities Safety Board is being established off-cycle with the intention that it will serve as the solid basis for any revision in the following years. We drafted it after receiving significant feedback from the National Academy of Public Administration and the Office of the Inspector General. It is our intention that this Strategic Plan will be the underpinning of our work planning and staffing going forward and will supersede any previous Agency plan prior to the 2020 work and staffing plan.

Given the opportunity to revisit the Strategic Plan, we took it upon ourselves to reassess our organization's goals and objectives relative to our mission. Developed with an iterative methodology designed to maximize interaction among staff, management, and the Board, the final document herein reflects input from all Agency levels and functions.

We believe this to be a re-base-lining for the Agency moving forward. It is focused on a vision of the Agency's future that emphasizes our technical excellence while allowing for continuous improvement and nimble response to a challenging environment. We set goals and objectives aimed at providing our best advice to the nuclear weapons complex, efficiently and effectively and transparently. Additionally, the plan will help us cultivate a multitalented and dynamic workforce that embodies our core values, focuses on the mission, and continuously hones its skills through training and development.

We commit ourselves to the mission, vision, goals, and objectives set forth in this document and to the workforce that supports us to realize that mission.

Bruce Hamilton
Jessie Roberson
Joyce Connery

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The Mission of the Defense Nuclear Facilities Safety Board

Under the Atomic Energy Act of 1954, as amended, the Defense Nuclear Facilities Safety Board (Board) is charged with providing independent safety oversight of the Department of Energy's (DOE) defense nuclear facilities complex—a complex that has served to design, manufacture, test, maintain, and decommission nuclear weapons, as well as other national security priorities. The Act mandates that the Board reviews the content and implementation of DOE standards, facility and system designs, and events and practices at DOE defense nuclear facilities to provide independent analysis, advice, and recommendations to inform the Secretary of Energy in providing adequate protection of public health and safety at DOE defense nuclear facilities.

Congress established the Board in 1988[1] as an independent federal agency within the executive branch of government, answerable to the President and subject to congressional oversight and direction. Five Board members, appointed by the President subject to confirmation by the Senate, are required to be "respected experts in the field of nuclear safety with a demonstrated competence and knowledge relevant to the independent investigative and oversight functions of the Board." The Board is a collegial agency, meaning that its actions are determined by the Board as a whole. The Board's chairman serves as the chief executive officer, and performs this function subject to Board policies.

The Board's essential mission is to provide independent analysis, advice, and recommendations to the Secretary of Energy to inform the Secretary, in his role as operator and regulator of DOE defense nuclear facilities, in providing adequate protection of public health and safety. As noted above, the Board's jurisdiction covers DOE's "defense nuclear facilities" – a term defined in the Atomic Energy Act of 1954, as amended. The Board only is concerned with facilities operated by DOE that are: (1) covered by the Atomic Energy Act; and, (2) have a function related to national defense. The phrase "defense nuclear facilities" thus excludes two major classes of government-regulated nuclear facilities: DOE's nuclear projects that are civilian in purpose, and commercial nuclear facilities regulated by the Nuclear Regulatory Commission (NRC). The Board's oversight jurisdiction also does not extend to the U.S. Navy's nuclear propulsion program or to environmental hazards regulated by other federal and state agencies. (The table on page 5 lists the major sites that the Board oversees.)

The Board's oversight mission covers all phases in the life of a defense nuclear facility: design, construction, operation, and decommissioning. Congress granted the Board a suite of statutory tools to carry out its mission. Principal among these is the formal Board recommendation issued to the Secretary. The statute requires the Secretary to either accept or reject the Board's recommendation, and in the case of an acceptance, to write and execute an implementation plan. This process all takes place on the public record. In cases involving an "imminent or severe threat" to the public health and safety, the statute requires the Board to also send its recommendation to the President, who makes the final decision on actions to be taken. In addition to recommendations, the Board is empowered to hold public hearings (and subpoena witnesses, if necessary), conduct investigations, obtain information and documents needed for the Board's work from DOE and its contractors, and review and comment on DOE requirements and standards affecting safety at defense nuclear facilities. DOE is required by law to grant the Board "ready access to such facilities, personnel, and information as the Board considers necessary to carry out its responsibilities." Finally, the statute authorizes the Board to seek assistance from other federal agencies (such as NRC) and from organizations outside the government (such as the National Academy of Sciences), as needed.

Major Sites Subject to Board Jurisdiction

Site	Location	Operations	Website
Hanford Site	Richland, Washington	Management and treatment of radioactive wastes; facility decommissioning	http://www.hanford.gov
Idaho National Laboratory	45 miles west of Idaho Falls,	Storage and processing of radioactive waste	http://www.inl.gov
Lawrence Livermore National Laboratory	Livermore, California	Research to support the nuclear weapons arsenal	https://www.llnl.gov
Los Alamos National Laboratory	Los Alamos, New Mexico	Research to support the nuclear weapons arsenal; manufacturing of nuclear weapon components; disposition of legacy transuranic waste	http://www.lanl.gov
Nevada National Security Site	65 miles northwest of Las Vegas, Nevada	Disposition of damaged nuclear weapons; critical and subcritical experiments; waste management	http://www.nnss.gov
Oak Ridge National Laboratory	Oak Ridge, Tennessee	Energy research; treatment and disposal of radioactive wastes	http://www.ornl.gov
Pantex Plant	17 miles northeast of Amarillo, Texas	Maintenance of the U.S. nuclear stockpile	http://www.pantex.com
Sandia National Laboratories	Albuquerque, New Mexico	Nuclear research; support for the weapons stockpile maintenance program	http://www.sandia.gov
Savannah River Site	Aiken, South Carolina	Tritium extraction, recycling, and storage; management and treatment of radioactive wastes; nuclear materials storage and disposition; research and development	http://www.srs.gov
Waste Isolation Pilot Plant	26 miles east of Carlsbad, New Mexico	Disposal of transuranic waste in underground repository	http://www.wipp.energy.gov/
Y-12 National Security Complex	Oak Ridge, Tennessee	Manufacturing and surveillance of nuclear weapons components; processing of weapons-grade uranium	http://www.y12.doe.gov/

Achieving our Vision and Mission

Mission

The mission of the Board shall be to provide independent analysis, advice, and recommendations to the Secretary of Energy to inform the Secretary, in the role of the Secretary as operator and regulator of the defense nuclear facilities of the Department of Energy, in providing adequate protection of public health and safety at such defense nuclear facilities.

Vision

To secure a safe future for the American people through proven technical excellence and transparency that inspires public confidence as the defense nuclear enterprise evolves**.**

Values

- Integrity
  - Interaction among DNFSB staff and colleagues is open, honest, and sincere
  - We commit to openness and trust in all relationships
  - We observe the highest ethical standards in all aspects of our work
  - We take personal responsibility for our own actions
  - We are accountable to each other for the highest standards of behavior
  - We clearly define and fulfill the commitments we make; if we cannot meet that commitment, we inform everyone who might be impacted
- Respect
  - We treat each other as we would like to be treated
  - We treat others with respect and value diverse points of view
  - We treat everyone fairly and provide everyone an opportunity to contribute
  - We are attentive, listen, and exhibit deference to those who express different opinions on issues
  - We respect decisions taken by the Board
- Excellence
  - We exhibit a passion for success, both individual and collective
  - We strive to be the best in achieving our goals
  - Excellence is a daily pursuit
  - Excellence is pursued in all aspects of performance
- Independence
  - Our mission is not compromised by the influence of others—we rely on the facts as presented and the highest level of professional judgment
  - Independence does not imply isolation, we seek all facts and opinions openly, and weigh them all before arriving at conclusions
  - Decisions are based on objective, unbiased assessments of all information and conclusions are well-documented
  - We perform our duties publically and transparently

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Key Factors Affecting our Strategic Outlook

Major Management Priorities and Challenges

As this document is being written, the Defense Nuclear Facilities Safety Board is celebrating its thirtieth anniversary. Created by Congress as an independent agency within the executive branch, the Board provides independent analysis, advice and recommendations to the Secretary of Energy in his role in ensuring public health and safety at Defense Nuclear Facilities. Over the years, the Agency has garnered the reputation of being a reliable, expert-based organization whose guidance and Recommendations were valued by the Department, Congress, and the public. In recent years, however, the reputation of the Agency as a whole, and the Board, in specific, has suffered.

In 2018, the Board commissioned the National Academy of Public Administration (NAPA) to develop a thorough organizational assessment, to include an evaluation of the functioning of the Agency as well as the execution of the mission along with recommendations for addressing the major challenges. In November of 2018, the Board received the final report which outlined the importance of the Board's mission, detailed significant organizational challenges and offered action-oriented recommendations for the Board to take in order to restore its effectiveness and its reputation. In addition to the NAPA report, the Board had received several climate surveys and Inspector General Reports that corroborated NAPA's findings. The key management challenges included: internal mistrust and discord; inadequate strategic direction; shortcomings in internal and external communication; complex procedures that hamper timely execution of mission; and lack of a human capital plan. The results of these conditions eroded staff morale and increased staff attrition, having a negative impact on mission work.

In this Strategic Plan, we, the Board, have committed to undertaking the steps necessary to redirect the Agency to focus on our mission through our core values of integrity, respect, excellence and independence--setting forth clear goals and objectives that will chart a path to success. We understand that a status quo approach would have continued negative impact on the organization and would not allow us to achieve our statutory mission. Frequent changes in Board leadership and composition have thwarted efforts to address the challenge outlined by NAPA. Over the past six years, the Board has had five Chairmen, for instance. As a result, we have not put in the work to put forward a strategic vision and plan that will sustain the Agency regardless of Board composition—until now.

In order to align ourselves, we, the Board members underwent a series of workshops with the Federal Mediation and Conciliation Service to develop strategies to better communicate, build trust, and identify common core values. We also underwent Clifton Strengths testing and related workshops to better appreciate and leverage each other's strengths. In addition to Board Members committing the time to fostering deliberation and teamwork, as recommended by NAPA, we also had several sessions with senior staff in order to better communicate our vision with them. We also exposed the entire staff to the same tool to foster better understanding and communication horizontally and vertically throughout the organization.

Once we had worked on the problem-solving and communication skills, we developed this Strategic Plan with input from across the Agency, at every level, as a commitment to re-baseline how the Board operates starting with a strategic vision, a value proposition, and shared goals. In addition, we are making employee engagement a priority by working vertically and horizontally across the agency to improve communications, hone interpersonal skills, and invest in employee development. We have woven these goals and performance measures into the Strategic Plan so that they may become a sustainable part of the Agency, regardless of which individuals occupy Board Member seats.

In addition to internal organizational challenges, there are several external factors that impacted how we developed our strategic plan. The pace and focus of the Board's oversight work is impacted, in a large part, by DOE's schedule for major actions in the defense nuclear complex. Changes in the Department's schedules and priorities based on circumstances within and beyond DOE's control, may require a corresponding change in the Board's oversight plans. We are working with staff to clarify our priorities both through the strategic planning and work planning process and to improve internal communications so that when issues arise, the Agency can nimbly respond. In instances in which those changes impact the Board's targets for a particular performance period, an explanation for the change as well as a description of work conducted in lieu of planned work will be provided.

We also feel that we will improve mission performance by making a concerted effort to examine safety issues that impact more than one site. Those safety concerns may impact two or three defense nuclear facilities or they can be complex-wide. By identifying similar concerns, it may become clear that the cause of the issue may reside in poorly written or conveyed standards or guidance to the sites that is negatively impacting implementation, allowing us to address the issue in the most efficient and broadly applicable manner.

We are also prioritizing timely and transparent communications and outreach. Our safety impact is directly correlated to the reviews we conduct and the outcomes of those reviews whether they be letters, reports, hearings or Recommendations. In all cases, the Agency endeavors to make a clear, concise, and compelling case. The NAPA assessment described a many-years erosion of effective Agency interactions with the Department of Energy, Congress, and other interested parties. In order to address this erosion, under our strategic goal for transparency, we specifically outlined outreach efforts to remedy that.

Staff disillusionment has been a recurring theme in all of the reports and reviews done on the Agency over the past half a dozen or so years. This has had the greatest impact on our work. We lost a considerable number of well-qualified, experienced, capable individuals leaving us suffering from a "brain-drain" and a lack of knowledge transfer. We recognize the need to develop and maintain an outstanding workforce. A portion of the strategic plan is therefore dedicated to the development of Board Policy on our human resources, a Human Capital Plan that includes succession planning, career pathing, and work force development. We have come to terms with the tension between wanting a small, nimble and responsive workforce with the realities of the need for key functions and redundancy for some of those functions. Through compromise, we have a shared vision of a steady state workforce that can be revisited when justified to meet mission needs. We also want to ensure that the individual workers at the Agency, regardless of field, can develop their career to meet their expectations as well as the expectations of the Agency.

Being a small Agency, the DNFSB has been able to work nimbly to address emerging safety issues, but it has also been challenging for the organization to keep up with burgeoning Federal requirements which stress a small management structure. Policies and procedures should make organizations run more smoothly. As the IG and NAPA both articulated in their reports to us, our policies and procedures are cumbersome and in some cases, antithetical to performing our mission. One of our priorities is to review and update our policies, directives, and procedures to streamline them and ensure that they are effective and efficient and meet all appropriate federal guidelines and requirements. We expect this Strategic Plan not to be a product that sits on the shelf, but an actionable roadmap to reinvigorate the Agency to most effectively accomplish its extremely important mission.

Significant External Challenge: DOE Order 140.1

One additional external factor that has created significant challenges for the Agency was the Department of Energy's issuance of Order 140.1 in May 2018 and its subsequent execution. The Order was designed to codify the Department's interface with the Agency in its conduct of its statutory mission. The Order, as written, attempts to curtail the Board's jurisdiction and access to information. At present, there are numerous examples in which access to information or activities was either denied or significantly delayed, and thereby impacting the Board's ability to carry out its statutory mission. Additionally, significant time and attention of senior management, and in some cases Board Members, has been taken up with adjudicating routine requests, disrupting daily work and impacting morale. The Board continues to challenge this order through various means, including direct communications with DOE and to the Hill in an effort to rescind or substantially revise the Order. Even if the Order is rescinded or revised, however, there remains the concern that the culture of resistance to oversight will remain and impact our ability to accomplish our mission.

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Roles and Responsibilities

The Board

- Uphold the Board's statutory safety mandate and communicate decisions to the Secretary of Energy/Department of Energy
- Develop and maintain productive relationships both internal and external to the Agency
- Provide strategic direction to the Agency
- Ensure the most technically-talented staff are hired and retained through a Human Capital Plan
- Develop and promulgate agency policy statements
- Model the culture desired in the Agency and uphold core values

The Executive Director of Operations (EDO)

- Propose strategic direction and provide strategic insight to the Board
- Implement the strategic direction of the Board
- Optimize and prioritize resources
- Speak externally on behalf of the Board when directed
- Lead the staff and execute the Human Capital Plan
- Manage and approve Agency-wide Directives
- Provide continuity to the Agency as Board composition changes
- Ensure communications within and across the organization
- Uphold Agency core values

Office Directors

- Provide strategic insight to the EDO
- Implement the strategic direction of the Board within respective component
- Optimize and prioritize resources within respective component
- Review work products through strategic lens
- Develop and maintain productive relationships both internal and external to the Agency
- Train, develop, and mentor staff
- Ensure communications within and across the organization
- Uphold Agency core values

Deputy Directors and Associate Directors

- Execute the respective work plan
- Identify process improvements
- Review work products for technical accuracy, impact, and readability
- Enable, lead, and manage staff
- Interact with the Department of Energy at appropriate levels
- Ensure effective communication within and across the organization
- Uphold Agency core values

Staff

- Execute the respective component work plan
- Comply with processes and communicate challenges
- Produce technically accurate, impactful and readable work products
- Work with management to identify training needs and professional development opportunities
- Ensure effective communications within and across the organization
- Uphold Agency core values

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Strategic Goals and Objectives Summary

Strategic Goal 1

Provide proactive and independent safety oversight of the defense nuclear complex.

Strategic Objective 1.1	Strategic Objective 1.2	Strategic Objective 1.3
Complete timely, high-quality safety reviews that identify and analyze safety issues and best practices, and search for similar challenges complex-wide.	Develop and issue advice and recommendations designed to ensure safety and employ best practices within the defense nuclear complex.	Provide robust field oversight of facilities and projects across the defense nuclear complex.

Strategic Goal 2

Enhance transparency of ongoing Agency initiatives and the state of safety within the defense nuclear complex.

Strategic Objective 2.1	Strategic Objective 2.2
Proactively sustain sound working relationships with relevant government and non-governmental entities.	Improve timely dissemination of information about the Board priorities and conclusions regarding the state of safety at Defense Nuclear Facilities.

Strategic Goal 3

Develop and maintain an outstanding workforce to achieve the Agency's mission.

Strategic Objective 3.1	Strategic Objective 3.2
Cultivate an agile workforce with the skills necessary to meet the mission.	Use professional development and training to efficiently and effectively accomplish the mission.

Strategic Goal 4

Maximize the DNFSB's performance by pursuing excellence in our Agency culture and operations.

Strategic Objective 4.1	Strategic Objective 4.2	Strategic Objective 4.3
Pursue efficiency through continuous improvement of internal policies and procedures through testing and evaluation.	Establish and maintain a culture that encourages teamwork and innovation across the Agency in accordance with core values.	Strengthen operational performance by modernizing Agency processes and associated infrastructure.

Strategic Goal 1

Provide proactive and independent safety oversight of the defense nuclear complex.

Strategic Objective 1.1
Complete timely, high-quality safety reviews that identify and analyze safety issues and best practices, and search for similar challenges complex-wide.

Key Performance Goals	**1 —** Prioritize and execute reviews to maximize impact on safety **2 —** Conduct cross-cutting as well as site specific reviews, identifying safety concerns and best practices in work products

Performance Measures:

1 — Completion of high priority reviews while demonstrating flexibility to address emerging issues.

2 — Work products provided to the Board within specified timeliness metric.

Strategic Objective 1.2
Develop and issue advice and recommendations designed to ensure safety and employ best practices within the defense nuclear complex.

Key Performance Goals	**1** — Provide timely, technically accurate, compelling information to the Secretary of Energy **2** — Ensure the Secretary of Energy has enhanced awareness of complex-wide safety issues

Performance Measures:

1 — Identification and inclusion of both site-specific and complex-wide safety concerns and best practices in products developed through routine oversight and reviews

2 — Encouragement provided to the Department of Energy to share best practices as well as safety concerns

Strategic Objective 1.3

Provide robust field oversight of facilities and projects across the defense nuclear complex.

Key Performance Goals	**1** — Identify site-specific safety challenges and analyze for commonalities across the complex **2** — Provide timely information to the Board, acting quickly on emerging issues

Performance Measures:

1 — Oversight presence sustained at an appropriate level

2 — Internal procedures ensure consistency of field oversight

3 — Field experience is shared throughout the agency

Strategic Goal 2

Enhance transparency of ongoing Agency initiatives and the state of safety within the defense nuclear complex.

Strategic Objective 2.1 **Proactively sustain sound working relationships with relevant government and non-governmental entities.**	
Key Performance Goals	**1** — Maintain effective communications with the Department of Energy at all organizational levels **2** — Maintain effective communications with Congress **3** — Maintain effective communications with relevant state, local, and tribal governments **4** — Maintain effective communication with the public, including relevant advocacy groups and organizations

<u>Performance Measures:</u>

1 — Periodic engagement at the Board and Senior Staff level with relevant senior DOE Officials

2 — Periodic briefings conducted to relevant Congressional Members and committees

3 — Periodic outreach conducted to relevant state, local, and tribal governments at both Board and staff level

4 — Periodic outreach conducted to the public, including relevant advocacy groups and organizations

Strategic Objective 2.2 **Improve timely dissemination of information about the Board priorities and conclusions regarding the state of safety at Defense Nuclear Facilities.**	
Key Performance Goals	**1** — Improve transparency through timely posting of Agency communication and public engagement **2** — Ensure Board work products are made available to Congress through proactive outreach

<u>Performance Measures:</u>

1 — Timely publication of weekly/monthly/annual reports

2 — Routine conduct of business meetings, Public Hearings, or Board visits

3 — Timely notification to interested parties of Public Hearings, meetings, reports, and Recommendations

Strategic Goal 3

Develop and maintain an outstanding workforce to achieve the Agency's mission.

Strategic Objective 3.1

Cultivate an agile workforce with the skills necessary to meet the mission.

Key Performance Goals	
	1 — Establish a multi-year, forward-looking Staffing Plan to inform budget requests **2** — Hire well-qualified, motivated individuals to fill vacant positions and to enable effective succession planning **3** — Ensure redundancy in key functions in order to reduce mission vulnerabilities due to projected staff attrition

Performance Measures:

1 — Human Capital Plan that includes succession planning, work force development, career pathing and values diverse talents

2 — Key functions requiring redundancy are identified along with requirements and cross-training needs

Strategic Objective 3.2

Use professional development and training to efficiently and effectively accomplish the mission.

Key Performance Goals	
	1 — Establish career path options and encourage professional development tailored to employee goals **2** — Provide new employees at all levels with resources needed to have an impact as soon as practicable upon entering the workforce

Performance Measures:

1 — Training and development for career pathing options identified and implemented

2 — A comprehensive, Agency-wide onboarding plan is developed and executed

3 — Formal mentoring and coaching for staff

Strategic Goal 4

Maximize the DNFSB's performance by pursuing excellence in our Agency culture and operations.

Strategic Objective 4.1 **Pursue efficiency through continuous improvement of internal policies and procedures through testing and evaluation.**	
Key Performance Goals	**1** — Establish Policy Statements that lead to mission outcomes consistent with Strategic Goals and Objectives **2** — Ensure Board Procedures are consistent with Strategic Goals and Objectives **3** — Ensure internal procedures and processes reflect Policy Statements

<u>Performance Measures:</u>

1 — Policy Statements revised to reflect Strategic Plan and Policy Statements for selected management practices developed

2 — Board Procedures reflect Agency personnel and processes

3 — Streamlined internal procedures reflective of Board Policy Statements

4 — Work planning that is informed by annual feedback and lessons learned

Strategic Objective 4.2 **Establish and maintain a culture that encourages teamwork and innovation across the Agency in accordance with core values.**	
Key Performance Goals	**1** — Institutionalize core values in all phases of employee experience **2** — Foster open discussions across the agency on important technical and non-technical topics **3**—Maintain a culture respectful of diverse points of view

<u>Performance Measures:</u>

1 — Core values are promoted in on-boarding, training and performance processes

2 — An awards program that emphasize agency values

3 — Periodic open forums to discuss Agency and related issues that may impact mission or staff

Strategic Objective 4.3

Strengthen operational performance by modernizing Agency processes and associated infrastructure.

Key Performance Goals	**1** — Improve efficiency through increased information accessibility and common platforms, where possible **2** — Be responsive to user needs and/or support requests across all agency functions

Performance Measures:

1 — Up-to-date platforms, systems, and software with interoperability, where possible

2 — Knowledge transfer programs and information management that support archiving and retrieving information essential to mission and mission support

3 — Updated employee guidance on processes and infrastructure that enables them to access systems and people needed to accomplish the mission and mission support across all agency functions

DEFENSE NUCLEAR FACILITIES SAFETY BOARD: THE FIRST TWENTY YEARS

A Report Prepared by the Federal Research Division,
Library of Congress
under an Interagency Agreement with the
Defense Nuclear Facilities Safety Board (DNFSB)

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✯ 61 Years of Service to the Federal Government ✯
1948 – 2009

PREFACE

The Defense Nuclear Facilities Safety Board (DNFSB or the Board), an independent oversight organization within the executive branch, was created by Congress in 1988 to provide advice and recommendations to the secretary of energy regarding public health and safety at the defense nuclear facilities managed by the Department of Energy.

This study captures how the Board met the competing national security, health and safety, environmental, government, and public demands placed upon DOE's defense nuclear facilities, explicating the principles and techniques the Board employed to efficiently function as a federal agency and effectively fulfill the Board's unique mandate under the Atomic Energy Act of 1954, as amended. While it chronicles events, the study also serves as the tutorial for those charged with the future administration of the Board's enabling legislation, making available to the current and future leadership the philosophical and jurisprudential underpinnings of the form of governance captured in the Board's enabling legislation and the resolution of changing and sometimes opposing national requirements.

The first chapter discusses the handling of safety issues in the defense nuclear complex prior to the creation of the Board. The chapter also examines historical circumstances that produced pressures to move toward more external regulation, including major accidents involving nuclear technology (especially Chernobyl), the waning of the nuclear arms race, and the lifting of the secrecy about the safety risks and environmental damage.

The second chapter reviews the debates in Congress that led up to the legislative compromise that created the Board as an expert body that would act as an independent adviser to the secretary of energy, rather than as a regulator.

The third chapter describes the development of the Board's manner of proceeding when it conducted oversight, in particular, how it interacted with the Department of Energy, congressional oversight committees, and the public, and how it wielded the tools that Congress granted it to exert authority that was effectively action-forcing.

The fourth chapter examines important recommendations on nuclear safety, both site-specific and complex-wide, that the Board issued to the secretary of energy, and how their follow-up was handled.

The fifth chapter discusses the shift of emphasis in the Board's activities that occurred with the end of the nuclear arms race and weapons production in 1992, mainly, the shift to greater emphasis on the stabilization and safe storage of surplus nuclear materials, as well as the safe execution of weapons dismantlement.

The sixth chapter focuses on the Board's advocacy of Integrated Safety Management to support longer-term, more comprehensive safety planning in the weapons complex, and the reexamination by policymakers and the Board of whether current oversight arrangements sufficed to ensure safety. In addition, the chapter examines the Board's increased technical oversight activities of design and construction projects throughout the DOE defense nuclear complex.

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INTRODUCTION

The Defense Nuclear Facilities Safety Board, (DNFSB or the Board), an independent executive-branch organization, was established by Congress in 1988 to provide technical oversight of the Department of Energy's (DOE) defense nuclear facilities in order to protect the health and safety of the public and workers. The Board was charged with identifying potential safety threats posed by the facilities, elevating such issues to the highest levels of authority, and informing the public.

In creating the Board, one aim of Congress was to provide an expert body to act as an adviser to DOE on establishing, and operating in accordance with, standards comparable to those that prevailed in the commercial nuclear power industry. The Board's responsibilities to review the standards that underpinned safety pertained to all life-cycle phases of defense nuclear facilities—design, construction, operation, and decommissioning. The Board is also responsible for investigating any event or practice at a DOE facility that had or could adversely affect public health and safety, for analyzing design and operational data pertinent to safety, and for pre-construction design reviews and construction oversight for DOE nuclear facilities.

Congress provided the Board with a variety of powers to carry out its oversight mission, chief among them, the power to issue formal recommendations to the secretary of energy—recommendations that the secretary is not required to accept, but is required to answer. In its efforts to formulate its recommendations and other advice, the Board is empowered to conduct investigations and studies, gather information, issue subpoenas, hold public hearings, and establish reporting requirements for DOE. The Board is statutorily required to make reports to Congress at least annually on its oversight activities, any recommendations issued to the secretary of energy, and improvements in safety achieved at defense nuclear facilities as a result of its activities.

DEFENSE NUCLEAR FACILITIES SAFETY BOARD: A COMPROMISE SOLUTION

The Board emerged at a particular historical juncture that made the prevailing type of governance in the nuclear weapons complex appear less tenable. Since the inception of the complex during World War II and the early Cold War years, it had been managed by the Department of Energy and its predecessor agencies without independent external oversight within the executive branch. The nuclear arms race and the Cold War sense of urgency about maintaining a strong nuclear deterrent force legitimized secretive operations in the complex and the prioritization of production needs over safety concerns.[1] The waning of the nuclear arms race in the late 1980s eroded the justification for secrecy and undermined public acceptance of production/safety trade-offs that sacrificed safety. This erosion was compounded by accidents involving nuclear technologies, such as the Chernobyl reactor accident, which aroused generalized public concern about nuclear safety. In addition, revelations mounted about the environmental and safety issues that had accumulated at the aging facilities in the weapons complex in the course of the nuclear arms race. These factors engendered increasing public distrust and led public officials and lawmakers to question the capacity of DOE to manage the complex and ensure the safety of operations without independent external oversight.

At the same time, the international security environment was highly unsettled in the late 1980s, making the period one of significant uncertainty in terms of what U.S. national security needs were and what the nation’s nuclear deterrent posture would be. Although the Cold War was winding down and downsizing of the nuclear weapons arsenal and complex was in the offing, national security policymakers did not know how much production capacity would still be needed. Fearing interference with national security imperatives, they were reluctant to impose a type of regulation on the weapons complex that might endanger national security by inhibiting the freedom of the national security establishment to make necessary security-related decisions. Policymakers were wary of stringent forms of full regulation that would produce what amounted to, as they put it, “unilateral disarmament” by imposing undue delay and expense in the name of safety on the defense production mission of the weapons complex. Many policymakers resisted full regulation as ill suited to handling the extremely complex technical issues affecting the U.S. nuclear deterrent capability. At the same time, they recognized that a precondition for the ongoing public support for U.S. nuclear deterrent policy was to decrease the radiological risks posed by the nuclear weapons complex, and to do so in a way that was convincing to an alarmed public.

The complicated sets and crosscurrents of concerns about the nuclear weapons complex fueled a contentious debate when Congress took up the question of establishing an external

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[1] F.G. Gosling and Terrence R. Fehner, *Closing the Circle: The Department of Energy and Environmental Management, 1942–1994* (Washington, DC: U.S. Department of Energy, 1994), 5.

oversight body. The extended debate within Congress and the administration turned not so much on the need for such a safety body but rather on defining its form and providing it with powers that struck the right balance among competing and conflicting goals. The debate eventually produced a compromise piece of legislation that sought to give the newly created Board sufficient powers to further safety and to establish credibility with the public, but not so much power as to permit the Board's insistence on safety upgrades that were at the expense of essential production for national security needs.

The legislative compromise embodied in the Board's enabling legislation took into account the special defense-related considerations dictating that the Board not be a full-blown regulator. The enabling legislation did not give the Board formal regulatory authority or enforcement powers. Instead, the Board was an expert body that would provide independent oversight and act as an adviser to the secretary of energy. However, the legislation contained elements designed to ensure that the Board's advice would carry significant weight with the secretary of energy and could not be lightly dismissed or disregarded. Providing the Board's advice with such weight, and the Board with substantial power, was key to engendering public confidence, as well as ensuring safety improvements in the weapons complex.

Among the elements designed to lend weight to the Board's advice were provisions that imposed requirements on the secretary of energy to respond in specified ways to the Board's advice, recommendations, reporting requirements, and requests for information. In the case of formal recommendations, DOE's obligations for response were laid out as a definite sequence of actions in a specified time frame. These requirements contributed to the seriousness with which the secretaries of energy always took Board advice and recommendations. In the two decades of the Board's operation, the secretary accepted, and formulated implementation plans for, all of the formal recommendations the Board issued.

Another important key to the Board's power was the make-up of the Board, specifically, the eminence and capabilities of the five Board members. The Board's enabling legislation called for a five-member Board composed of recognized technical experts. The composition of the Board as envisioned by the lawmakers was a unique blend of technical nuclear-safety expertise and proven managerial capability. The idea was to create a body of seasoned experts who would become honest brokers of technical information to ensure that the administration and Congress would have unbiased and timely information on the state of the DOE nuclear complex as regards the health and safety of workers and the public.[2] Congress and the administration sought well-respected leaders capable of addressing problems in the defense nuclear complex from an engineering perspective, and of navigating the uncharted territory of external oversight in a highly dynamic period in the international security environment and in the nuclear deterrent posture of the United States. The lawmakers expected the Board members to balance their efforts to improve safe operations at the U.S. defense nuclear facilities with their recognition of DOE's duty to do its essential national defense work of maintaining an effective nuclear deterrent without unjustifiable delay or expense.

The five-member inaugural Board assembled by the administration in the course of 1989 more than fully embodied the requirements of the Board's congressional creators. The exemplary group collectively brought many decades of high-level engineering and management experience in various aspects of nuclear safety—ideal experience for organizing a highly technically competent staff, interacting effectively with the Department of Energy and Congress, and communicating with the public to restore public confidence. Above all, as intended by the legislative creators of the Board, the Board brought a depth of scientific, technical, and managerial skills commensurate with the enormity of the safety challenges and the unique hazards that the nuclear weapons complex posed.

THE NUCLEAR WEAPONS COMPLEX AND ITS CHALLENGES FOR SAFETY OVERSIGHT

The U.S. nuclear weapons complex and nuclear arsenal, products of the nuclear arms race, achieved their 1989 size and character a quarter century earlier, in the late 1960s.[3] At its peak, the complex—an immense, widely dispersed industrial, laboratory, and testing enterprise—consisted of some 16 major installations and many smaller facilities spread over a dozen or so states.[4] A number of the defense nuclear sites occupied vast tracts of land, including the Hanford Site in the state of Washington, the Savannah River Site in South Carolina, the Idaho National Engineering Laboratory, the Nevada Test Site, and the Oak Ridge Reservation in Tennessee. The Hanford Site alone was huge. The largest of the three original World War II–era

[2] Interview, Kenneth M. Pusateri (Board general manager, 1989–2006), Washington, DC, January 3, 2008.
[3] Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Washington, DC: Brookings Institution Press, 1998), 491. See also U.S. Department of Energy, Office of Environmental Management, "History," August 26, 2008, http://www.em.doe.gov/pages/History.aspx.

sites for nuclear weapons production—Hanford, Oak Ridge, and Los Alamos National Laboratory—Hanford was roughly half the size of Rhode Island, at nearly 600 square miles.[5] The Idaho site topped 800 square miles, and Savannah River occupied 300 square miles.[6]

Evolving since World War II, the weapons complex engaged up to the late 1980s in four types of arsenal-building operations, which were concentrated at particular facilities and sites—research, nuclear materials production, the manufacturing of weapons components, and weapons testing.[7] Weapons research and design was conducted at DOE's three defense laboratories, Los Alamos and Sandia National Laboratories in New Mexico and Lawrence Livermore National Laboratory in California. The processing and production of nuclear materials, notably plutonium and tritium, took place chiefly at the Hanford Site and the Savannah River Site. For example, Hanford, with its nine plutonium reactors built between 1943 and 1963, along with five reprocessing facilities, produced 64 metric tons of plutonium over 40 years.[8] Uranium processing was a task of the Idaho National Engineering Laboratory and the Feed Materials Production Center in Ohio. The fabrication of warhead components took place at the Rocky Flats plant in Colorado, the Y-12 plant at Oak Ridge, the Mound plant in Ohio, and several other locations. Weapons assembly was conducted at the Pantex plant in Texas, and nuclear testing at the Nevada Test Site.[9] Collectively, in the period up to 1989, the facilities manufactured tens of thousands of nuclear warheads, and conducted more than one thousand test nuclear detonations.[10]

At the time the Board began operations in 1989, with its mandate to identify and mitigate radiological risk in the weapons complex, the hazards that the Board expected to confront included those associated with DOE's production of nuclear materials, most notably, hazards posed by operating nuclear reactors. Although all of the major production facilities were then in a stand-down condition, having recently been shut down for safety reasons, DOE expected that production would resume once safety upgrades of the production infrastructure were made. Thus

[4] Gosling and Fehner, 2.
[5] U.S. Department of Energy, Hanford Site, "Hanford Overview," March 25, 2008, http://www.hanford.gov/?page=215& parent=0.
[6] U.S. Department of Energy, Office of Environmental Management, "Savannah River Site Overview," September 10, 2008. http://www.em.doe.gov/SiteInfo/SavannahRiver.aspx?PAGEID=MAIN.
[7] U.S. Congress, Office of Technology Assessment, *Complex Cleanup: The Environmental Legacy of Nuclear Weapons Production*, OTA–O–484 (Washington, DC, February 1991), 15, http://www.fas.org/ota/reports/9113.pdf.
[8] U.S. Department of Energy, Hanford Site, "Hanford Overview."
[9] OTA, Complex Cleanup, 18–19.

the Board's review of potential contributors to risk initially included a focus on DOE's preparations to restart production. When DOE's production mission definitively ended with the end of the Cold War in 1992 and the downsizing of the weapons complex, DOE's mission shifted, and the Board's safety focus shifted accordingly. The risks and safety issues on which the Board focused became exclusively those involved in maintaining the safety and reliability of the nation's remaining, smaller nuclear weapons stockpile and in cleaning up contaminated sites and facilities. The Board's oversight focused on the safe execution of the dismantlement of nuclear weapons to achieve arms control objectives, the storage and disposition of surplus fissionable materials, and the decontamination and decommissioning of facilties.[11]

Notwithstanding this early shift of the Board's specific safety focus, the magnitude of the risks the Board sought to mitigate was formidable, and indeed only heightened by the cessation of production and the cleanup efforts that followed. Nearly 50 years of nuclear weapons production had left a legacy of vast quantities of nuclear waste and surplus materials. The complex held in storage millions of gallons of high-level radioactive liquid waste in tanks awaiting treatment, and still larger quantities of waste with lower levels of radioactivity.[12] Other radioactive wastes and residues in processing lines and deteriorating temporary packaging existed throughout the complex in sufficient quantities to pose the risk of criticality accidents and radioactive releases to the environment. Radioactive and other toxic materials had already resulted in widespread contamination of soil and groundwater at DOE sites. Numerous potential mechanisms for the release of hazardous materials posed ongoing risks to workers and the public, e.g., fire, inadvertent detonation of explosives, chemical reactions, equipment malfunctions, natural disasters, failures in aging facilities, and human error. Other hazards in the complex were associated with the arsenal of nuclear weapons itself and the activities required to maintain the enduring stockpile, as well as to dismantle thousands of excess or obsolete weapons. Such activities posed dangers unique to the weapons complex, because they involved co-located explosives and nuclear material. As the Board often pointed out,

> Unlike commercial nuclear facilities, the risks at these defense nuclear facilities are not solely a function of the quantities of nuclear material present but more

[10] Gosling and Fehner, 2.
[11] Defense Nuclear Facilities Safety Board, "About DNFSB: Who We Are," http://www.dnfsb.gov/about/index.php.
[12] U.S. Congress, Congressional Budget Office, *Cleaning Up the Department of Energy's Nuclear Weapons Complex* (Washington, DC, 1994), 1, http://www.cbo.gov/ftpdocs/49xx/doc4914/doc26.pdf.

importantly, the material processes involved and the potential for explosive dispersal of radioactive materials or inadvertent nuclear detonation.[13]

[13] Defense Nuclear Facilities Safety Board, *FY 2010 Budget Request to the Congress* (Washington, DC, May 2009), http://www.dnfsb.gov/about/files/budget/budget_fy2010.pdf.

CHAPTER 1: NUCLEAR SAFETY REGULATION BEFORE THE BOARD'S CREATION

NUCLEAR POLICIES, GOVERNANCE, AND MAJOR U.S. NUCLEAR LEGISLATION UP TO THE ABOLITION OF THE ATOMIC ENERGY COMMISSION

The nuclear weapons complex had its origins during World War II in the Manhattan Project, the "epic, top-secret engineering and industrial venture" that created atomic weapons in less than three years.[14]

The Manhattan Project, Atomic Energy Act of 1946, and Atomic Energy Commission

The U.S. Army Corps of Engineers, beginning in 1942, directed the Manhattan Project, rapidly developing and managing the construction of a nationwide network of research and production facilities that operated in secret.[15] During the race to create the bomb, the three main sites developed were Los Alamos, New Mexico, with its weapons design laboratory, Oak Ridge, Tennessee, with its monumental uranium-enrichment plants, and Hanford, Washington, with its three plutonium production reactors and two reprocessing plants to extract plutonium from the reactor fuel.[16]

To build and operate the complex, which was federally owned, the army's project leadership used the practice of hiring private corporations as contractors.[17] This recourse to a consortium of contractors, which was justified by the wartime national emergency, set the precedent for the government-owned, contractor-operated (GOCO) system that has prevailed in the nuclear weapons complex ever since.[18]

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[14] U.S. Department of Energy, Office of Environmental Management, *Environmental Management: History* (Washington, DC, August 8, 2008), http://www.em.doe.gov/pages/History.aspx.

[15] A. Costandina Titus, *Bombs in the Backyard: Atomic Testing and American Politics* (Reno: University of Nevada Press, 1986), 7.

[16] F.G. Gosling, and Terrence R. Fehner, *Closing the Circle: The Department of Energy and Environmental Management, 1942–1994* (Washington, DC: U.S. Department of Energy, 1994), 1. The first three reactors at the Hanford site remained in operation for some 20 years. The B-reactor began production in September 1944 and shut down in February 1968. The D-reactor, operational in December 1944, and the F-reactor, producing by February 1945, shut down in June 1967 and June 1965, respectively. In 2008 the B-reactor was declared a National Historic Landmark.

[17] George T. Mazuzan, and J. Samuel Walker, *Controlling the Atom: The Beginnings of Nuclear Regulation, 1946–1962* (Berkeley: University of California Press, 1984), 10–11.

[18] Barton C. Hacker, *Elements of Controversy: The Atomic Energy Commission and Radiation Safety in Nuclear Weapons Testing, 1947–1974* (Berkeley: University of California Press, 1994), 10–11. According to Hacker, about seven-eighths of the 44,000-strong wartime workforce in the Manhattan Project were private-sector employees. See

Another precedent set during the Manhattan Project was that the nuclear weapons complex was "self-regulating," in that it had the "authority to regulate its own nuclear safety."[19] The project's leaders in the Corps of Engineers managed the project without independent oversight by any agency or staff external to the project. In managing nuclear safety, the project leadership disseminated in an ad hoc fashion the then-limited knowledge of its project scientists about mitigating the hazards of the use of nuclear energy.[20] The leadership augmented the scientists' advice with the expertise of the project's private-industry contractors in matters of general industrial and chemical safety. Participants in the project had great leeway to use their own judgment in applying such safety-related information.

After World War II, the U.S. Congress took up the question of the future governance of the nuclear weapons complex and the future utilization of atomic energy. One of the major issues was whether the nuclear enterprise should remain under military management or be transferred to control by a civilian government agency.[21] After a protracted debate, Congress passed legislation that affirmed civilian government control while leaving "military applications" of atomic energy the "paramount" mission of the nuclear enterprise.[22] The legislation, the Atomic Energy Act (AEA) of 1946, was the first major nuclear-era statute and has remained a cornerstone of U.S. nuclear policy.[23] The act established the civilian-led U.S. Atomic Energy Commission (AEC), a single federal agency that for the next 29 years combined the functions of managing and regulating the production and uses of atomic energy.[24] As prescribed by the 1946

also U.S. Congress, Office of Technology Assessment, *Hazards Ahead: Managing Cleanup Worker Health and Safety at the Nuclear Weapons Complex*, OTA–BP–O–85 (Washington, DC, February 1993), 62.

[19] Glenn Russell George, "Negotiated Safety: Intragovernmental Risk Regulation in the U.S. Nuclear Weapons Complex" (Ph.D. diss., Harvard University, May 1995), 50, 57 (accessed via Proquest). On the concept of "self-regulation," see also, "Appendix 2: Statement by Joseph J. DiNunno Relative to the Report of the Advisory Committee on External Regulation," A2/1–2, in Defense Nuclear Facilities Safety Board, *Report to Congress on the Role of the Defense Nuclear Facilities Safety Board Regarding Regulation of DOE's Defense Nuclear Facilities* (Washington, DC, November 1998), http://www.dnfsb.gov/pub_docs/dnfsb/rc_199811.pdf. Joseph J. DiNunno, Board member of the Defense Nuclear Facilities Safety Board, uses the term "self-regulation" in several historical accounts of regulatory arrangements that prevailed in the nuclear weapons complex prior to the 1980s.

[20] Joseph J. DiNunno, "Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*,* A Discussion Paper," October 26, 2001, 2/2, http://www.dnfsb.gov/pub_docs/dnfsb/ts_200110_multi.pdf.

[21] Mazuzan and Walker, 3.

[22] Titus, 27.

[23] *Atomic Energy Act of 1946*, Pub. L. No. 79–585, ch. 724, 60 Stat 755, August 1, 1946. See also Bert Chapman, "The Defense Nuclear Facilities Safety Board's First Decade," *Journal of Government Information* 27 (2000): 347, http://docs.lib.purdue.edu/lib research/70.

[24] J. Samuel Walker, *A Short History of Nuclear Regulation, 1946–1999* (Washington, DC: U.S. Nuclear Regulatory Commission, January 2000), 43.

law, the new agency took over the army's responsibilities for the nuclear weapons complex, beginning in January 1947.

The commission authorized by the 1946 law was composed of five civilian members nominated by the president and confirmed by the Senate for staggered five-year terms of office.[25] The commissioners were not required to be nuclear scientists or experts and, indeed, were more usually legal, business, or management professionals.[26] Not scientists themselves, the commissioners relied for scientific and technical advice on one of the several support committees provided for by the 1946 Atomic Energy Act, the General Advisory Committee, which consisted of nine presidentially appointed civilian atomic scientists. Another mandated advisory committee, the Military Liaison Committee, was made up of military officers appointed by the secretaries of war and of the navy, and provided the AEC with Pentagon input.[27] The third statutory committee, the Joint Committee on Atomic Energy (JCAE), ensured a continuing prominent role for Congress in nuclear matters. The JCAE, until disbanded in 1977, was the sole congressional committee with nuclear responsibilities.[28] Made up of nine members each from the Senate and House of Representatives, the JCAE served as a legislative-branch "watchdog" to keep Congress apprised of atomic affairs and to monitor the operations of the five-member executive-branch AEC.[29] The bicameral and bipartisan committee was vested with full jurisdiction over "all bills, resolutions, and other matters in Congress relating to the Commission or to the development, use or control of atomic energy," including budget authorizations for the AEC and international nuclear agreements.[30] Through public hearings and other public informational activities, the committee eventually played a significant role as a champion of commercial nuclear power.

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[25] Mazuzan and Walker, 4.
[26] Robert Pool, *Beyond Engineering: How Society Shapes Technology* (New York: Oxford University Press, 1997), 191.
[27] Mazuzan and Walker, 3.
[28] On committee oversight, see Stephen I. Schwartz, "Congressional Oversight of the Bomb," in Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Washington, DC: Brookings Institution Press, 1998), 513–17. See also Titus, 19.
[29] Interview, John T. Conway, March 26, 2008. Conway was an inaugural member of the Board and its first chairman, serving from October 1989 to April 2005. Previously, he had served as staff director on the JCAE. On the JCAE, see also Mazuzan and Walker, 11–12.
[30] Pub. L. No. 79–585, ch. 724, Section 2(b), 60 Stat 755, 757. See also Titus, 28. Uniquely among modern joint committees, as Conway observed, the JCAE had the authority to produce, as well as to report bills. The committee also produced studies and publications and held hearings in both public and secret executive sessions.

In the initial eight years, the AEC devoted itself almost exclusively to its military mission, the management of the design and production of a stockpile of nuclear weapons.[31] This predominance of the military mission, notwithstanding that the AEC was a civilian body, was in accordance with the 1946 AEA. The act clearly specified that the primary purpose of atomic development, at least in the short run, was to produce a nuclear arsenal for defense. The act contained the provision that the president "from time to time" could direct the commission to deliver "weapons to the armed forces for such use as he deems necessary in the interest of national defense."[32] The act also provided for a second eventual goal—one envisioned to involve the private sector—of developing atomic energy for peaceful purposes. However, the 1946 act mandated that the AEC establish a military-headed Division of Military Applications and give its functions priority.[33] The emerging Cold War confrontation with the Soviet Union and the imperatives of the resultant nuclear arms race reinforced this statutory priority of military production.[34] As the Cold War developed, most of the AEC's resources were absorbed in defense-related activities as the commission refurbished the production and research facilities built during the war, and expanded the defense nuclear complex.[35] For the first 15 years of the AEC's 29-year existence, 70 percent of its expenditures went to the weapons-development programs carried out by the commission's Division of Military Applications.[36] For another half decade, military-related programs commanded the most of the AEC's time and the major portion of the budget.[37]

The statutory priority and Cold War urgency of the AEC's military mission made for considerable continuity between the wartime management of the nuclear weapons complex and

[31] Mazuzan and Walker, 13, 17–18.
[32] Pub. L. No. 79–585, ch. 724, Section 6(a), 60 Stat 755, 763.
[33] The 1946 Atomic Energy Act mandated four operational AEC divisions: research, production, engineering, and military application. Research was later subdivided into sections for physical research and biomedical research. Production was responsible for producing nuclear material. Engineering was concerned with building reactors. And military application dealt with nuclear weapons. See Mazuzan and Walker, 4; and Titus, 27.
[34] See Titus, 22–31.
[35] On the growth of the nuclear weapons complex, see Kevin O'Neill, "Building the Bomb," in Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Washington, DC: Brookings Institution Press, 1998), esp., 35–41, 64–69. To meet the early Cold War's escalating requirements for fissionable material, the AEC authorized major overhauls of the original reactors and two new plutonium reactors for the Hanford plant. At Oak Ridge, an addition to the existing K–25 plant was built, along with a third gaseous diffusion plant for the production of uranium 235.
[36] Titus, 27.
[37] Alice L. Buck, *A History of the Atomic Energy Commission*, DOE/ES–0003/l (Washington, DC: U.S. Department of Energy, July 1983), 1, http://www.atomictraveler.com/HistoryofAEC.pdf.

its governance under the early Cold War AEC. The AEC, for example, placed a similar premium on maintaining secrecy about nuclear activities. A major provision of the Atomic Energy Act of 1946 justified atomic secrets in the name of national security.[38] In turn, the need for secrecy made the continuation of government ownership of nuclear facilities attractive, because of fear that private possession could jeopardize military secrets. The 1946 act maintained the federal government's monopoly over nuclear energy and technology. All nuclear reactors and production facilities were government-owned, and all technical information and research results were under commission control. At the same time, for the actual operation of the complex, the law allowed the AEC to let contracts, and it chose to continue the system of private-sector contractor operation initiated during the Manhattan Project.[39] A further element of continuity with wartime management was the exceptional freedom the AEC enjoyed to marshal the services of highly qualified scientists and technical personnel. In the case of the AEC, Congress provided the commission with privileged appointment and position classification authorities whereby its employees, although federal personnel, were exempt from many of the restrictions and limitations of the Civil Service system.

The AEC's statutory responsibility for fostering and managing the nuclear enterprise was coupled in the 1946 act with a second charge for the commission, namely, the obligation to regulate the very activities and facilities it managed. In particular, according to the dual mandate specified in the act, the AEC was responsible for the achievement of safety in the fulfillment of its nuclear weapons mission. While managing the operations of the nuclear weapons complex, the AEC was authorized to ensure their safety or, in the wording of the act, Section 12(a), to

> (2) establish by regulation or order such standards and instructions to govern the production and use of fissionable and byproduct materials as the Commission may deem necessary or desirable to protect health or to minimize danger from explosions and other hazards to life or property.[40]

The act omitted any detail as to how the commission should regulate the health and safety aspects of the nuclear enterprise. The act provided only that the AEC would "establish . . .

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[38] Eugene A. Rosa and William Freudenburg, "The Historical Development of Public Reactions to Nuclear Power: Implications for Nuclear Waste Policy," in Riley E. Dunlap et al, eds. *Public Reactions to Nuclear Waste: Citizens' Views of Repository Siting* (Durham, NC: Duke University Press, 1993), 33.
[39] Mazuzan and Walker, 7, 9–11. Among the early industrial firms contracted to operate the weapons production facilities were DuPont, Union Carbide, Monsanto, and Philips Petroleum. See also DiNunno, *Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*, 2/4.
[40] Pub. L. No. 79–585, ch. 724, Section 12(a)(2), 60 Stat 755, 770.

standards and instruction" for the complex, and implied that it would carry on the same kind of self-regulation that prevailed during the Manhattan Project. That is, the standards and instructions would be established and enforced in processes entirely internal to the commission itself.[41]

For help in carrying out the safety and health component of its dual mandate, the AEC made provisions early on to set up advisory committees on various aspects of nuclear safety.[42] Such committees were a source of expert advice for both the federal personnel of the AEC and its corporate contractors. Among the panels advising on safety, the most important was an independent advisory committee of scientists first assembled in late 1947 "to counsel the AEC on reactor safety."[43] Originally known as the Reactor Safeguards Committee, the body was soon merged with a panel on facility siting under the new name of Advisory Committee on Reactor Safeguards (ACRS).[44] This expert body, although strictly advisory and without statutory authority in its first decade, performed such vital tasks as reviewing the designs of existing and proposed reactors and advising on the potential hazards of their operation.[45] An early issue addressed, for example, was whether the safety of a reactor necessitated its enclosure in a concrete radioactivity-containment vessel or could be sufficiently assured by geographic isolation and the use of ventilation systems with filters.[46] The committee accepted the latter, unenclosed design in the case of the military's early large reactors, while later calling for containment structures for commercial reactors.[47] The committee's advice and recommendations

[41] George, 52.
[42] Pub. L. No. 79–585, ch. 724, Section 2(b), 60 Stat 755, 757.
[43] Pool, 90.
[44] Pool, 90, 190–97. See also George, 53.
[45] See Pool, 190. After 1957, Congress mandated that the ACRS review all applications to build and operate nuclear power plants.
[46] Michele Stenehjem Gerber, *On the Home Front: The Cold War Legacy of the Hanford Nuclear Site* (Lincoln: University of Nebraska Press, 1992), 24–26. See also *The History of Nuclear Power Safety*, http://users.owt.com/smsrpm/nksafe/forties.html, which states: "In the earliest large reactors, the plutonium production reactors at Hanford, the role of geographic isolation in protecting the safety of the general public was emphasized. At its first meeting in 1947, the Reactor Safeguards Committee of the Atomic Energy Commission considered containment for protection of the general public." Eventually, analyses by the ACRS of "maximum credible accidents" contributed to the adoption of containment vessels for reactors. Used as of the mid-1950s in commercial power plants, such vessels were recommended as a safer alternative to the filtered ventilation system previously used to ensure against accidental radiological releases. See Pool, 91ff, and O'Neill, 73.
[47] On the ACRS's view of containment domes, see Gerber, 102–3. See also J. Samuel Walker, *Containing the Atom: Nuclear Regulation in a Changing Environment, 1963–1971* (Berkeley: University of California Press, 1992), 57–59.

on such issues as containment were in no way binding.[48] The AEC was not required to respond to such recommendations in any particular way, or to implement them.

Other early expert advisory panels provided advice to the AEC on safety topics besides the design safety of nuclear facilities. For example, shortly after the AEC began operations, it set up a 12-person Safety and Industrial Health Advisory Board to survey health and safety issues throughout the complex, such as fire-protection practices and hazardous waste management. On the topic of waste disposal, the advisory panel warned as early as 1948, "The disposal of contaminated waste in present quantities and by present methods (in tanks or burial grounds or at sea), if continued for decades, presents the gravest of problems."[49] The panel called for more laboratory and field study of waste disposal and other issues, and for less diffused managerial responsibility for health and safety. Another group of subject matter experts in the Division of Biology and Medicine, beginning in 1948, conveyed its research results on the biological effects of radiation on people and the environment to the AEC, which largely relied on its contractors to make use of the results. As in the case of its other advisory panels, the AEC was free to disregard the safety recommendations of its own experts.[50]

The Atomic Energy Act of 1954

By 1954, under the AEC's direction, the defense nuclear complex had greatly expanded, and a massive stockpile of nuclear weapons had been accumulated. The nation's security interests appeared more reconcilable than before with the private-sector use of nuclear technologies for civilian commercial purposes.[51] Such use had been envisioned in the AEA of 1946 but had taken a back seat to defense-related applications of nuclear energy in the buildup of nuclear weapons during the early Cold War years.[52] Advocates of civilian uses, including the Joint Committee on Atomic Energy and President Dwight D. Eisenhower, now urged Congress to change the Atomic Energy Act to accommodate private enterprise in nuclear matters.[53]

[48] Pool, 90.
[49] Gosling and Fehner, 8.
[50] Pool, 90.
[51] Titus, 31.
[52] Mazuzan and Walker, 19–22, 25–29.
[53] In 1952 the JCAE issued a paper entitled "Atomic Power and Free Enterprise" that urged the private sector to develop nuclear power for commercial purposes. Two years later, President Eisenhower called for turning "atomic swords into plowshares" and urged Congress to enact the necessary legislation. See "President Eisenhower's "Atoms for Peace" Speech, Before the General Assembly of the United Nations on Peaceful Uses of Atomic

In 1954 Congress passed a sweeping revision of Atomic Energy Act of 1946 to permit for the first time private-sector development of a commercial nuclear power industry.[54] The Atomic Energy Act of 1954 as amended, which remains the primary U.S. statute governing nuclear matters, both commercial and defense-related, loosened many of the earlier AEA restrictions to create the necessary conditions for private-sector nuclear activity.[55] The amended act modified the conditions pertaining to ownership and use of nuclear materials and reactors, and ended the government's eight-year monopoly on such ownership, making possible the private ownership of nuclear power plants by utility companies. The act also lifted the government's exclusive control of technical data on nuclear matters, thereby diminishing the hindrance that secrecy posed to the advancement of nuclear technology for non-military purposes.[56]

With the opening up of the nuclear enterprise to private development, the AEC acquired augmented statutory responsibilities. From 1954 until the elimination of the AEC in 1974, the commission's charge encompassed both military and civilian applications of nuclear energy. The law contained the proviso that defense applications were still the top priority of the commission; it was to pursue peaceful applications of nuclear energy only "to the maximum extent consistent with the common defense and security and with the health and safety of the public."[57] However, most of the amended act dealt with the AEC's new charge of helping to establish a viable commercial nuclear enterprise. The structure of the commission was divided into two distinct categories: those dealing with atomic energy and those with atomic weapons. A new Division of Civilian Applications, headed by a civilian, was assigned primary responsibility for the development and application of civilian uses of atomic energy.[58] The Division of Military Applications, whose director by law still was a member of the armed forces, retained responsibility for weapons development.[59]

As in the case of military uses of nuclear energy, the AEC had a dual mandate vis-à-vis civilian applications. The act assigned the AEC the functions both of advancing the use of commercial nuclear power and of regulating its safety. In its role as a promoter of nuclear power,

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Energy," December 8, 1953, *atomicarchive.com,* http://www.atomicarchive.com/Docs/Deterrence/Atomsforpeace.shtml.

[54] Walker, *A Short History*, 2–5.

[55] *Atomic Energy Act of 1954*, Pub. L. No. 83–703, ch. 1073, 68 Stat 919, August 30, 1954.

[56] Walker, *A Short History,* 5. See also Titus, 31–33.

[57] Pub. L. No. 83–703, ch. 1073, 68 Stat 919, 921.

[58] George, 54.

[59] Hacker, 12. See also Titus, 32–33.

the AEC was "to encourage widespread participation in the development and utilization of atomic energy for peaceful purposes."[60] The AEC was also to provide the fledgling nuclear power industry with technical, research, and financial assistance in adapting nuclear fission to the generation of electricity.[61] With the backing and urging of Congress's Joint Committee on Atomic Energy, the AEC became heavily engaged in nuclear reactor projects, seeking acceptable reactor designs. The AEC performed such research in collaboration with private utility vendors and in parallel with the U.S. Nuclear Navy's Naval Nuclear Propulsion Program, led by Admiral H. G. Rickover. The navy's program to develop nuclear reactors for naval-vessel propulsion, the Naval Reactors Program, was also under AEC oversight jurisdiction and proved to be a crucial source of engineering expertise and management discipline for building a commercial nuclear power industry.[62] The navy's own task of harnessing fission to produce a controlled release of energy to propel a naval vessel demanded design and testing rigor, system reliability, and a strong regard for safety, all characteristics reinforced by Rickover's leadership.[63] Rickover emphasized strong top management guidance to contractors, training, adherence to safety standards, and standards and procedures designed with major input by system designers.[64] The contractors for early civilian reactors relied heavily on the experience their engineers and scientists had gained through the work on the naval projects, as well as projects in the nuclear weapons program. The AEC's Reactor Development Division also brought naval and weapons-development experience to bear in its work with private utility vendors on reactor designs.[65]

Besides the development help on technical matters provided to the nuclear power industry by the AEC, another major service the AEC performed to advance the industry was to support necessary changes in the law pertaining to nuclear matters. In particular, the AEC supported the need for indemnity legislation that would shield private utility owners from huge liability claims in the event of a catastrophic accident in a nuclear power plant. Utility owners

[60] Pub. L. No. 83–703, ch. 1073, 68 Stat 919.
[61] Walker, *A Short History*, 4.
[62] Pool, 46–52, 194.
[63] Mazuzan and Walker, 16–17, 21–22.
[64] Interview, John W. Crawford Jr., September 21, 2008. An inaugural Board member on the Defense Nuclear Facilities Safety Board, Crawford served for 10 years in the Naval Nuclear Propulsion Program under Admiral Rickover, becoming Deputy Manager, Naval Reactors Program.
[65] See Mazuzan and Walker, 21–22. Soon after enactment of the Atomic Energy Act of 1954, Duquesne Light Company received permission to design and build the first "commercial" nuclear power plant at Shippingport, Pennsylvania. The project began in September 1954, with Westinghouse as the contractor. The U.S. Navy had

were hesitant to pursue nuclear power as long as they could be destroyed financially by the liability arising from a nuclear accident.[66] Thus, a precondition for stimulating the private capital investment necessary to launch the industry was to ensure an upper limit on private liability claims. The AEC backed an amendment to the Atomic Energy Act that would provide government coverage for liability claims in excess of a specific cap. Congress enacted the amendment, known as the Price-Anderson Act, in 1957.[67] This third significant nuclear-era law, which added Section 170 to the AEA, authorized the AEC to enter into indemnification agreements with the owners of private reactors.[68] These owners were obliged to carry $60 million in private insurance coverage for each reactor, the maximum available from the consortium of insurers.[69] However, as that amount did not approach the AEC's estimates of possible liability costs arising from a nuclear accident, the AEC, per the Price-Anderson Act, would supplement the private protection with an amount up to $500 million.

Divergent Safety Regimes in the Nuclear Power Industry and the Weapons Program

The dual mandate of the AEC, after the expansion of its jurisdiction to the commercial sector, included, as before, responsibility for regulating the safety of the nuclear enterprise. Under the 1954 AEA, the purview of the AEC's regulatory power now extended to private, commercial applications of nuclear energy, as well as to federal, defense-related applications. The amended act of 1954 reiterated much of the general language of its 1946 predecessor, assigning the AEC broad regulatory authority and directing it to "(1) protect health, (2) minimize danger to life or property, and (3) require the reporting and permit the inspection of work performed thereunder, as the commission may determine."[70] Section 161 of the act made reference to tools—standards and instructions—that the AEC was to use to promote safe nuclear operations. According to Section 161,

contracted with Westinghouse in the late 1940s to provide a research facility and technical expertise for the development of a nuclear propulsion plant for naval vessels.

66 Walker, *A Short History*, 13–15.

67 *Price-Anderson Nuclear Industries Indemnity Act*, Pub. L. No. 85–256, 71 Stat 576, September 2, 1957.

68 See *Atomic Energy Act of 1954, as Amended,* § 170, which was added by Pub. L. No. 85–256 § 4, 71 Stat 576. See also Mazuzan and Walker, 199–212.

69 Chapman, 348.

70 Pub. L. No. 83–703, ch. 1073, Section 31(c), 68 Stat 919, 927.

> In the performance of its functions the Commission is authorized to—
> . . .
> b. establish by rule, regulation, or order, such standards and instructions to govern the possession and use of special nuclear material, source material, and byproduct material as the Commission may deem necessary or desirable to promote the common defense and security or to protect health or to minimize danger to life or property . . .
>
> (i) (3) to govern any activity authorized pursuant to this Act, including standards and restrictions governing the design, location, and operation of facilities used in the conduct of such activity, in order to protect health and to minimize danger to life or property."[71]

The 1954 AEA, like its 1946 predecessor, allowed the AEC to establish "standards and instruction" to protect health and safety.[72] The 1954 act did make one expectation clear about the AEC's enlarged regulatory mission, namely, that its oversight would proceed along different paths for private commercial and defense-related activities. In the case of privately owned facilities, Congress envisioned a licensing arrangement as the means of furthering the protection of public health and safety. The Atomic Energy Act of 1954 required all commercial nuclear facilities to be licensed and gave the AEC the authority to act as a nuclear licensing agency.[73] Licensing was a mechanism by which continuing public control over private activities could be exercised. Such continuing control was a precondition for the acceptability of the private ownership of nuclear facilities, the private use of fissionable material, and private industrial access to needed technical information. For defense-related nuclear operations, Congress established no licensing scheme.[74] The exempted facilities were owned by the federal government and bore a different relationship to the public interest. Their regulation was not taken up as a matter requiring statutory change.

The introduction of a licensing requirement for the commercial nuclear power industry and its omission for the defense nuclear complex contributed over time to a widening divergence in their respective regimes for regulating safety. The divergence between the commercial and defense sides of the nuclear enterprise in regard to safety began slowly at first and then

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[71] Pub. L. No. 83–703, Section 161(b) and 161(i)(3), ch. 1073, 68 Stat 919, 948–49.
[72] See U.S. Congress, Office of Technology Assessment, *Managing the Nation's Commercial High-Level Radioactive Waste,* OTA–0–171 (Washington, DC, March 1985), 83, 95, http://www.princeton.edu/~ota/disk2/1985/ 8514_n.html; Mazuzan and Walker, 30–31; and Rosa and Freudenburg, 34.
[73] Buck, 6.
[74] George, 175.

accelerated. Eventually, the two sides, although broadly similar as users of nuclear technologies, addressed safety issues in a different manner.

Driven by licensing dynamics, this growing difference was masked initially by the fact that the two sides both had rather loose safety standards and casual safety management. Under the licensing arrangement, the authorization to build or operate a commercial nuclear power plant was contingent upon safety reviews by AEC staff of the potential private licensee's facilities and operating practices. During the infancy of nuclear power, such reviews leading to the issuance or denial of a license, had much in common with safety reviews performed as part of health and safety programs in the weapons complex. In both instances, reviews proceeded on a case-by-case basis and without reference to clearly defined standards as to what constituted safe installation design or operations.[75] The basis for judgments about safety, given the still limited and fluid knowledge about nuclear matters in the mid-1950s, was the "consensus of experts."[76] Another commonality that marked early nuclear safety reviews of both government-owned defense and commercial facilities was their reliance on the same organizational source of expertise on reactor designs, the Advisory Committee on Reactor Safeguards, the AEC's principal safety group.[77] The ACRS grew in influence after 1957, when an amendment to the Atomic Energy Act upgraded its status to that of a statutory advisory committee to the AEC, with a mandate to review all applications to construct and operate nuclear power plants.[78] Offering the AEC independent technical safety evaluations, the ACRS not only reviewed every proposal for a power reactor, but also performed periodic safety reviews of such defense facilities as Hanford's new production reactor—the N-reactor, built in 1963—and the Savannah River production reactors.[79]

Although nuclear safety reviews performed for the purpose of licensing commercial nuclear facilities and those performed in the weapons complex did not at first sharply

[75] Walker, *A Short History*, 8.
[76] DiNunno, *Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*, 2/4.
[77] Walker, *A Short History*, 13. The ACRS, interested in how to ensure reactor safety, drew upon the engineering expertise of the national laboratories, which researched the technical aspects of reactors, for example, how fuel elements would react if the temperature of the core exceeded normal operating temperature, how much pressure a reactor containment vessel could withstand, and whether an emergency core-cooling system would perform as designed.
[78] Pool, 90. See also Buck, 6. This upgrade of the ACRS reflected the recognition by proponents of nuclear power that a single accident in a nuclear reactor could severely weaken the nascent industry.

differentiate the regulatory regimes of the two sides of the nuclear enterprise, the requirement of licensing for commercial plants resulted in a regulatory regime and approach quite different from that pursued in the weapons complex. The licensing requirement produced a number of interacting effects.[80] One was increased pressure on the commercial nuclear industry to develop consistent and measurable standards as the foundation upon which licensing could rest. Another effect was to necessitate the enlargement and organizational consolidation of the regulatory staff charged with processing applications for licenses and monitoring compliance with their terms. A third effect was to open up the commercial nuclear enterprise to increased public scrutiny, because of the public's right to request public hearings or review as part of licensing proceedings, and its right to prior notice and an opportunity to comment—"prior notice and comment"—on standards proposed for promulgation as regulations in the U.S. Code of Regulations.[81]

With respect to standards, the need for a clear and publicly defensible technical basis for the licensing of commercial plants prompted the AEC to step up its efforts to specify the safety requirements to which the private vendors of nuclear power were obliged to adhere. The AEC sought standards and requirements that embodied available scientific information and, following the lead of the Naval Nuclear Propulsion Program, moved increasingly to the use of written standards.[82] During the 1960s, the AEC worked toward greater rigor in several important areas, including standards on protection measures against radiation exposure, requirements to prevent major radiation releases from a power reactor, and standards relating to reactor safety engineering issues, such as pressure vessel integrity and emergency core cooling systems. Gradually the AEC's standard setting on the commercial side took the form of promulgating legally binding regulations in a formal process that included prior issuance for public comment. The first topic addressed in this formal rulemaking process was the required elements in a reactor

[79] U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities: Hearings on H.R. 783, H.R.. 2047, and H.R. 3123*, 100th Cong., 1st sess., November 5, 19, 1987, 34. See also Buck, 6.

[80] J. Samuel Walker, *Containing the Atom: Nuclear Regulation in a Changing Environment, 1963–1971* (Berkeley: University of California Press, 1992), 37ff.

[81] Interview, Sherri Wasserman Goodman, Alexandria, VA, September 10, 2008. Goodman was on the professional staff of the Senate Armed Services Committee when the creation of the Board was debated. See also Walker, *A Short History*, 13. The Price-Anderson Act included a provision that required public hearings on all reactor applications.

[82] Defense Nuclear Facilities Safety Board, *Fifth Annual Report to Congress* (Washington, DC, February 1995), 78, http://www.dnfsb.gov/pub_docs/reports_to_Congress/all/rc.php.

site. In 1962 the AEC's specification of reactor siting criteria, which emphasized quantitative measures, was codified in Title 10, Part 100, of the U.S. Code of Federal Regulations.[83] Other regulations followed, along with regulatory guides to aid in judging compliance. In connection with private-sector licensed operators, the AEC operated increasingly as a true regulator. Besides the power to define standards and promulgate regulations, it also had enforcement authority, including the power to maintain surveillance of licensed reactors and to threaten operators with the withholding, suspension, or non-renewal of a license.

The AEC's efforts to develop standards and regulations necessitated organizational changes that gave greater prominence to its regulatory arm. In 1961 the AEC modified its internal structure to separate regulatory functions from operating functions and upgraded the former by placing them under a newly created director of regulation, who reported directly to the commissioners.[84] The AEC also expanded its regulatory staff. A larger staff was needed to handle the increased workload brought on by the formalization of standard setting and regulation, as well as the mid-1960s boom in orders and construction of commercial nuclear power plants. From a slow start of only eight small power reactors ordered prior to 1966, 52 reactors were on order by November of that year, flooding the AEC with applications for licenses.[85]

In addition to strengthening the AEC's regulatory arm and standard setting, its licensing and regulatory activities under the 1954 act provided the avenues for public as well as judicial involvement in its processes of decision-making about commercial nuclear power.[86] For example, by law, following any change in a licensing application, the public had a specified period during which a public hearing could be requested to provide a forum for airing concerns

[83] For discussion of 10 CFR Part 100 in a meeting before the Defense Nuclear Facilities Safety Board, see *Public Meetings and Hearings, 1991, Before the Defense Nuclear Facilities Safety Board*, vol. II of II (Washington, DC: Defense Nuclear Facilities Safety Board, 1991), 187–90. See also J. Samuel Walker, *Three Mile Island: A Nuclear Crisis in Historical Perspective* (Berkeley: University of California Press, 2004), 52–62.
[84] Buck, 8.
[85] Merritt E. Langston, "Continuing Evolution of U.S. Nuclear Quality Assurance Principles, Practices and Requirements," Part I, August 2005, 5, http://www.hss.energy.gov/CSA/CSP/qa/NQAStandardsEvolution1.doc.

> An exponential growth in the nuclear power plant market began in 1965. This growth followed the successful demonstration of commercial nuclear power at the Shippingport, Pennsylvania, nuclear plant. At that time, eight reactors with a combined capacity of 4,870 megawatts electrical (Mwe) were on order. In the first eight months of 1966, 15 more reactors with a total capacity of 11,800 Mwe were ordered. By November 1966, there were 52 civilian power reactors with a total capacity of 26,890 Mwe on order. The AEC predicted an increase in capacity of from 80,000 to 110,000 total Mwe by 1980. Plant capacity had increased in size from several hundred to 1,100 Mwe.

and opinions.[87] Similarly, opportunities for public comment were part of the formal process for promulgating regulations. In addition, licensing decisions became subject to judicial review. During the early years of commercial nuclear power, such avenues for outside involvement drew largely benign public and media attention to the industry and served to elicit community acceptance of industry and AEC decisions, for example, on plant siting.[88] As the industry rapidly grew during the 1960s and early 1970s, however, the avenues for involvement brought interventions by outside parties that challenged industry and AEC freedom of action. Such parties included local citizens groups, media, state and local governments, antinuclear and environmental activists, and, finally, the judiciary, all of which questioned the industry's handling of safety, health, and the environment.[89] By the early 1970s, when the nuclear power industry and the AEC were increasingly under fire by such outside parties, citizen activists frequently exploited the hearing process to delay the construction and raise the costs of nuclear power plants.[90]

The type of answerability to public concerns that the AEC's licensing procedures brought to the commercial nuclear power industry and its AEC regulators did not pertain on the defense side of the nuclear enterprise or to the staff in charge of the commission's health and safety programs in the nuclear weapons complex. The evolution of such programs, although exhibiting some parallels to that of the AEC's private-sector regulation, did not involve the institution of any practices that would normally occasion or allow public hearings. The federally owned nuclear facilities were exempt from licensing by statute, and the AEC staff for these facilities developed health and safety standards without recourse to the formal processes of promulgating regulations.[91] The staff did pursue improved definitions of standards and requirements and

[86] Anthony R. Buhl, Thomas Murley, George Edgar, and Donald Silverman. "NRC Regulation of DOE Facilities," *Nuclear News,* May 1997, 29.
[87] Rosa and Freudenburg, 41–42.
[88] Rosa and Freudenburg, 34.
[89] Walker, *Three Mile Island*, 9–17.
[90] Pool, 195.
[91] George, 54. See DiNunno, *Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*, 2/4. According to DiNunno,

> In 1959, for closer scrutiny of the operations of its own nuclear facilities, the AEC consolidated its subject matter experts in applied health physics, fire protection, and industrial health and safety standards into an Operational Safety Division. These experts, along with those in the Division of Biology and Medicine, had been largely advisory to weapons production managers . . . .The establishment of the Operational Safety Division marked the first forceful federal insertion of safety expectations into the production programs of the government's weapons contractors.

captured them informally in a Manual of Standards.[92] However, the standards they developed, mainly designated as orders and directives, had a different status from legally binding regulations and could be instituted and changed without public notice and comment. The absence of practices that invited public involvement shielded the nuclear weapons side of the nuclear enterprise from public scrutiny. Another contributor to the absence of public involvement in the weapons program was national security concerns.

The comparative invulnerability of the defense side of the nuclear enterprise to public scrutiny and challenge, even as the public mood concerning nuclear activities darkened by the late 1960s, contributed to the continuation of a relatively relaxed safety regime in the weapons complex. Under this safety regime, for example, the processes of defining, using, and enforcing standards were pursued without a great sense of urgency. A key task of the weapons program's health and safety staff was to formulate orders and directives to be written into contracts and followed by the weapons contractors.[93] This task of formulation was given to delay, allowing contractors to rely on their own experience for many safety issues.[94] In these tasks, the contractors typically continued the ad hoc and case-by-case approach of the nuclear enterprise's earlier days, and contractors neither offered, nor were systematically called upon to give, feedback that could inform the ongoing efforts of AEC staff on the defense side to formalize safety-related standards.

With respect to the standards—the orders and directives—that *had* been defined and written into contracts, compliance was far from a given. Accustomed to working according to their own standards, contractors tended to view the safety orders and directives written into their contracts as "'goals' to be met over time," rather than as strict requirements demanding adherence.[95] Both the means and the will to punish contractors for their non-adherence to contractual standards were limited. Numerous factors hampered stringent enforcement, including insufficient numbers of technically qualified AEC staff to monitor and inspect operations and facilities. Also, the AEC was highly dependent on its consortium of contractors to realize the weapons production goals that were part of the commission's dual mission of production and

[92] DiNunno, *Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*, 2/4.
[93] National Academy of Sciences, National Research Council, Committee to Assess Safety and Technical Issues at DOE Reactors, *Safety Issues at the Defense Production Reactors: A Report to the U.S. Department of Energy* (Washington, DC: National Academy Press, 1987), esp., 222–26, in "Appendix H, Structure of the DOE Safety System: Technical Discussion," http://books.google.com/books?id=q2MrAAAAYAAJ&printsec=titlepage.
[94] Office of Technology Assessment, *Hazards Ahead*, 54.

safety. While in theory contractor non-compliance with a contract's built-in safety orders could be grounds for abrogating a contract, in practice the AEC's dependence on its contractors undercut its leverage to enforce their attention to the safety of operations. The priority of production goals limited the AEC's incentive to enforce safety requirements.

The weaknesses of the weapons program's system for ensuring safety escaped sustained public, media, and congressional criticism longer than did safety issues in the commercial nuclear power industry. The main safety issue related to nuclear weapons that received attention prior to the mid-1980s was the radioactive fallout resulting from aboveground nuclear weapons testing.[96] The flare-up of concern about that issue subsided with the 1963 ban on aboveground testing of nuclear weapons, leaving the commercial nuclear power industry the chief target of the public's increasing skepticism about the nuclear enterprise and growing distrust of its governing body, the AEC.[97]

By the 1970s, citizen activists opposed to nuclear technology took advantage of the AEC's comparatively wide avenues for public involvement in commercial nuclear activities and appeared regularly at AEC licensing hearings for nuclear power plants to express safety concerns, e.g., about the chances of a large-scale accident and the hazards of long-lived radioactive waste, as well as economic arguments. Opponents of nuclear technology filed petitions with the AEC and legal motions with the courts, seeking to stall the licensing and operation of nuclear power plants, and thereby to block the nuclear industry's expansion.

NUCLEAR DOUBTS AND THE ENERGY CRISIS

The safety concerns involving commercial nuclear power were attributed in part to the AEC's dual mandate, now widely seen as involving conflicting, perhaps even irreconcilable, objectives, i.e., on the one hand, to advance the growth of a private commercial nuclear industry and, on the other hand, to ensure its safety. To be sure, the AEC had striven to balance these objectives. After the early period of the nuclear industry, when the industry's launch and growth had priority, the AEC had upgraded its regulatory arm, giving more influence to those charged with safety, and acted as a far more stringent regulator. Still, balancing these objectives was

[95] Buhl, et al., 29.
[96] Walker, *A Short History*, 17–21.
[97] Buck, 4–5. The Limited Test Ban Treaty of 1963 banned atmospheric testing while permitting underground testing.

difficult to achieve, and many viewed the commission as still too caught up with the industry it regulated.

The Breakup of the AEC

After years of public debate, Congress judged the AEC's dual mission to be no longer tenable and enacted the Energy Reorganization Act (ERA) in 1974 to separate the commission's two conflicting objectives and assign them to different federal agencies.[98] Senator Abraham Ribicoff, chairman of the committee with primary jurisdiction for the act, explained its rationale,

> [T]he development of the nuclear power industry has been managed by the same agency responsible for regulating it. While this arrangement may have been necessary in the infancy of the atomic era after World War II, it is clearly not in the public interest to continue this special relationship now that the industry is well on its way to becoming among the largest and most hazardous in the Nation. In fact, it is difficult to determine . . . where the commission ends and the industry begins.[99]

The legislation of 1974 disbanded the AEC and assigned its responsibility for nuclear safety in civilian nuclear applications, including all commercial nuclear plants, to the newly created U.S. Nuclear Regulatory Commission (NRC). The NRC, an independent regulatory agency that began operations in January 1975, inherited "all the licensing and related regulatory functions of the Atomic Energy Commission."[100] The 1974 act transferred the AEC's regulatory arm intact, including existing regulations and the staff and programs that governed safety in the nuclear industry.[101] The NRC also was assigned some units that had previously provided safety support to both the power industry and the weapons program. The NRC inherited, for example, the

[98] *Energy Reorganization Act of 1974*, Pub. L. No.93–438, 88 Stat. 1233, October 11, 1974, as amended, 42 U.S.C. Sec. 5801 *et seq*.
[99] 120 Cong. Rec. 28129 (1974) (statement of Senator Ribicoff). Ribicoff, who chaired the Committee on Government Operations, reported the act to the Senate in June 1974.
[100] Pub. L. No. 93–438, Sec. 201(f), 88 Stat 1233, 1243. See Terrence R. Fehner and Jack M. Holl, *Department of Energy, 1977–1994: A Summary History* (Washington, D.C.: U.S. Department of Energy, November 1994), 18–20, http://www.osti.gov/bridge/servlets/purl/10106088-mgIkuD/webviewable/10106088.PDF. Although the NRC's mandate generally restricted NRC authority to the regulation of the commercial nuclear industry, the NRC licensed some government-owned nuclear facilities, including some operated for the military. None of these NRC-licensed, government-owned facilities were involved in weapons production. See also Buhl et al, 28–30.
[101] Interview, John E. Mansfield, Board vice chairman (since 2007; Board member, 1997–present), Washington, DC, August 25, 2008. See also Pool, 196; and George, 55.

Advisory Committee on Reactor Safety, whose focus became almost exclusively commercial nuclear activities.[102]

With the enactment of the 1974 act, the NRC was not given any developmental, operational, or promotional responsibilities for either commercial nuclear power or the weapons program. A second new agency, the Energy Research and Development Administration (ERDA), was given these non-regulatory responsibilities of the AEC—mainly, managing the nuclear weapons and naval reactor programs—as well as energy development programs.[103] Becoming the managing agency for the nuclear weapons complex, ERDA also assumed responsibility for safety in the weapons program, since, when the NRC was created, no comparable independent safety authority was created for defense nuclear facilities.[104] Under the new arrangement of 1974, the duties to ensure safety and production continued to reside in the same agency, ERDA.[105] Thus, the agency restructuring of 1974, while undoing the problematic duality of the AEC's mission on the civilian side of the nuclear enterprise, left such a duality of agency mission in place on the side of the weapons program. This difference in agency arrangements for the power industry and the weapons program was ultimately to reinforce and sharpen over time the divergence that had already developed in the two spheres' respective safety regimes.

The Birth of the Department of Energy in the Era of Energy Crises

In 1977 further organizational changes occurred in the energy arena, this time precipitated not by dissatisfaction with the AEC, but by the nation's ongoing energy crisis and concerns about U.S. vulnerability to energy supply–disrupting events, such as the oil embargo of

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[102] The ACRS is subject to the NRC regulations set forth in 10 CFR Part 7.
[103] Pub. L. No.93–438, Section 102(g), 88 Stat 1233, 1235–37. The Energy Reorganization Act perpetuated the AEC's compartmentalization of military applications by stipulating a statutory position, "Director of Military Applications" within ERDA. ERDA assumed "activities relating to research and development on the various sources of energy (and) other functions, including but not limited to the Atomic Energy Commission's military and production activities and its general basic research activities."
[104] Pub. L. No. 93–438, Section 2a, 88 Stat 1233. The statute that established ERDA charged it with operating the agency to "advance the goals of restoring, protecting and enhancing environmental quality, and to assure public health and safety."
[105] DiNunno, *Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*, 2/6. According to DiNunno,

> ERDA's organization included an Assistant Administrator for Environment and Safety. The functions of this Environment and Safety group, like those of its predecessors, were largely in support of the line. The functions included a lead role in sponsoring biomedical and environmental research, oversight of a health and safety laboratory, development of environmental control

1973. To the Carter administration, the energy crisis demonstrated a need for comprehensive national energy planning and coordination. The Carter administration wanted both to raise energy issues to a higher level on the policy agenda and to enhance energy-planning efficiency by centralizing the dispersed energy-related activities of various federal agencies. The administration concluded that the reorganization of 1974, in its establishment of ERDA, was inadequate to current needs and proposed to replace ERDA with a new cabinet-level department that incorporated ERDA's functions, along with some others.[106] At the administration's urging, Congress enacted the Department of Energy Organization Act of 1977, creating the Department of Energy (DOE), which began operations on October 1, 1977.[107] The act transferred to DOE the duties previously performed by the short-lived ERDA, including control of the nuclear weapons complex.[108] For the defense-related tasks so transferred, Congress required a continuing compartmentalization of weapons-related activities under an assistant secretary for defense programs and national security functions. In addition, the DOE enabling legislation expanded the new department's non-nuclear management responsibilities beyond the non-nuclear duties, primarily research, that ERDA had performed. DOE inherited and consolidated, for example, non-nuclear energy regulatory programs, including those of various cabinet-level departments.[109]

Thus, with the establishment of DOE, responsibilities for the weapons complex came to reside in an organization whose functions were more encompassing than those of its immediate predecessor, ERDA, as well as quite different from those of the AEC, whose focus had been on nuclear matters exclusively. As the successor to both the AEC and ERDA for defense nuclear activities, however, DOE was still the carrier of a dual mission, inheriting both managerial and regulatory responsibilities. DOE's charge was both to manage the production of nuclear weapons and to ensure the safe operation of DOE production facilities. Assigning DOE the broad goal of

technologies, development of safety standards, compliance oversight, coordination of safety reactor research, and waste management and transportation.

[106] Fehner and Holl, 22–23; Titus, 35.

[107] *Department of Energy Organization Act of 1977*, Pub. L. No. 95–91, Title II, Section 201, 91 Stat 565, 569. See also U.S. Department of Energy, Office of Environmental Management, *Linking Legacies: Connecting the Cold War Nuclear Weapons Production Processes to Their Environmental Consequences* (Washington, DC, January 1997), http://www.em.doe.gov/Publications/linklegacy.aspx.

[108] These defense functions were transferred to DOE by Pub. L. No. 95–91, Title II, Section 203(a)(5), 91 Stat 565, 570.

[109] George, 56. See also DiNunno, *Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*, C/2.

protecting public health and safety, and mentioning environmental protection, the act stated that DOE's mission was to include:

> [I]ncorporation of national environmental protection goals in the formulation and implementation of energy programs and to advance the goals of restoring, protecting, and enhancing environmental quality, and assuring public health and safety.[110]

The act made clear that DOE's statutory authority included the power to establish, impose, oversee, and enforce compliance with nuclear safety requirements.[111] Otherwise, like earlier nuclear-related legislation, the act lacked specifics as to how to accomplish safety aims. As the National Academy of Sciences/National Research Council later commented about the law that created DOE, "Congress gave DOE nearly complete discretion to determine how it should go about protecting the public."[112]

The newly created DOE focused the bulk of its attention on activities to address the energy crisis —energy development and regulation to promote efficiency and conservation—rather than on the nuclear weapons complex.[113] Regarding the weapons complex, DOE, following its AEC/ERDA predecessors, emphasized the production of nuclear materials and weapons. With respect to such issues in the weapons program, DOE carried forward the system of "self-regulation" inherited from its predecessors, and continued to develop and maintain the internal system of orders and directives under which nuclear safety had been regulated. DOE specified the set of orders to be written into its management and operation (M&O) contracts and formulated other types of guidance for its contractors.[114] In doing so, DOE often adopted NRC standards as part of its internal orders.[115] Otherwise, DOE remained resistant to outside pressures for improvement in environment, safety, and health (ES&H) protection measures in its nuclear operations, for example, pressures arising from the growing national environmental protection movement. From the time of its establishment in 1977, DOE came under pressure to comply at DOE weapons-production sites with environmental statutes and

[110] Pub. L. No. 95–91, Section 102 (13), 91 Stat 565, 568; 42 U.S.C. Section 7101 et seq., section 7191.
[111] Pub. L. No. 95–91, Section 102 (13), 91 Stat 565, 568.
[112] National Academy of Sciences, National Research Council, *Safety Issues at the Defense Production Reactors*, 224.
[113] Fehner and Holl, 22–26.
[114] Interview, Mansfield. Within DOE's safety regime, standards-based operation was relatively strong in relation to reactors, but weaker in other areas. For a description of the various types of standard-like instruments that DOE used to promote safety, see National Research Council/National Academy of Sciences, *Safety Issues at the Defense Production Reactors*.

regulations, e.g., the recently enacted Resource Conservation and Recovery Act of 1976 or RCRA, administered by the states, and, slightly later, the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, or CERCLA, also known as "Superfund," which was administered by the Environmental Protection Agency (EPA).[116] However, DOE, like its predecessors, was intent on remaining "self-regulating" for health and safety matters at defense nuclear facilities and resisted being compelled to comply with such laws, claiming exemption under the terms of the Atomic Energy Act.[117]

While DOE initially was successful in fending off pressures to submit its nuclear facilities to the external constraints, such as environmental laws, similar kinds of pressure brought dramatic change to the commercial side of the nuclear enterprise and its regulator, the NRC. The commercial industry faced environmental and civic activism generated by deteriorating public confidence in the safety and environmental benignity of nuclear technologies, and by alarm at the long-standing, apparently intractable problem of nuclear waste. Such intensified public concern and activism, plus the high costs of nuclear power generation, brought an abrupt halt to further growth of the industry.[118] After 1978, no U.S. utility company ordered a nuclear power reactor, and all orders placed after 1974 were eventually canceled.[119] This collapse of new orders in turn changed the NRC's focus. The NRC continued its licensing and regulatory activities, gradually developing "a full set of legally binding regulations and a wide range of interpretive guidance to judge compliance." However, with the end of new applications for plant construction, the NRC's focus in standard setting was less on the safe design of reactors than on the safety standards for their operation and maintenance.[120]

THE THREE MILE ISLAND SHAKEUP: AFTERMATH

The efficacy of such efforts to improve safety management in the two sides of the nuclear enterprise was suddenly called into question at the end of that decade by the trauma of the core-

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[115] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 208.
[116] Pub. L. No. 94–580, 90 Stat 2795, and Pub. L. No. 96–510, 94 Stat 2767.
[117] Len Ackland, *Making a Real Killing: Rocky Flats and the Nuclear West* (Albuquerque: University of New Mexico Press, 2002), 200, 205.
[118] Walker, *Three Mile Island*, 42.
[119] U.S. Department of Energy, Energy Information Administration, *The Changing Structure of the Electric Power Industry, 2000: An Update*, DOE/EIA–0562(00) (Washington, DC, October 2000), 161, http://www.eia.doe.gov/cneaf/electricity/chg_stru_updated/toc.html.
[120] See Walker, *A Short History*, 61.

melt accident at the Three Mile Island (TMI) nuclear power plant in Pennsylvania. The accident, the most serious in U.S. commercial nuclear plant operating history, began at the plant's Unit 2 on March 28, 1979.[121] About half of the radioactive, heat-producing core melted before the reactor could be brought to a "cold shutdown" a month later.[122] For a time, the events in progress at the plant raised fears that widespread radioactive contamination would escape the containment vessel—fears fueled by an erroneous NRC warning about an explosive "hydrogen bubble" within the reactor.[123] The crisis ended without a major radiation release, injuries, or the need for a general evacuation, but it hardened preexisting public and media suspicion about the nuclear enterprise, both the technology and its governance. As had been the case in earlier flare-ups of public alarm about nuclear technology, public concern was relatively undifferentiated, pertaining to all things nuclear, whether commercial or defense-related.

While the Three Mile Island accident was a major setback for trust in all things nuclear, the accident was an impetus for safety improvements. Although the accident brought added scrutiny of nuclear safety across both sides of the nuclear enterprise, the direct and immediate impact of the accident as a driver of safety upgrades was much greater in the commercial industry and at the NRC than in the weapons program and at DOE.[124] Accounting for this difference in part was still the greater vulnerability of the commercial side to the exertion of various kinds of public pressure. Another reason for the difference in the immediate impetus to safety improvements was simply the fact that the TMI accident involved a commercial plant, whose regulation was the NRC's responsibility.

In the aftermath of the accident, a presidential commission, the Kemeny Commission, was set up to investigate the accident and directed, among other things, to address whether licensed commercial nuclear power reactors should be allowed to continue operating.[125] The Kemeny Commission answered in the affirmative but identified, and proposed as a precondition, significant items requiring industry-wide corrective measures. Because analyses of the accident

[121] U.S. Nuclear Regulatory Commission, *NRC: Our History*, February 3, 2009, n.p., http://www.nrc.gov/about-nrc/history.html#aec.
[122] Walker, *Three Mile Island*, chapters 4–8.
[123] William Lanouette," The Atom, Politics, and the Press" (Washington, DC: Media Studies Project, Woodrow Wilson International Center for Scholars, December 1989), 106.
[124] Interview, Goodman.
[125] For an account of post-TMI safety-related changes in the commercial industry, see Joseph V. Rees, *Hostages of Each Other: The Transformation of Nuclear Safety Since Three Mile Island* (Chicago: University of Chicago Press, 1996).

underscored that severe accidents could result from small equipment failures compounded by human error, the NRC henceforth placed far greater emphasis on the training of reactor operators and "human factors" in plant performance.[126] The NRC also called upon the industry to make wide-ranging improvements in emergency-response planning, the documentation of plant operating histories, radiation protection practices, and human factors engineering. In addition, the NRC tightened and stepped up its regulatory oversight activities. Based on a recommendation of the Kemeny Commission, the NRC, for example, established onsite inspectors at all its licensed sites.[127]

In making these post-TMI reforms, the NRC attempted to emulate the most successful model in the history of nuclear technology, Rickover's Nuclear Navy. Based on observation of navy practices, the NRC and the industry remedied a good deal of pre-TMI sloppiness in operations, establishing more detailed rules and specifications covering more seemingly minor matters, as well as more disciplined record-keeping.[128] In addition, the NRC augmented its own efforts by delegating some of its responsibilities to a new industry group, the Institute of Nuclear Power Operations (INPO), which was founded in response to a recommendation of the Kemeny Commission Report.[129] Funded by the U.S. nuclear power industry, INPO was created to improve the sharing of operational experience and best practices among nuclear power plants.[130] INPO conducted nuclear plant evaluations, identified strengths and common operational deficiencies, and disseminated its findings and data analyses within the nuclear industry, typically without revealing the names of particular plants or making its findings public.[131] In addition, based on the data it collected, INPO set performance objectives, defined benchmarks of quality in reactor operations, and disseminated guidelines industry-wide.[132]

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[126] Walker, *A Short History*, 51–53.
[127] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities,* 174.
[128] Pool, 204.
[129] U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Energy Conservation and Power, *Nuclear Reactor Safety,* 99th Cong., 2d sess., May 22 and July 16, 1986, 3.
[130] Interview, Mansfield. Pointed out that DOE contractors on the defense side of the nuclear enterprise eventually formed a counterpart on INPO, the Energy Facility Contractors Group (EFCOG), which had the similar aim of sharing best practices. On INPO, see Rees, 41ff.
[131] On INPO's treatment of its data as "proprietary," see House Energy and Commerce Subcommittee on Energy Conservation and Power, *Nuclear Reactor Safety*, 3.
[132] Matthew L. Wald, "10 Years After Three Mile Island," *New York Times*, March 23, 1989, http://query.nytimes.com/gst/fullpage.html?res=950DE0DF1738F930A15750C0A96F948260&sec=&spon=&pagewanted=print.

Similarly sweeping and direct post-TMI changes did not take place in the nuclear weapons complex or at DOE. Among notable short-run effects of the TMI accident was a comprehensive self-assessment conducted in 1981 for the secretary of energy on the safety of DOE's production reactors.[133] The 1981 report, known as the Crawford Committee report, was authored by a panel whose head, John W. Crawford Jr., would later become an inaugural member of the Defense Nuclear Facilities Safety Board. The Crawford Committee report revealed numerous safety deficiencies in DOE nuclear operations and DOE.[134] The report faulted DOE on a number of grounds, including a lack of adequate standards, inadequate requirements for ensuring the quality of operating personnel, and spottiness in implementing lessons learned from the TMI accident. On the issues of standards and training, the report criticized DOE in explicitly comparative terms, chiding it for falling short in safety upgrades compared to the NRC and the commercial nuclear industry. The report stated,

- DOE Headquarters policies, instructions, and other information relating to nuclear matters . . . have not been upgraded to take into account the standards and requirements reissued by NRC.
- A coordinated DOE-wide program relative to TMI Lessons learned has not been established, and only isolated corrective measures are evident at reactor sites.
- DOE lags behind the commercial nuclear industry in issuing uniform unambiguous requirements for the selection, training, and qualification of reactor operating personnel.[135]

The report concluded with a call for further study, as well as recommendations for internal organizational changes in DOE that would elevate the status of ES&H functions.

The findings of the Crawford Committee report accorded with a later summary assessment by a congressional staff participant in the Defense Nuclear Facilities Safety Board's establishment, namely, that the nuclear weapons complex, relatively speaking, "did not benefit from the safety upgrades prompted by the Three Mile Island accident."[136] The staffer mentioned several reasons, both long-term and shorter term, for the relatively slight effect of the Three Mile

[133] U.S. Department of Energy, *A Report on a Safety Assessment of Department of Energy Nuclear Reactor: Report of the Crawford Committee,* DOE/US–0005 (Washington, DC, March 1981).
[134] See U.S. Congress, Senate, Committee on Armed Services, Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 100th Cong., 1st sess., October 22, 26, 27, 30, November 3, 1987, 305, on the Crawford Committee, also known as the Nuclear Facility Personnel Qualification Committee. The panel's head, John W. Crawford Jr., was then the deputy assistant secretary for nuclear energy. See also DiNunno, *Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*, C/3.
[135] DiNunno, *Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*, C/3.

Island accident on safety activities in the nuclear weapons complex compared to the shakeup it produced in the nuclear industry and NRC. The long-term reason, already suggested, was that the legacy of secrecy that had always prevailed in the defense nuclear complex remained in force, rendering DOE nuclear facilities and DOE safety activities still relatively sheltered from outside scrutiny. Not particularly subject to outside pressure to force remedial action on safety issues, DOE was also temporarily restrained from taking action on its own account because of a significant increase in the demand for nuclear weapons production in the early 1980s. This increased demand began with President Carter's last defense budget, whose request roughly coincided in time with the Three Mile Island accident. The buildup of weapons continued well into the Reagan years, making the early to mid-1980s a period of intense nuclear weapons production. DOE was called upon to expand significantly its output of nuclear materials and weapons, as well as its research and development of nuclear weapons.[137] The buildup of the nuclear arsenal took priority, shifting DOE away both from its originally stronger focus on energy issues and from any significantly increased post-TMI focus on safety issues in DOE's nuclear operations.[138] A Board employee later remarked upon the weapons buildup and its deleterious effect on DOE's performance in health and safety matters, stating,

> The nuclear business is like other industries. They have busy times. They have slack times and I guess it is fair to say that the 1980s, early and mid-1980s, was a very busy time in the weapons production complex.
>
> During busy times, plants concentrated on making their product—in this case weapons components—and deferred other things: maintenance and upgrades and scrap processing.[139]

Although the Reagan administration's weapons buildup contributed to DOE's deferral of remedial action on the kinds of safety issues that various TMI accident analyses highlighted, DOE did not altogether escape external pressures reflecting heightened post-TMI public concerns about nuclear-related matters. In particular, DOE felt the impact of intensified public

[136] Interview, Goodman.
[137] On the Reagan administration's buildup and its impact on safe operations in the DOE nuclear complex, see Schwartz, 496–502.
[138] Fehner and Holl, 38–41. The Carter administration's fiscal year 1982 Department of Energy budget ($12.6 billion) and the Reagan administration's FY 1985 budget ($12.8 billion) were similar in amount but differed in priorities. Reagan's budget doubled expenditures for the nuclear-weapons program, while halving spending for energy areas such as conservation and renewable energy research.
[139] *Public Meetings and Hearings, 1995*, *Public Meetings and Hearings, 1995, Before the Defense Nuclear Facilities Safety Board*, vol. I (Washington, DC: Defense Nuclear Facilities Safety Board, 1995), 18.

concerns about nuclear waste disposal and environmental contamination by radioactive wastes. As a result of such concerns, DOE came under increased pressure to subject its own activities at defense nuclear sites to outside scrutiny and external regulation under various state and federal laws. DOE had successfully resisted inroads of external regulation in the past, refusing to acknowledge, for example, its obligations to comply with environmental laws and regulations. However, in 1984 DOE had a setback in litigation in a federal court that challenged its handling of wastes at DOE nuclear facilities.

Environmental activists brought suit against DOE in the Eastern District Court of Tennessee, charging DOE with violating environmental laws in its operation of the Y-12 nuclear weapons component manufacturing plant at the 37,000 acre Oak Ridge Reservation in Tennessee.[140] According to documents made public in 1983, 2.4 million pounds of mercury had been discharged from the plant.[141] In *Legal Environmental Assistance Foundation, Inc, et al v. Hodel*, the plaintiffs charged that DOE, in its handling of mercury and other hazardous materials, had violated the provisions of the Resource Conservation and Recovery Act (RCRA) that applied to the treatment, transportation, storage, and disposal of hazardous waste, as well as sections of the Clean Water Act.[142] In its defense, DOE asserted that Y-12 operations were not covered by the RCRA, because the Atomic Energy Act (AEA) exempted DOE from state regulation. DOE claimed further that the AEA placed authority for waste disposal with DOE and, moreover, restricted the dissemination of data on nuclear materials and weapons.[143]

On April 13, 1984, in a landmark ruling, Judge Robert L. Taylor rejected DOE's arguments, finding in favor of the plaintiffs. The court agreed that the RCRA's hazardous waste disposal regulation applied to DOE at Y-12. The judge waived damages in view of the national defense mission of the Y-12 plant, and of DOE's expressed commitment to remediate the environmental damage at the site.[144] Nonetheless, the court ruling marked a significant change, with its finding that DOE indeed was subject to external regulation in aspects of its operations in

[140] U.S. Congress, House of Representatives, Committee on Science and Technology, Subcommittee on Energy Research and Production and Subcommittee on Investigations and Oversight, *The Impact of Mercury Releases at the Oak Ridge Complex,* 98th Cong., 1st sess., July 11, 1983, 18.
[141] Gerber, 8.
[142] *Legal Environmental Assistance Foundation Inc. v. Hodel,* 586 F.Supp. 1163, (E.D. Tenn.) (1984).
[143] Chapman, 348–49.
[144] See also Mark Holt, *Nuclear Weapons Production Complex: Environmental Compliance and Waste Management,* CRS Issue Brief 90074, updated (Washington, DC: Congressional Research Service, Library of Congress, 1990, 1997), 2, 8–11, http://www.cnie.org/nle/waste-3.html.

nuclear facilities. The ruling determined that DOE had to comply with environmental statutes and regulations administered by EPA and, in effect, granted EPA the authority to regulate DOE.[145] The ruling, while not eliminating DOE's "self-regulating" status, narrowed the scope in which it could operate with purely internal oversight.[146]

In so doing, the ruling paved the way for further impositions of federal and state statutes and regulations on DOE nuclear facilities. Congress, for example, reinforced the trend toward limiting DOE's "self-regulating" status, with the passage of the Superfund Amendments and Reauthorization Act of 1986.[147] The act made clear that sites owned by the government could be considered for inclusion on the National Priorities List, part of the Superfund law listing the nation's most contaminated sites.[148] Such a listing would entail remedial environmental action under the jurisdiction of the states and/or EPA.[149] In addition, DOE, in May 1987, came to an understanding with EPA regarding mixed wastes—low-level radioactive wastes mixed with non-radioactive hazardous chemical constituents—conceding that the RCRA applied to their hazardous components and that mixed-waste disposal would be subject to regulatory oversight by EPA.

Notwithstanding such congressionally and litigation-driven expansion of the reach of external regulations in DOE, the department remained a "self-regulating" entity in many important areas, most crucially, in matters of nuclear safety at DOE facilities.

CHERNOBYL BRINGS HOME THE NEED FOR SAFETY REFORMS AND STEPPED-UP OVERSIGHT IN DOE'S NUCLEAR OPERATIONS

The limited imposition by courts and Congress of external regulation on DOE nuclear operations up to the mid-1980s might have assuaged public and congressional safety and environmental concerns about them for some time, keeping such concerns on a low burner. However, the Soviet Union's Chernobyl nuclear disaster on April 26, 1986, shattered that possibility. That accident, more than the TMI accident, aroused public and media alarm about the

[145] On the shared responsibilities of DOE and EPA, see House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 208.
[146] U.S. General Accounting Office, *Department of Energy: Clear Strategy on Externa1 Regulation Needed for Worker and Nuclear Facility Safety*, GAO/T–RCED–98–163 (Washington, DC, May 1998), 3, http://www.gao.gov/archive/1998/rc98163.pdf.
[147] Pub.L.No. 99–499, 100 Stat 1613, October 17, 1986.
[148] Ackland, 201.
[149] DiNunno, *Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*, 2/7.

defense nuclear complex and brought home to Congress and DOE the need for serious safety reforms and greatly stepped-up oversight in that side of the nuclear enterprise, as well as the commercial side.

The Chernobyl nuclear power station accident provided a dramatic demonstration of the havoc that a major accident in a nuclear facility could cause. The accident, later characterized by a Belarussian ambassador as “the worst technogenic catastrophe that has ever occurred on this planet,” began with a power excursion, followed by an explosion that destroyed the unit 4 reactor and blew off its top.[150] The explosion and resulting fire in the reactor’s graphite core released massive amounts of radioactivity. A radioactive plume spread as fallout to European countries as distant as Poland, Germany, Switzerland, Italy, Sweden, and Finland.[151] The consequences for nearby areas, especially Belarus, which received 70 percent of the fallout, were dire in the near term and expected to be severe in the long term.[152] As analyzed later, in Belarus, in the first post-Chernobyl decade, the incidence of thyroid cancer in children rose by 285 times, and Chernobyl-related issues absorbed 25 percent of the government’s budget. In Ukraine 270 square miles were contaminated with plutonium-239, and another 9 million hectares contaminated with radioactive residues.[153] Analyses of the accident listed various causes, including operator errors ultimately attributable to poor training and poor management, and to faulty reactor design. Another, more general contributing factor usually cited was the pervasive secrecy in nuclear matters during the Soviet era.

Whatever the exact thrust of the analyses of the disaster’s causes, ongoing revelations about the causes and consequences were profoundly unsettling to those with responsibility for safety in the U.S nuclear enterprise, including DOE’s defense nuclear operations. The revelations had the effect both of spurring accelerated internal change within DOE in the weapons area and of finally stirring Congress into action on legislative initiatives designed to improve defense nuclear safety. By 1987, numerous proposals for the establishment of an external arrangement for oversight of DOE’s nuclear operations were under consideration by Congress.

[150] U.S. Congress, Commission on Security and Cooperation in Europe, *The Legacy of Chornobyl, 1986 to 1996 and Beyond,* 104th Cong., 2d sess., April 23, 1996, 3, http://csce.gov/index.cfm?FuseAction=UserGroups.Home&ContentRecord_id=156&ContentType=H&ContentRecordType=H&UserGroup_id=117&Subaction=ByDate&CFTOKEN=53. See also Walker, *A Short History*, 49–51.
[151] See House Energy and Commerce Subcommittee on Energy Conservation and Power, *Nuclear Reactor Safety*, 3; 66–67.
[152] Chapman, 349.
[153] Commission on Security and Cooperation in Europe, *The Legacy of Chornobyl,* 32–34, 44–45, 47.

DOE's Internal Reforms Prior to Chernobyl

With regard to changes within DOE, the fifth secretary of energy, John S. Herrington, both pushed for more rapid implementation of reforms underway before Chernobyl and undertook new ones. Herrington, who had taken office in January 1985 at the start of President Reagan's second term and about a year before the Chernobyl accident, had already taken significant steps toward improving DOE's internal nuclear safety management.[154] For example, in September 1985, responding to a special report that he had ordered, which characterized DOE's ES&H activities as "a disgrace," he consolidated into one headquarters division previously scattered environmental, safety, and health functions.[155] Cognizant of the report's finding that such functions were "widely perceived as having no clout and of being ignored by senior management unless a crisis develops," he ensured their elevation in status and authority by placing the consolidated division, the Office of Environment, Safety, and Health (EH), under the direction of a newly created assistant secretary for environment, safety, and health.[156] In establishing the ES&H office and the new assistant secretary position, Herrington aimed to bolster DOE's mechanisms of internal safety oversight by clearly separating and upgrading the organization responsible for oversight from the line office responsible for actually *achieving* safety in the course of nuclear weapons production, the assistant secretary for defense programs (DP).[157] In effect, he sought a safety oversight body that, while internal to DOE, was not as conflicted as other internal units with carrying out the dual mission of production and safety. The safety responsibilities of the new assistant secretary's office, as later described by John W. Crawford Jr., an inaugural member of the Board, were to:

(1) independently confirm that safety [was] achieved by the line management organizations,

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[154] For a description of Herrington's actions both before and after Chernobyl, see the testimony of Joseph F. Salgado, Under Secretary, DOE, in House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities,* 125–28.
[155] See Fehner and Holl, 41
[156] See Fehner and Holl, 41.
[157] According to later testimony by Senator John Glenn, Herrington, in reorganizing the DOE's ES&H activities, in effect, adopted the advice of several GAO reports in the early 1980s. See the 1983 GAO report, U.S. General Accounting Office, *DOE's Safety and Health Oversight Program at Nuclear Facilities Could Be Strengthened*, RCED–84–50 (Washington, DC, November 1983), for its recommendation of the reorganization of DOE's safety and health program to provide it with more authority and independence. See also the 1981 GAO report, GAO, *Better Oversight Needed for Safety and Health Activities at DOE's Nuclear Facilities*, EMD–81–108 (Washington, DC, August, 4, 1981).

(2) develop safety standards,

(3) and provide "technical assistance" to line organizations concerning governmental, safety, and health matters.[158]

Other pre-Chernobyl actions Herrington undertook in the name of improved safety included ordering detailed technical appraisals of nuclear safety at all of DOE's high-hazard facilities, a major environmental survey of conditions at DOE nuclear facilities, and the revision of DOE orders on safety-related topics, such as the preparation of safety analysis reviews (SAR).[159] In addition, just a month prior to the Chernobyl accident, Herrington began to implement a new government policy of greater transparency concerning the environmental, safety, and health effects resulting from five decades of nuclear weapons production and testing in the nation's defense nuclear reservations.[160] In February 1986, DOE took early steps in what would eventually be a large-scale release of previously unavailable or declassified records documenting "how decades of making and testing nuclear weapons had affected those who worked and lived in the vicinity" of the facilities.[161]

DOE's Internal Reforms after Chernobyl

In addition to boosting initiatives already underway in DOE to increase transparency, and accelerating intradepartmental safety management reforms, Chernobyl also served as the stimulus for undertaking new internal DOE initiatives to improve nuclear safety. The major post-Chernobyl actions on Herrington's part included immediately commissioning a study by the National Research Council, the research arm of the National Academy of Sciences (NAS) and the National Academy of Engineering, to make an independent assessment of the safety of

[158] See John W. Crawford Jr., *An Assessment Concerning Safety at Defense Nuclear Facilities: The DOE Technical Personnel Problem*, DNFSB/TECH–10 (Washington, DC: Defense Nuclear Facilities Safety Board, March 1996), 26, http://www.dnfsb.gov/pub_docs/dnfsb/tr_199603.html. As Crawford pointed out, with the establishment of the new EH office, there were two large organizations in DOE Headquarters with key responsibilities for the safety of defense nuclear facilities, including the line organizations headed by the assistant secretary for defense programs (DP). In 1989, a second line organization with safety responsibilities was established, an office headed by the assistant secretary for environmental management (EM).

[159] The technical safety appraisal process was developed from the Institute of Nuclear Power Operations (INPO) and NRC evaluation methods. See *Safety Oversight for Department of Energy Nuclear Facilities*. See also U.S. General Accounting Office, *Environment, Safety, and Health: Status of Department of Energy's Implementation of 1985 Initiatives*, RCED–86–68FS (Washington, DC, March 1986), and U.S. General Accounting Office, *Nuclear Safety: Safety Analysis Reviews for DOE's Defense Facilities Can Be Improved,* GAO/RCED–86–175 (Washington, DC, June 1986), 22, http://archive.gao.gov/d4t4/130648.pdf.

[160] Gerber, 1.

[161] Gerber, 4.

DOE's largest reactors, with particular attention to the lessons learned from the Chernobyl accident. The focus of the NAS study, conducted by a 16-member expert panel, was DOE's defense production reactors—reactors operated to supply the plutonium and tritium needed for nuclear weapons—the N-reactor at Hanford and the K-, L-, and P- reactors at Savannah River.[162] Begun around May 1986, the study's report, *Safety Issues at the Defense Production Reactors: A Report to the U.S. Department of Energy*, was published on October 29, 1987, with interim findings available earlier.[163] The study was highly critical of safety conditions at the reactors, identifying both managerial shortcomings and technical problems.[164]

On the question of the likelihood of a Chernobyl-like accident in U.S. reactors, the NAS study found that the reactors, notwithstanding "acute aging," were not inherently unstable in the same way that the Chernobyl plant was. However, major gaps existed in the understanding of how the reactors would perform in certain kinds of severe accidents that U.S. civilian plants were designed to withstand, for example, a loss-of-coolant accident. The study also found "significant uncertainties" about the ability of the defense reactors—with their filters rather than containment structures—to limit the release of radioactive materials in a major accident. Serious technical deficiencies identified in the study included suspected stress-corrosion cracks in reactors at the Savannah River Site.[165] On management issues, the study found many problems associated with DOE's reliance on its consortium of contractors, in the words of the report, "a loose-knit system of largely self-regulated contractors operating within budgetary constraints imposed by and on

[162] The National Academy of Science's National Research Council later also produced reports on defense nuclear facilities other than the reactors. These reports appeared in 1988 and 1989 on the eve of the Board's startup. The reports raised both safety and environmental concerns. On the environment, the 1989 report stated, "Virtually every facility in the complex has contamination on site, some of it extensive, and many of them have contamination off site as well." On safety, the reports listed the following specific problems, as well as general problems, such as the facilities' age:

- "[T]here are troublesome elements in the fire protection program."
- "[A] pattern of routine use of respirators [to prevent the inhalation of radioactive materials] is an indication of the failure of production, maintenance, and housekeeping procedures."
- "Plutonium exists in the exhaust ducts downstream of the high-efficiency particulate air (HEPA) filters at the plutonium finishing facility at Hanford . . . [and] in an exhaust duct of Building 771 at Rocky Flats."
- "Medical departments are . . .relegated to a reactive role. . . . Medical monitoring and surveillance programs in the complex should be improved substantially."

[163] National Academy of Sciences, National Research Council, *Safety Issues at the Defense Production Reactors*, vii.

[164] Matthew L. Wald, "Weapon Reactors Faulted on Safety," *New York Times*, October 29, 1987.

[165] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 104. See also Gerber, 5.

the Department."[166] The study pointed out that DOE depended excessively on contractors to identify remedies for safety issues, and provided insufficient central direction concerning safety expectations and standards, as well as too little monitoring.[167] Broaching a theme later emphasized by the Defense Nuclear Facilities Safety Board, the study attributed such problems to an imbalance in the technical expertise of DOE and contractor personnel. As the report stated,

> [DOE] both at headquarters and in its field organizations, has relied almost entirely on its contractors to identify safety concerns and to recommend appropriate actions, in part because [of] the imbalance in technical capabilities and experience between the contractors and DOE staff.[168]

The study summarized its assessment of DOE's management of its aging facilities by saying, DOE "falls short of reasonable expectation in attempting to cope with the mix of production and safety responsibilities."[169]

In addition to commissioning the special National Academy of Sciences study of 1987, a second significant post-Chernobyl action taken by Herrington was to call for the formation of several advisory committees. One was the six-member Roddis panel, specifically formed to ascertain the state of the N-reactor, DOE's largest nuclear materials plant and the only U.S. reactor even superficially similar to the Chernobyl flammable graphite-moderated reactor.[170] The N–reactor, built in 1963 and designed for 20 years of service, was in stand-down status in January 1987 for safety improvements and had to be assessed prior to restart. Another advisory committee, the Advisory Committee on Nuclear Facility Safety (ACNFS), was DOE's answer to one of the recommendations in the National Academy of Sciences study, the recommendation for an independent safety oversight committee—a committee of non-DOE experts—serving as advisors to the secretary of energy on the safety of operations of DOE's nuclear facilities. Chartered by Secretary Herrington in 1987, the ACNFS was a DOE-appointed group of 15 nuclear safety experts largely from outside DOE.[171] This committee, whose members were chosen by the secretary and served part-time, was known as the Ahearne Committee, after its

[166] National Academy of Sciences, National Research Council, *Safety Issues at the Defense Production Reactors*, 80.
[167] National Academy of Sciences, National Research Council, *Safety Issues at the Defense Production Reactors*, vii, 76, 78, 80–82.
[168] National Academy of Sciences, National Research Council, *Safety Issues at the Defense Production Reactors*, 75.
[169] National Academy of Sciences, National Research Council, *Safety Issues at the Defense Production Reactors*, xx.
[170] Fehner and Holl, 43.
[171] The committee was terminated in November 1991. See U.S. Department of Energy, "Terminated Federal Advisory Committees," 3, n.d., http://management.energy.gov/documents/TerminatedAdvisoryCommittees.pdf.

chairman, Dr. John F. Ahearne, a former chairman of the NRC.[172] The ACNFS, whose goal was to provide a degree of independent safety oversight *within* DOE, initiated reviews of a number of the most pressing issues in the complex, for example, the storage of high-level waste at Hanford, unsafe plutonium residues at Rocky Flats, and staff training and qualification, particularly in radiological protection practices.[173] As recommended in the National Academy of Sciences/National Research Council study, most of the committee's work was to be unclassified and publicly available. The study had regarded such transparency as essential to repair the public's confidence in the safety of DOE's nuclear operations.

[172] Interview, A.J. Eggenberger, Board chairman (since 2005; vice chairman, 1989–2005), Washington, DC, July 9, 2008. Secretary of Energy Watkins phased ACNFS out after the Board was fully in operation. See also Fehner and Holl, 50.

[173] Interview, Kenneth M. Pusateri, Board General Manager (1989–2006), Washington, DC, January 3, 2008. Eventually, the Board subsumed the records of the Ahearne Committee.

CHAPTER 2: ESTABLISHMENT OF THE BOARD, 1987 TO 1989

CONGRESSIONAL PUSH FOR EXTERNAL SAFETY OVERSIGHT IN DOE'S NUCLEAR OPERATIONS

As the Advisory Committee on Nuclear Facility Safety was getting underway and the National Academy of Sciences study was in progress, Congress was also mobilizing under the stimulus of Chernobyl to examine safety issues in nuclear facilities and to consider legislating new mechanisms of safety oversight. Although the Chernobyl power station, like Three Mile Island, was a power plant rather than a defense-production reactor, the Chernobyl accident focused congressional attention on the perceived safety problems of both sides of the nuclear enterprise—DOE's nuclear facilities and the nuclear power industry.

In regard to the commercial industry, several committees in the House of Representatives held hearings in 1986 on the future of nuclear power in the light of the Chernobyl accident, noting with dismay "a return to the pre-Three Mile Island business-as-usual mentality" that had taken place by then.[174] The House Energy and Commerce Subcommittee on Energy Conservation and Power found that NRC and DOE officials had told their nuclear safety experts to refrain from discussing the Chernobyl accident with the media and from comparing Chernobyl with U.S. reactors.[175] The NRC also requested the subcommittee to keep secret the details of 151 accidents at nuclear facilities in 14 countries other than the United States and the Soviet Union between 1971 and 1984. Deploring such "policies of public exclusion and conspiratorial silence" about safety problems, several House panels floated proposals for the reform of NRC licensing, the standardization of power plant design, and other safety initiatives.[176] The overall aim of such congressional activity was twofold: "maintaining public confidence through citizen participation, and developing a safer product."[177]

In regard to DOE's nuclear facilities, Congress also came to insist that both public confidence and safety required a definitive break with the legacy of secrecy and congressional

[174] U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Energy Conservation and Power, *Nuclear Reactor Safety,* 99th Cong., 2d sess., May 22 and July 16, 1986, 3. See also U.S. Congress, House of Representatives, Committee on Interior and Insular Affairs, Subcommittee on Energy and the Environment, *Nuclear Licensing and Regulatory Reform Legislation,* 99th Cong., 2d sess., June 26, July 22, 1986.
[175] House, Energy and Commerce Subcommittee on Energy Conservation and Power, *Nuclear Reactor Safety,* 3. See also Bert Chapman, "The Defense Nuclear Facilities Safety Board's First Decade," *Journal of Government Information* 27 (2000): 349, http://docs.lib.purdue.edu/lib research/70.
[176] House, Energy and Commerce Subcommittee on Energy Conservation and Power, *Nuclear Reactor Safety*, 3.
[177] House, Energy and Commerce Subcommittee on Energy Conservation and Power, *Nuclear Reactor Safety*, 4.

inattention. A number of committees became involved in hearings on the state of safety in the weapons complex and on DOE's record of safety management.[178] By the 100th Congress, which was in session from January 1987 through October 1988, Congress began in earnest "to examine the question of whether the responsibility for ensuring the safety of DOE's reactors ought to be removed from the Department and assigned to an independent agency."[179] During this period, both houses of Congress examined a number of legislative proposals to create a mechanism for continuous independent external oversight of safety in the weapons program. The proposals reflected the belief that the adequate protection of public health and safety required the end of continuing reliance on DOE self-regulation—the "fox guarding the henhouse" and "Dracula guarding the blood bank"[180] Among these legislative proposals was S. 1085, the Nuclear Protections and Safety Act of 1987, a bill sponsored by Senator John Glenn (D–Ohio) that ultimately proved precursory to the 1988 enabling legislation for the Defense Nuclear Facilities Safety Board (DNFSB or the Board).[181]

A number of factors besides Chernobyl were significant in precipitating the flurry of legislative activity on nuclear safety oversight during the 100th Congress. One factor was the winding down of the Cold War, which was signaled, beginning in the year after Chernobyl, by political changes in the Soviet Union and nuclear arms control agreements.[182] The period from the summer 1986 meeting between President Ronald Reagan and Soviet General Secretary

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[178] On the congressional committees that took up issues involving the defense nuclear complex, see Stephen I. Schwartz, "Congressional Oversight of the Bomb," in Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Washington, DC: Brookings Institution Press, 1998), 513. After 1977, when nuclear matters ceased to be the province of a single committee, i.e., the Joint Committee on Atomic Energy (JCAE), several dozen committees had occasional say on matters in the weapons complex. However, the JCAE's responsibilities devolved for the most part on two sets of committees in both houses of Congress, the House and Senate Armed Services committees, and the House and Senate Appropriations committees, more specifically their subcommittees with responsibilities related to energy. The appropriations subcommittees handled funding for DOE. During the period of intensified congressional action on nuclear weapons safety in the mid- to late 1980s, other committees and subcommittees played a significant role, most notably, the Senate Governmental Affairs Committee.

[179] U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*: *Hearings on H.R. 783, H.R. 2047, and H.R. 3123,* 100th Cong., 1st sess., November 5 and 19, 1987, 2.

[180] See House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 34, for Representative Ron Wyden (D–OR) quoting a constituent.

[181] Senator John Glenn, "The Nuclear Protections and Safety Act of 1987," 133 Cong. Rec. 9431–9436 (1987). Glenn's bill contained four separately titled portions. When reported to the Senate (S. Rep. No. 100–173), they were S.1085 *Title I, Defense Nuclear Safety Board Oversight Act of 1987; Title II, Application of OSHA and NIOSH to DOE Nuclear Facilities; Title III, Mixed Hazardous Waste Amendment Act of 1987; Title IV, Radiation Study Advisory Board Act of 1987*.

Mikhail Gorbachev in Reykjavik, Iceland, to the September 1987 signing of the Intermediate Nuclear Forces treaty, which banned a category of weapons, has been called "the beginning of the end of the U.S.–Soviet nuclear arms race."[183] This waning of the arms race undermined the national security rationale for the secrecy and self-policing that still prevailed in the nuclear weapons complex.[184]

Another reason for stepped-up activity and the emergence of legislative proposals for independent safety oversight in the 100th Congress was that the Senate majority passed from Republican to Democratic hands, giving the chairmanship of a key committee, the Senate Governmental Affairs Committee, to Senator John Glenn, previously the committee's ranking minority member.[185] Glenn, a former test pilot and astronaut, was a Senate leader in nuclear nonproliferation and long conversant with questions about the safety and environmental impact of DOE's nuclear facilities.[186] In attaining the chairmanship of the Governmental Affairs Committee, a standing body with jurisdiction over regulation or regulatory bodies such as the NRC, he was now in a leadership position to move legislation on nuclear safety.[187]

The second committee that shaped the Board's enabling legislation was the Senate Armed Services Committee, which, in its own words, had "exclusive jurisdiction" over DOE's defense nuclear complex.[188] The Senate Committee on Armed Services and, more specifically, its Subcommittee on Strategic Forces and Nuclear Deterrence, were responsible for legislation relating to nuclear weapons, national defense, and nuclear deterrence. With the shift to a Democratic Senate majority in the 100th Congress, the new chairman of the Armed Services Committee was Sam Nunn (D–Georgia), who was amenable to working with Glenn, also an Armed Services Committee member, on legislation related to nuclear safety.

Glenn's actions in the 100th Congress—his initiation of hearings and his introduction of S.1085 on April 23, 1987—were not his earliest actions in connection with safety issues in the

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[182] Len Ackland, *Making a Real Killing: Rocky Flats and the Nuclear West* (Albuquerque: University of New Mexico Press, 2002), 216.
[183] Ackland, 208.
[184] Ackland, 216.
[185] Glenn was chair of the Governmental Affairs Committee from the 100th through the 103d Congresses, i.e., January 1987 through December 1994, after which Senate Republicans regained the majority.
[186] F.G. Gosling, and Terrence R. Fehner, *Closing the Circle: The Department of Energy and Environmental Management, 1942–1994* (Washington, DC: U.S. Department of Energy, 1994), 81.
[187] Interview, Sherri Wasserman Goodman, Alexandria, VA, September 10, 2008. Goodman was a senior staffer on the Senate Armed Services Committee in the late 1980s and active in the deliberative sessions that ultimately led to the establishment of the Defense Nuclear Facilities Safety Board.

weapons complex. Glenn had become actively concerned about the safety of DOE facilities several years before he unveiled legislation.[189] As early as July 1980, he began commissioning reports from the General Accounting Office on various aspects of safety, health, and environment issues in the weapons program.[190] One consistent message from the reports that he and others requested—21 reports between 1979 and 1987—was the need for greater independence in DOE's safety oversight programs in the weapons complex. The GAO explicitly distinguished the type of oversight it advocated from oversight that remained an internal function within DOE, noting that the latter produced inevitable trade-offs between DOE's programmatic objectives and safety considerations during the budget process—to the detriment of safety. The GAO, noncommittal as to the specific mechanism of outside oversight, advocated "an outside organization, independent of funding by DOE . . . [whether] another federal agency, such as NRC, or an independent review panel not associated with DOE." [191]

In addition to sponsoring GAO investigations of problems in the weapons complex, Glenn pioneered congressional hearings on the subject. He did so at the prompting of nonproliferation experts on his staff, including Leonard S. Spector and Leonard Weiss, an electrical engineer, who was instrumental in formulating the Nuclear Nonproliferation Act of 1978, and related legislation sponsored by Glenn.[192] Glenn also heeded the concerns of environmental activists such as Robert Alvarez, who joined his staff during the 100th

[188] S. Rep. 100–232, at 2 (1987).
[189] On Glenn's description of his involvement in defense nuclear matters, see U.S. Congress, Senate, Committee on Armed Services, Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 100th Cong., 1st sess., October 22, 26, 27, 30, November 3, 1987, 57–58, 67–68. When Glenn campaigned unsuccessfully to become the Democratic candidate for president in 1984, he highlighted his nuclear arms control advocacy. He supported, first, a mutual, verifiable freeze on the production and deployment of nuclear weapons; second, reductions in U.S./Soviet nuclear arsenals; third, an end to the spread of nuclear weapons technology by strict enforcement of the nuclear nonproliferation legislation he authored in the Senate; fourth, involvement of all other countries possessing nuclear weapons in the arms control process; and fifth, negotiations on reductions of conventional weapons. See *John Glenn for President 1984 Campaign Brochure: 'Believe in the future again'*, *4president.org*, http://www.4president.org/brochures/johnglenn1984brochure.htm.
[190] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 210.
[191] U.S. General Accounting Office, *Nuclear Safety: Safety Analysis Reviews for DOE's Defense Facilities Can Be Improved,* GAO/RCED–86–175 (Washington, DC, June 1986), 22, http://archive.gao.gov/d4t4/130260.pdf.
[192] *Nuclear Nonproliferation Act of 1978*, Pub. L. No. 95–242. Weiss was staff director of the Senate Governmental Affairs Subcommittee on Energy, Nuclear Proliferation, and Federal Services from 1977 to 1981 and minority staff director of the same subcommittee from 1981 to 1987. He remained a chief policy adviser to Glenn until 1999. Spector was chief counsel of the subcommittee until the mid-1980s, when he went on to the Carnegie Endowment for International Peace and eventually to DOE.

Congress.[193] Alvarez and others underscored the urgency of the matter of legacy nuclear wastes, as well as the health impact of defense nuclear production, including operations in Glenn's own state of Ohio, at the Feed Materials Production Center in Fernald, Ohio. The Fernald site, a 1,050-acre uranium-processing complex, was shut down in December 1984 "after DOE disclosed that excessive quantities of uranium dust and oxides had been released through the ventilating system in a recent three-month period."[194] During the 99th Congress, which ran from January 1985 through October 1986, Glenn used his position as chair of the Governmental Affairs Subcommittee on Energy, Nuclear Proliferation, and Government Processes to bring to national prominence through hearings the issue of nuclear wastes and cleanup at the nation's nuclear materials production plants. Beginning in 1985, Glenn and his staffer Weiss led the first comprehensive examinations of DOE's nuclear weapons complex, initially launching an investigation of health and safety problems at Fernald.[195] As the hearings revealed,

> [O]ver 230 tons of radioactive material from Fernald had leaked into the Greater Miami River valley during the preceding three decades. The whereabouts of another 337 tons of uranium hexaflouride . . . could not be documented. Thousands of kilograms (kg) of uranium dust had been discharged to the atmosphere and to surface water. Five million kg of radioactive and hazardous (mixed) substances had been released to pits and swamps, permitting percolation into groundwater. Concrete silos containing solid radioactive wastes had vented radon gas. Additionally, about two hundred thousand canisters and barrels at Fernald held mixed and hazardous wastes that had not been identified precisely.[196]

After the first hearings on Fernald, Glenn made a further request of GAO to review health and safety issues at a number of DOE facilities around the country. The resulting 1986 GAO report documented serious safety issues at nearly all of the sites examined.

The actions of Glenn and his staffers proved to be important groundwork for the intensified focus on defense nuclear safety in the 100th Congress in both the House and the Senate. Glenn's bill, S. 1085, and its House counterpart, H.R. 3123, were not the only pieces of DOE nuclear oversight legislation to emerge in 1987, nor the only ones to generate extensive

[193] Interview, John E. Mansfield, Board vice chairman (since 2007; Board member, 1997–present), Washington, DC, August 25, 2008.

[194] Michele Stenehjem Gerber, *On the Home Front: The Cold War Legacy of the Hanford Nuclear Site* (Lincoln: University of Nebraska Press, 1992), 6.

[195] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 57–58, 67–68.

[196] Gerber, 6–7. See also U.S. Congress, Senate, Committee on Governmental Affairs, *Environmental Issues at Department of Energy Nuclear Facilities*, 100th Cong., 1st sess., March 17, 1987, 1–15.

hearings. The other bills and the hearings in which they were debated presented a range of options both in the definition of the type of entity that would provide external oversight and in the level of authority it would have.

In defining the entity, one bill, H.R. 783, proposed putting the defense nuclear complex under NRC jurisdiction and oversight, rather than creating a new body or agency.[197] Other proposals, like S. 1085, envisioned a new oversight entity, but deviated to varying degrees from the approach of Glenn's bill. S. 1085 took the NRC as a model for such features of the oversight body as its composition, its mode of appointment, and its political balance. S. 1085 envisioned a board of multiple members—respected experts in nuclear safety (three members in S. 1085 rather than the NRC's five commissioners), appointment by the president with Senate approval, and party balance (with no more than two board members from one party). By contrast, one piece of legislation that elicited serious debate, H.R. 2047, Defense Nuclear Facilities Safety Agency Act, introduced in the House by Representative Norman Dicks (D–WA), proposed an oversight entity headed by a single administrator, appointed by the president with Senate approval.

More contentious than the type of entity—a board or an administrator-headed agency—that should perform oversight was the question of its level of authority. In the shorthand that developed throughout numerous congressional hearings, the question was whether the oversight entity should be advisory or regulatory in character. For the most part, the proposals that received serious consideration fell short of recommending full regulatory oversight.[198] While a number of environmental activists, including Alvarez and Dan Reicher of the National Resources Defense Council, favored NRC regulation of DOE nuclear facilities, most participants in the hearings, including representatives speaking for the NRC did not.[199] The NRC and others offered a number of objections to using the NRC as the oversight body, including resource constraints and the fact that commercial power reactors differed technically from DOE reactors and other production facilities. The NRC also begged off on the grounds that it had not previously had anything to do with weapons production, and thus lacked the capacity

[197] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 61–82.
[198] Interview, Richard. A. Azarro, Board general counsel, Washington, DC, August 20, 2008. On various regulatory possibilities, see Glenn Russell George, "Negotiated Safety: Intragovernmental Risk Regulation in the U.S. Nuclear Weapons Complex" (Ph.D. diss., Harvard University, May 1995) (accessed via Proquest).
[199] For the debate about the possibility of the NRC as the oversight body for DOE's nuclear facilities, see House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 166–219.

to address some of the issues of security that such oversight entailed.[200] The commission, according to an NRC spokesman, valued "the clear distinction between military and civilian uses of atomic energy . . . [and] would not want to see that distinction compromised."[201]

Although most proposals for oversight did not advocate a full-blown regulatory regime, the thrust of the bills on the table during the 1987 congressional hearings did favor powers that went well beyond the merely advisory. The sponsors of external oversight bills, including Dicks, Representative Ron Wyden (D–Oregon), and Glenn, as well as their other proponents, were generally adamant that they wanted oversight with "real teeth," rather than just another advisory body—another "toothless tiger"—whose advice could be ignored with impunity by the secretary of energy.[202] The powers of the oversight entities proposed by their bills were, in the words of one hearing witness, "regulatory-like," and of another, "advisory-plus."[203] In Dicks's bill, H.R. 2047, which was referred jointly to the House Armed Services and the Energy and Commerce Committees on April 9, 1987, one feature that represented "real teeth" was the authorization for the administrator to suspend operations or construction at new or existing defense nuclear facilities if he determined "that the health and safety of the public is not reasonably protected."[204] The bill also empowered the administrator to set safety standards on radioactive emissions, rather than merely to provide advice about standards, and required him to report to Congress every three months about DOE's compliance with the standards.[205]

Bolstering the Case for an Oversight Board with Strong Powers

In advancing such strong oversight provisions, the sponsors of bills such as H.R. 2047, H.R. 783, and H.R. 3123 bolstered their case by documenting DOE's failures to protect the environment and the health and safety of workers in, and residents near, DOE nuclear facilities. Proponents of strong oversight powers provided extensive testimony in hearings in various House and Senate committees throughout the 100th Congress, drawing upon a growing

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[200] Although the NRC had responsibility for some government-owned facilities, specifically reactors belonging to the armed services, these facilities were used for purposes other than weapons production, e.g., for research and medicine.
[201] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 175.
[202] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 33, 56. See also Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 56.
[203] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities,* 135, 310.
[204] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 90.

accumulation of damaging evidence about safety, much of it newly unclassified and made available to the public. Examples included recently released official records from DOE archives, personal records of former government officials, interviews with eyewitnesses, the series of GAO investigations, and studies by ad hoc panels, including the NAS review committee and the Roddis panel.[206] The testimony covered various types of safety, health, and environmental issues and deficiencies, such as plant conditions judged to pose catastrophic risks, elevated levels of cancers and other ailments among nuclear workers as shown by epidemiological studies, and disposal practices for nuclear and hazardous waste that had led to widespread contamination both onsite and beyond the boundaries of nuclear weapons production sites.[207]

Citing the Chernobyl accident, many witnesses focused on the possibility of a similar reactor disaster—an explosion or meltdown—and the structural problems and operating conditions that might contribute to it. Problems mentioned included the radioactivity-induced embrittlement of structures in the aging facilities that had led to cracking and radiation leaks. All of the reactors in the weapons complex, as many pointed out, were old—the last defense production reactor, the N-reactor, was completed in 1963—and only the reactors at the Savannah River site had containment vessels.[208] As one expert observed, "none of the military production reactors . . . had the pressurized steel and reinforced concrete containment building required by law for all civilian power reactors."[209] Some witnesses claimed that despite these defects of age and design, the reactors had long been run at potentially unsafe operating power levels and without strict adherence to nuclear material safety procedures or careful monitoring in the interest of production. For example, between 1979 and 1986, four reactors at Savannah River operated at power levels "substantially higher than what the emergency core cooling system

[205] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 92.
[206] On the increased information sources available by the late 1990s, see Gerber, v–viii.
[207] Evidence of serious safety, health, and environmental problems in the DOE nuclear complex continued to come to light in hearings throughout the 101st Congress, which was in session from January 1989 through October 1990, during the first two years of the administration of President George H. W. Bush. See, for example, a 1989 congressional summary of safety violations, mishaps, and near misses in the weapons complex, U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Oversight and Investigations, *Health and Safety at the Department of Energy's Nuclear Weapons Facilities*, 101st Cong., 1st session, June 1989, Committee Print 101–H.
[208] Ben A. Franklin, "Key U.S. Reactor to Shut 6 Months for Safety Moves," *New York Times*, December 13, 1986, 1.
[209] Kevin O'Neill, "Building the Bomb," in Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Washington, DC: Brookings Institution Press, 1998), 73.

could handle in an accident."[210] As witnesses questioning DOE's ability to manage risk pointed out, DOE only began reducing the reactors' power levels in late 1986, responding belatedly to the combined pressures of a National Academy of Sciences reactor study recommendation and the scrutiny of the Senate Governmental Affairs Committee.[211] In explaining DOE's delayed action, witnesses concurred, "production has been the overriding measure of performance"[212]

Besides reactors, other facilities flagged for questionable structural integrity and the potential for catastrophic radioactive releases were nuclear waste storage tanks throughout the defense complex. One witness, Alvarez, an aide to Senator Glenn, was particularly concerned about the potential for severe explosions in high-level nuclear waste storage tanks at Hanford, where a large proportion of the complex's millions of gallons of high-level radioactive liquid waste were stored. He feared the buildup of hydrogen gas in the tanks in the event of a failure of the tank ventilation system.[213] Such gas was generated by chemical reactions in the tanks' inadequately analyzed contents.[214] Alvarez noted that the potential for the explosive dispersal of radioactive materials in tanks was by no means hypothetical, mentioning just such a massive storage tank accident in Russia in 1957. The Mayak explosion dispersed enormous quantities of liquid radioactive waste, and contaminated several hundred square miles—an area later characterized as equal to the size of New Jersey.[215] This nuclear accident at Mayak, which killed many and forced the evacuation of 11,000 people, may have released twice the curies of the Chernobyl reactor accident.[216]

In addition to pointing out the potential risk of an explosive dispersal of radioactivity, hearing witnesses presented a record of non-catastrophic but significant radioactive releases and leaks, and cited conditions that had or could lead to the release of radioactivity, such as plant fires and faulty ducts or piping. A "raging," "nearly catastrophic" fire in 1969 in the plutonium-

[210] S. Rep. No. 100–173, at 9 (1987).
[211] S. Rep. No. 100–173, at 11 (1987).
[212] S. Rep. No. 100–173, at 10 (1987).
[213] Interview, Mansfield.
[214] Interview, Mansfield. The potential for a buildup of gas to an explosive level in the waste tanks at Hanford had been known for nearly a decade. Glenn became concerned when he heard that things were out of control at Hanford, specifically that lightly acidic nitric acid (used to control reactions) created ferrocyanide and generated hydrogen that had the potential to create an explosion.
[215] Defense Nuclear Facilities Safety Board, *FY 2008 Budget Request to the Congress* (Washington, DC, February 5, 2007), 4, http://www.dnfsb.gov/budget/budget_fy2008.pdf.
[216] Defense Nuclear Facilities Safety Board, *Strategic Plan: FY 2003–2009* (Washington, DC, November 17, 2003), 3, http://www.dnfsb.gov/pub_docs/dnfsb/rcsp_2003.pdf.

manufacturing building at DOE's Rocky Flats facility, for example, caused major accidental releases, leading to increased exposures to workers and nearby populations.[217]

Direct epidemiological evidence of health risks posed by the complex was as yet available only in limited amounts during the 100th Congress, and some witnesses viewed what was available with skepticism. They noted that DOE, with its near-monopoly on radiation health impacts research, was usually the source of data, and had a conflict-of-interest between its dual mission of developing radiation technologies and assessing their health impacts. Nonetheless, some cited DOE-sponsored epidemiological studies and worker health studies in support of their call for strong external oversight. DOE studies showed elevated risks of dying from cancer and other diseases in 12 groups of DOE radiation workers, e.g., excess death rates from leukemia among Rocky Flats workers exposed to plutonium.[218] Non-DOE studies had similar results, e.g., findings of the Du Pont Company, the contractor that had operated the Savannah River Site since it opened in 1952. Du Pont findings showed excess cases of leukemia among Savannah River Site workers—findings of which a Centers for Disease Control and Prevention (CDC) panel learned in 1983 and made DOE aware.[219] Witnesses testified also to widespread flouting of radiation protection policies in DOE facilities and to recommendations against informing workers if they exceeded official radiation exposure limits.

In addition to the focus on direct human health risks, a major topic in the hearings was DOE's record on environmental protection. Advocates of strong oversight powers acknowledged that environmental damage and health and safety issues were not exactly the same thing from a regulatory standpoint. However, witnesses saw them as "intrinsically related," and considered DOE's environmental carelessness to be indicative of a broader attitude of heedlessness to the negative consequences of nuclear weapons production. A widespread practice in the weapons complex, dating back to World War II, had been to use air, soil, ground, and surface waters as disposal media for massive amounts of radioactive and toxic pollutants. Ohio's Attorney General Anthony J. Celebrezze, Jr., for example, testifying about DOE activities and disposal practices at a uranium-enrichment complex, stated,

> During a ten-year period beginning in 1974, DOE pursued a policy of disposing some of its radioactive and solvent-contaminated waste oil by spreading it on the

[217] Ackland, 3, 86, 143–63.
[218] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 184.
[219] S. Rep. No. 100–173, at 5 (1987).

> ground and then roto-tilling it into the soil. About 50,000 gallons were disposed in this fashion. [220]

Such practices at that site and elsewhere had left a legacy of severe contamination problems in rivers, streambeds, soils, and underground aquifers. One witness summarized the evidence of contamination by saying, "DOE's record of policing itself is very, very sorry."[221] Many pointed out that such contamination would endure for millennia, and that cleanup, insofar as it was possible, would cost in the hundreds of billions of dollars.[222]

Much of the environmental damage and flouting of nuclear safety principles that was highlighted in the hearings had occurred despite the existence and efforts over the years of numerous advisory boards and panels to assist DOE and its predecessors. Thus, many witnesses advocating strong oversight bolstered their case not only by highlighting the magnitude and pervasiveness of DOE's safety problems, but also by documenting DOE's lack of responsiveness to mechanisms of safety oversight that were "merely" advisory. They cited numerous instances in which the advice of such advisory boards had simply been ignored, for example, the urgent recommendation of the Advisory Committee on Reactor Safety in the late 1950s, which called containment domes at the N-reactor "essential" to contain fission products in case of a severe reactor accident. Another example of long-ignored advice was the 1966 Trumble report, which called for major safety reforms and was kept under wraps for 21 years, until after the Chernobyl accident. Witnesses marshaled such examples to demonstrate that "foot-dragging on safety" would continue to be a problem as long as safety oversight was "toothless."[223]

Debating Glenn's Bill and How a Safety Board's Statutory Mandate Should Read

In the course of 1987, a consensus emerged that some kind of safety board should be established—a board that was continuous or permanent, rather than "ad hoc in nature," as the NAS, Roddis, and other panels had been. By May 1987, even DOE had conceded "the need to institutionalize independent oversight of DOE nuclear facilities."[224] As Under Secretary of DOE Joseph F. Salgado said, "Secretary Herrington took an historical step for the Department of

[220] S. Rep. No. 100–173, at 4–5 (1987).
[221] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 58.
[222] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 187.
[223] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 47.
[224] S. Rep. No. 100–173, at 11 (1987).

Energy. He endorsed the need for an independent advisory body to advise him."[225] The Senate Armed Services Committee, the committee of jurisdiction, was in agreement with DOE's endorsement when it took up debate about the particulars of a safety board in the fall of 1987. As Salgado said,

> The Governmental Affairs Committee, the GAO, and the NAS have all asserted that a safety board is needed to ensure that meeting production requirements does not overshadow the need for safe production. The Armed Services Committee agrees completely with that rationale.[226]

Of the legislative proposals put on the table in 1987, Glenn's version of oversight legislation—specifically Title I establishing a safety board—was the bill that continued to receive examination up to and through 1987 in both the House and Senate. The Senate Governmental Affairs Committee held four days of hearings on Glenn's entire bill between March and June 1987, reporting favorably on it in August and referring it on September 24, 1987, to the Senate Armed Services Committee, which had a five-member overlap with the Governmental Affairs Committee—Senators Glenn, Nunn, Carl Levin (D–Michigan), Jeff Bingaman (R–New Mexico), and William S. Cohen (R–Maine).[227] The Armed Services Committee assigned the safety board title of Glenn's bill to the Subcommittee on Strategic Forces and Nuclear Deterrence, the subcommittee of jurisdiction. Chaired by J. James Exon (D–Nebraska), the subcommittee held five days of hearings in October and November to debate the details of the safety board proposal and what an enabling statute for a safety board ideally should contain. At the conclusion of the hearings on S. 1085 in November 1987, the Armed Services Committee produced an amended version. Along with the Senate amendment, the committee authored the report of the Senate Armed Services on S. 1085, which proved to be the principal Senate committee report on the Board's enabling legislation.

The legislation under discussion in the numerous Senate hearings of 1987, S. 1085, Title I, Independent Nuclear Safety Board Oversight Over Department of Energy Facilities, would amend the Atomic Energy Act of 1954 to establish a Defense Nuclear Safety Board as an

[225] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 180.
[226] S. Rep. No. 100–232 (to accompany S. 1085), at 9 (1987).
[227] The Senate Governmental Affairs Committee reported out S. 1085 on September 24, 1987 as Senate Report No. 100–173, *Nuclear Protections and Safety Act of 1987*.

independent entity in the executive branch. The Board would have six main functions, as stated by Glenn,

> First, it will ensure that DOE's current health and safety standards are being implemented. Second, it will recommend changes in the content and application of DOE's standards. These recommendations are advisory, not mandatory. Third, it will investigate those events at DOE facilities which the Board determines to be important because of their actual or potential adverse effect on the public's health or safety . . . . Fourth, the board will recommend specific measures designed to reduce the likelihood of such events occurring.
>
> These recommendations must be administratively responded to in specific ways. Fifth, the board will issue periodic unclassified reports with its recommendations, as well as the decision to implement corrective steps at DOE facilities. Finally, the board shall be consulted and make recommendations to ensure that the design, construction, and health and safety standards of all new DOE facilities are appropriate, and that these standards are commensurate with standards that are imposed on comparable private sector facilities.[228]

S. 1085's articulation of the functions of the Board emphasized the tasks of investigation, recommendation, communication with the public, and review of the adequacy of safety standards. In calling for such review, the bill reflected approval of DOE's stated commitment to the goal of "comparability," that is, the goal of holding DOE facilities to the same level of safety as commercial nuclear facilities. Glenn underscored in testimony that the Board would fulfill an advisory, non-regulatory role and that its recommendations would be "advisory" rather than "mandatory" or "binding."[229] The proposed bill did not accord the Board some of the more intrusive or coercive powers proposed in other congressional bills, such as the power to *set* standards and the power to shut down operations or construction in the weapons complex. Glenn explicitly denied that his legislative proposal gave the Board the power to shut down operations, even if it determined some practice or procedure to be potentially injurious.[230] However, Glenn's proposal featured elements that advocates of a strong safety body considered crucial, as GAO Assistant Comptroller General J. Dexter Peach, stated,

> We believe that any oversight approach, to be effective, should have five key elements: independence, technical expertise, ability to perform reviews of DOE

[228] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities,* 69.
[229] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 55, 61.
[230] The assurance that the Board could not stop production was crucial to the Senate Armed Services Committee and others with a national security mandate, as the Board's current general counsel, Richard. A. Azzaro, emphasized in an interview, Washington, DC, August 20, 2008.

> facilities as needed, clear authority to require DOE to address the organization's findings and recommendations, and a system to provide public access to the organization's findings and recommendations. The legislation you [Senator Glenn] have submitted creating a Nuclear Safety Board does address each of these elements.[231]

Of the "five key elements" that Peach listed, S. 1085 embodied three in a manner that did not elicit a great deal of debate in the fall 1987 Senate Armed Services Committee hearings from either proponents or critics of the bill as written. The three relatively uncontroversial elements were the requirements for technical expertise, public openness, and onsite review powers. Like the other legislation proposing a safety body, including the legislation ultimately adopted, S. 1085 called for an oversight board that consisted of technical experts. Its members were to be—in the wording of both Glenn's bill and the Board's ultimate enabling legislation—"respected experts in the field of nuclear safety." S.1085 also mandated that the oversight board make its findings and recommendations public, and endowed it with investigative powers and tools, including such tools as the power "to issue subpoenas commanding the testimony of witnesses and the production of evidence."[232]

More controversial than S. 1085's handling of three of the five elements mentioned by Peach was its handling of the remaining two, "independence" and the "authority to require DOE to address the organization's findings and recommendations." Some of the characteristics that could be construed as guaranteeing the Board's independence were unproblematic to hearing participants, for example, the idea that the members of the Board would be appointed by the president rather than by the secretary of energy. Although Secretary of Energy Herrington backed the idea of secretarial appointment, most hearing participants, including critics of S. 1085, accepted its proposed mode of appointment—by the president with Senate approval.[233] They also accepted the premise of S. 1085 that independence meant security of tenure for the Board members for fixed (staggered) terms of office. The members were not to be subject to removal at will by either the secretary of energy or the president.

A worrisome dimension of "independence" that DOE representatives and other critics saw in S. 1085, however, was the leeway that the Board members apparently would have to set

[231] S. Rep. No. 100–173, at 11 (1987).
[232] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 39.
[233] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 53.

the safety agenda, i.e., unilaterally to define the safety issues that they would pursue and to define the standard or level of safety they could demand of DOE for a given activity or facility. Some witnesses envisioned that the Board would pursue safety improvements that might be heedless of the secretary of energy's need for production and unconstrained by considerations such as technical feasibility or cost. A related worry for some critics focused on the authority the Board would have, in Peach's words, to "require DOE to address" the Board's findings and recommendations. Some critics envisioned an undue degree of coercive power by which the Board could force the secretary of energy to act in accordance with the Board's will, regardless of his own judgment about the proper balance of safety and national security–driven production.

Such concerns about the Board's independence and authority were the main themes of the fall 1987 hearings in the Senate Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence. Advocates of Glenn's bill, including Glenn, confronted representatives of DOE and the Reagan administration defense establishment, who, while conceding the need for a safety board, were anxious to confine its powers within tighter bounds than S. 1085 seemed to mandate. At the same time, they recognized that DOE and the weapons complex faced an increasingly negative public mood, which only a safety body with a convincing measure of independence and authority was likely to assuage. Restoring public confidence that DOE could operate the weapons complex safely was a *sine qua non* for the ambitions that DOE and the defense establishment still harbored for the complex in late 1987. DOE aimed to restore its greatly diminished production capacity and to modernize it, in order to continue the production of nuclear materials and weapons. At that time, production was in a state of near-collapse. The N-reactor was shut down and the prospect for reopening it was dim, as was the prospect for restoring the production reactors at Savannah River to full power. The Savannah River reactors were the nation's sole source of tritium, an indispensable, but perishable initiator material in nuclear weapons.[234] Short of being able to replenish the stores of tritium, which has a half-life of only 12 years (in contrast to plutonium's half-life of 24,000 years), the nation, it was argued,

[234] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 53. See also Gerber, 4. The Savannah River Site was the nation's sole producer of tritium, the hydrogen isotope that increases the explosive yield of thermonuclear weapons. Decaying about 5 percent a year, it must be periodically replenished in nuclear weapons. The end of the Cold War and the arms control agreements to reduce nuclear arsenals eliminated any immediate need to produce new tritium. To support the nation's enduring stockpile, existing tritium was recovered and recycled, mostly from decommissioned weapons.

would be "unilaterally disarming."[235] Exon, as chair of the subcommittee hearings, summarized the aims and challenges of DOE and its supporters,

> The Department of Energy has a difficult mandate to fulfill in the nuclear area. It must maintain our Nation's ability to produce critical nuclear materials with the schedule set forth annually in the President's stockpile memorandum, yet it operates under the mounting constraint of aging facilities, limited budget and some political hostility to its primary mission.[236]

Those on the Armed Services Committee who argued on national security grounds for refurbishing and modernizing the nuclear weapons complex were cognizant that what Exon termed "political hostility" could jeopardize their aims, making it more difficult, among other things, to argue successfully for the congressionally approved budgetary increases that modernization projects would require.[237] "Political hostility" and public concern had by no means reached their highest point at the time of the hearings in late 1987. A year later, in the last three months of the Reagan presidency, in-depth national media coverage brought home to the public the full magnitude of the safety problems and environmental contamination associated with DOE's nuclear complex. DOE's problems were the topic of numerous stories in major newspapers and television news, including 85 articles in the *New York Times*, 39 on the front page.[238] In 1987 public and media concern about the DOE nuclear complex was growing as the salience of national security arguments for further nuclear arms production was receding. Nuclear arms reduction talks and nuclear arsenal downsizing, underway by the fall of 1987, rendered the need for further production of nuclear materials more questionable. Former Secretary of Energy Herrington was famously quoted as saying "We are awash in plutonium."[239]

In the transitional historical and policy context of 1987, in which modernization of the nuclear complex was still a plausible but not a certain prospect, modernization's advocates were thrown into a somewhat defensive position in addressing how the law should empower the safety

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[235] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 4.
[236] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 54.
[237] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities,* 82–83.
[238] George, 67. See also William Lanouette, *Tritium and the Times: How the Nuclear Weapons-Production Scandal Became a National Story*, Research Paper R–1 (Cambridge, MA: Joan Shorenstein Barone Center for the Press, Politics and Public Policy, John F. Kennedy School of Government, Harvard University, May 1990), 7–9.

board. They needed a board sufficiently empowered to improve the public's confidence in DOE's ability to manage the complex safely, but not so empowered as to be able to dictate to the secretary of energy or to veto actions he deemed necessary for the accomplishment of DOE's defense mission. In making their case, they argued that there was no need to go overboard in granting oversight powers, because DOE under Herrington had over several years already demonstrated significant improvement in its responsiveness to safety panels with "mere" advisory powers.[240] In addition, they countered with the argument that the past and present deficiencies in safety management were less dire than DOE's critics made them seem. Such criticism, they said, produced an exaggerated picture of such deficiencies by conflating the environmental and safety records of the DOE complex.

The advocates of the complex's refurbishment readily conceded that the environmental legacy of the complex was egregious and the physical conditions of the plants seriously run-down. Speaking of "the environmental waste problem that has been building up since the Manhattan Project," they said,

> There is no question that the defense nuclear complex's managers made serious mistakes, beginning years ago, in ignoring the long-term implications of disposal practices for radioactive and toxic waste. The magnitude of the problem, although not yet fully documented, is enormous.[241]

In conceding this, modernization advocates anticipated that they would need in the upcoming year to cite the poor condition of DOE facilities to argue for enormous budgetary increases for renovation and cleanup of the nuclear complex. However, they insisted that the admittedly deplorable environmental record of the obsolescent complex should be distinguished from the actual safety record. They cited performance measures, such as rates of incidents, accidents, injuries, lost work days, and radiation exposure regulatory violations to argue that DOE's safety record, as opposed to its environmental record, was not bad, or was even "excellent."[242] DOE had not put the public at excessive risk, and it could claim an improved record in occupational safety, as demonstrated by, for example, a reduction of radiation exposures to workers since

[239] Interview, Sherri Wasserman Goodman. See also Keith Schneider, "Nuclear Arms and New Jobs Clash in Idaho," *New York Times,* March 27, 1988, http://query.nytimes.com/gst/fullpage.html?res=940DEEDC1530F934A15750C0A96E948260&sec=&spon=&pagewanted=print.
[240] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 179.
[241] S. Rep. No.100–232, at 9 (1987).
[242] S. Rep. No.100–232, at 8 (1987).

1974.[243] Thus, the safety board, whose mission was to induce reductions in radiological risk, not environmental cleanup, did not need the degree of coercive power that some critics of DOE wanted. The environmental issues of the complex were already well covered by strong regulatory mechanisms wielded by EPA and sanctioned by the RCRA and other environmental laws. As the report of the Senate Armed Services Committee on S. 1085 stated,

> Environmental matters in DOE—the management of waste operations and the cleanup of existing waste sites—are already heavily regulated by EPA and the states under the Superfund and RCRA legislation.[244]

Such environmental issues did not justify magnifying the powers of the Board beyond the advisory and non-regulatory.

The assurance that these advisory powers would not be "toothless" or a mere "jawboning" exercise lay, according to DOE representatives, in several of the requirements for which the Board's enabling statue would provide. One requirement was that the Board's interactions with DOE be transparent and open to the public. According to Undersecretary of DOE Salgado, public scrutiny was a sufficient constraining power to compel the secretary of energy to take the Board's advice seriously. The public airing of issues and of DOE–Board deliberations would remedy the old problem with advisory committees, namely, that DOE could ignore their recommendations with impunity. Moreover, in addition to the requirement for openness, DOE would be required to respond to the receipt of a Board recommendation in a specified period of time and through a specified series of actions as specified in the statute. The prescribed administrative procedures for a formal response by DOE to the Board, combined with the requirement of openness to the public, obviated the need for the Board to have statutory powers by which it could, for example, mandate that DOE follow its recommendations. The secretary of energy could remain the final decision-maker, retaining the ultimate responsibility to accept or decline advice.

In constantly reiterating that the Board's powers should be advisory only, the intent of DOE and Department of Defense spokesmen before the Armed Services Committee was to stand against the arbitrary and excessively stringent authority that S. 1085, in their reading, allowed the

[243] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 169.
[244] S. Rep. No. 100–232, at 19 (1987).

Board. In November 1987, as the committee was drafting its amended version of S. 1085, Title I, it listed as particular areas of concern,

> Investigative priorities of the Board, the risk standards to be applied by the Board, and the mechanisms for consideration and disposition of the oversight Board's recommendations to the Secretary of Energy. Other areas of concern include the facilities under the Board's purview and the extension of the Board's responsibility to environmental matters.[245]

With respect to the problems of defining priorities and acceptable standards of risk, the critics of S. 1085 charged that the bill was vague in a way that left the Board free to be unduly strict in identifying the safety issues and risks that required attention. The fear was that the Board could focus on relatively minor safety deficiencies or remote dangers, rather than on matters that posed an imminent danger or "undue risk." Referring to how S. 1085 could be construed, the report of the Senate Armed Services Committee stated,

> The risk of an incident with minor adverse effects, such as an accidental release of small amounts of toxic or radioactive substances, potentially has the same standing as the risk of catastrophic adverse effects, such as an accident on the scale of the Chernobyl reactor disaster.[246]

The concern about the potential for such a broad interpretation of risk was aggravated by the uncertain state of the weapons complex in 1987. The weapons complex was in a deteriorated condition and had innumerable deficiencies upon which a safety oversight body could focus. DOE saw in this situation the potential for Board interference in a key task DOE would face as long as it still had the dual mission of ensuring production and safety. The task was to weigh the tradeoffs between backfits that would improve the safety of old production facilities and building new facilities. DOE needed continually to determine if it was "better to husband limited resources to replace existing facilities rather than continue to make marginal improvements to obsolete plants."[247] The Armed Services Committee did not want a safety body that would effectively preempt the secretary of energy's decision-making responsibility and force a choice of safety upgrades of old plants or their shutdown. Even if the Board itself, made up of serious technical experts, could be counted on to avoid focusing on minor safety issues, the critics of S. 1085 suggested that the bill's vague language could create "a potential field day for outside intervenors," inviting lawsuits from citizen groups that were hostile to the mission of the

[245] S. Rep. No. 100–232, at 3 (1987).
[246] S. Rep. No. 100–232, at 12 (1987).
[247] S. Rep. No. 100–232, at 18 (1987).

weapons complex.[248] Such outside parties, welcoming the continuing closure of DOE's nuclear facilities, "might seek to compel the Board to exercise its full legal mandate and powers."[249] As the committee's report stated,

> Even if the Board does not choose to interpret its mission in these terms . . . third parties might seek to enforce their interpretation of the Board's mandate and duty through litigation.[250]

The committee report stressed the committee's desire for statutory language that would leave no doubt as to the Board's obligation to focus on major safety deficiencies and imminent dangers. It stated,

> It is important that the Board be supplied with a sense of priority, and be focused on significant risks and consequences to public health . . . . The Committee categorically rejects any concept of "zero risk' or minimizing all risk of harm.[251]

As a model for defining acceptable standards of risk, the critics of S. 1085 pointed to the NRC's application to commercial facilities of the concept of "adequate protection of public health and safety," a concept equivalent to DOE's "avoidance of undue risk." As set forth in the Atomic Energy Act and Nuclear Regulatory Commission regulations, the broad adequate protection standard fell short of requiring absolute protection. The committee report stated,

> As applied to commercial facilities, the standard of adequate protection means "reasonable assurance that the health and safety of the public will not be endangered by the operation of the facility." (10 C.F.R. 50.35(c)). Absolute certainty or perfect safety is not required.[252]

The committee endorsed the "adequate protection" standard as the standard to be written into the Board's enabling statute, while acknowledging that the translation of the broad standard into concrete requirements would differ for defense and commercially licensed nuclear facilities to the extent that the facilities themselves differed. The committee stated,

> It is appropriate to require the same general level of safety from DOE nuclear facilities as is required of commercial facilities. The Committee recognizes that specific quantitative and qualitative standards for achieving adequate protection may not necessarily be the same as those applied to commercial facilities, to the extent DOE and commercial facilities are significantly different.[253]

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[248] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 318.
[249] S. Rep. No. 100–232, at 18 (1987).
[250] S. Rep. No. 100–232, at 13 (1987).
[251] S. Rep. No. 100–232, at 20 (1987).
[252] S. Rep. No. 100–232, at 24 (1987).
[253] S. Rep. No. 100–232, at 23 (1987).

In endorsing this adequate protection standard, the committee aimed to ensure that the Board's pursuit of safety or risk reduction could be tempered by considerations of cost and technical feasibility. S. 1085 could be interpreted to disallow such considerations in the Board's formulation of its advice about safety. For the committee, once the "adequate protection" standard was satisfied, such considerations could and should come into play. If higher than "adequate" levels of protection were sought, they needed to be justified by a technical or economic feasibility test. Concerned about an insufficient differentiation between serious and minor or remote safety issues, the committee called, for "cost-benefit analyses that might filter out recommendations that are expensive but confer little benefit in terms of reduced risk to the public."[254] Supporting this view of the adequate protection standard, the final Board enabling legislation of 1988 read, "In making its recommendations, the Board shall consider technical and economic feasibility of implementing the recommended measures."

In addition to the concerns about S. 1085's treatment of risk standards and priorities, another major concern of the bill's critics on the Armed Services Committee was its methods for the handling of Board recommendations—the Board's primary regulatory tool—upon their receipt by the secretary of energy. For the critics, the proposed legislation rendered a class of Board recommendations—those dealing with the prevention of "events"—effectively mandatory or binding on the secretary, rather than advisory. In the critics' reading, the secretary could not reject such recommendations without making a case to the president and receiving presidential concurrence in their rejection. This provision for presidential review of secretarial dissents threatened to "permit minor safety issues to be elevated to the President."[255]

As the committee report summarized their view of S.1085's shortcomings taken together,

> The Board is permitted to recommend any measure that the Secretary is unable to prove is not infeasible, regardless of cost, so long as it reduces the chances of even remote events, which could have only negligible adverse consequences for the public health and safety from occurring.[256]

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[254] S. Rep. No. 100–232, at 16 (1987).
[255] S. Rep. No. 100–232, at 18 (1987).
[256] S. Rep. No.100–232, at 13 (1987). In a similar vein, Senator John W. Warner (R–VA), during confirmation hearings for the inaugural Board members in late 1989, caricatured as heavy-handed regulation what had been averted with the modification of Glenn's original proposal. Warner said,

> The Defense Nuclear Facilities Safety Board was born in some controversy in 1987. The original proposal would have given the Board the responsibility to apply the absolute highest achievable standards of safety, no matter how small the incremental improvement nor how high the cost to all defense nuclear facilities, including those whose safety was already regulated.

Senator Glenn took exception to this reading of S. 1085. In testimony about its provision for presidential adjudication in case of an unsatisfactory secretarial response, he denied that the provision's intent was to involve the president in minor matters, bypassing the secretary. Rather, he proposed presidential review—"bucking [a disputed matter] up to the President"—as a safeguard against a situation, expected to be rare, in which the secretary and the Board disagreed about a safety matter that the Board deemed important or urgent.[257] The provision for presidential review would give the Board legal recourse, supplementing the other provisions in the Board's enabling legislation that were designed to ensure the secretary take Board advice seriously. Glenn was unwilling to put as much weight as did DOE representatives on the efficacy of the public airing of issues, on the grounds that much of what DOE and the Board needed to discuss remained classified and thus out of the public eye. He held out for presidential review in order to guarantee that a rejection of a Board recommendation by the secretary would not simply end the matter. He saw such review as a means to give the Board "authority to require action on its recommendations or findings."[258] Others saw his provisions for presidential review as needlessly constraining, likely to foster an adversarial spirit in Board–DOE interactions, and possibly counterproductive to the kind of cooperative interaction needed to address highly technical problems in the nuclear weapons complex.

In the end, the Board's enabling legislation softened Glenn's original proposal for presidential review, explicitly limiting the requirement for presidential involvement to circumstances in which a Board recommendation pertained to an "imminent or severe" situation or matter. The committee report spelled out an example of a situation in which the "imminent or severe" provisions of the Board's enabling legislation might be invoked, the case of the Savannah River reactors, which had been discovered to be operating at excessive power levels. In such an urgent case, the Board was charged with notifying the secretary and the president. The president could also become involved if implementing a Board recommendation would be precluded by budgetary constraints or by the necessity "to meet the annual nuclear weapons stockpile requirements."[259] In cases in which implementation was "impracticable" for these reasons, the president could be given a report and the "opportunity to review the determination of

[257] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 315.
[258] S. Rep. No. 100–232, at 21 (1987).

the Secretary of Energy, as appropriate, to ensure that budgetary constraints and materials requirements are properly balanced with safety concerns."[260] In ordinary circumstances, a secretarial rejection of a Board recommendation would not trigger presidential involvement. As articulated in the Board's enabling statute, which echoed the Senate amendment, a Board recommendation would normally be routed to the secretary and then to committees of Congress, specifically, the Senate Committees on Armed Services and Appropriations, and the Speaker of the House of Representatives. If the secretary were to reject a Board recommendation, it would go back to the Board for reaffirmation or revision, and then to Congress.

Beyond the concerns of S. 1085's critics about its proposed mechanisms for the disposition of recommendations and its handling of risk standards, a further concern was the scope of Board jurisdiction that S. 1085 seemed to sanction, in particular, the extension of the Board's jurisdiction to environmental remediation or cleanup. As the committee report noted, "Title I of S. 1085 could be construed as opening the door to the proposed safety board to inject itself in the waste regulator process."[261] The committee argued for confining the Board's mission to the oversight of public health and safety *per se*, while recognizing that the line between safety and health issues and environmental issues was fuzzy and, possibly, liable to ongoing adjustment. The committee report stated,

> The Committee believes that it is both unnecessary and inappropriate to extend a safety board's mandate to include environmental restoration matters. This belief stems not from a view that the Department's environmental problems are unimportant or insignificant in scope; nor does the Committee deny that the distinction between safety issues and environmental issues can in some instances be blurred. The Committee emphasizes, however, that a distinction exists, and that other legislative remedies and oversight of environmental problems are already in existence . . .
>
> Given the existence of a comprehensive regulatory regime, it is not necessary to assign an environmental oversight role to a safety board. For one thing, the technical issues are quite different, requiring different—and additional—expertise within the Board. Second, it would needlessly dilute the focus and mission of the Board. Third, insofar as the Board's basic mission is to ensure that, in satisfying production requirements, the commitment to safety is not compromised, it is hard to discern a rationale for including environmental restoration in the Board's

[259] S. Rep. No. 100–232, at 26 (1987).
[260] H.R. Rep. No. 100–989, at 491 (1988) (Conf. Rep.).
[261] S. Rep. No. 100–232, at 9 (1987).

> charter or for citing environmental problems in the justification for creating the Board in the first place.[262]

The Board's 1988 enabling statute did not expressly include "environment" with the term "public health and safety" in the Board's statutory grant of jurisdiction. The committee allowed, however, that the Board could consider environmental issues related to "on-going production operations" when the Board saw connections with public health and safety issues. Elaborating on this point, the committee report identified "unintended releases" of radioactivity as an appropriate issue for Board oversight, while most environmental restoration and cleanup would be conducted under the jurisdiction of other segments of the government and pursuant to other laws. The report stated,

> The distinction between safety and environmental issues, in the Committee's view, should be that safety includes unintended releases from on-going production operations, which is a concept that would exclude normal waste management operations and remedial actions associated with existing waste storage sites. The Committee stresses that a safety board should not be prohibited outright from crossing that potentially elusive line; the Committee seeks only to clarify its intention that safety of production operations must be the Board's primary concern.[263]

By the time that the Board's enabling legislation was finalized, it further clarified how far the Board jurisdiction reached on issues of storage and waste cleanup of nuclear waste. The Board's jurisdiction was explicitly said to encompass certain DOE "nuclear waste storage facilities," such as high-level nuclear waste tanks at Hanford and Savannah River, but not NRC-licensed facilities, such as the Yucca Mountain repository. The waste tanks were and remained a major focus of concern about "unintended releases," which qualified as a Board issue because of the inextricability of danger to public health and safety and to the environment.

THE BOARD'S ENABLING STATUTE AND LAUNCH

The Senate amendment of S. 1085 addressed to the satisfaction of the bill's critics the main issues that they found problematic in Senator Glenn's original formulation. The amendment was completed with the expectation that substantially similar legislation would be enacted, and the Board set up, in early 1988. However, the amendment languished for some

[262] S. Rep. No. 100–232, at 19–20 (1987).

months, until it was reincarnated without major change as provisions of H.R. 4481. H.R. 4481's provisions establishing the Board, in turn, were incorporated, after discussion and minor changes in conference, into the Department of Defense authorization bill for fiscal year 1989.[264] Public Law No. 100-456, National Defense Authorization Act, Fiscal Year 1989, received final congressional approval from the House and Senate on September 28, 1988, and President Reagan signed into law the authorization act on the next day.[265] Pub. L. No. 100-456, Section 1441, amended the Atomic Energy Act of 1954 by adding a new chapter: "Chapter 21. Defense Nuclear Facilities Safety Board," which created the Board. Capping almost two years of movement through Congress, "the new provisions inserted into the Atomic Energy Act represented the most extensive modification of that statute since the Energy Reorganization Act of 1974."[266]

The enabling statute of the Board that emerged from Congress in late 1988 embodied modifications that S. 1085's critics saw as more conducive than S. 1085 to the development of a consultative, non-adversarial relationship between the Board and DOE.[267] The idea that the Board's primary mission was to *assist* DOE appeared repeatedly throughout the Senate report on S. 1085, the report that elaborated most fully on the intent of Congress in creating the Board. The report spoke of "establishing this institutional mechanism to assist DOE on safety matters."[268] This shift of emphasis in the thrust of the statute to *assisting* DOE reflected a key preference of the Armed Services Committee and its chair, Senator Sam Nunn.[269] Once the shift of emphasis was achieved, much of the remainder of the statute was not far out of line with what Glenn had originally proposed. The Board's enabling statute followed in broad outlines, for example, S. 1085's definition of the Board's makeup and functions. The enabling statute retained S. 1085's specification of technical expertise as a requirement for appointment to the Board. It stipulated a Board made up of five civilians appointed to staggered renewable five-year terms by the president from among U.S. citizens who were "respected experts in the field of nuclear safety

[263] S. Rep. No. 100–232, at 9, 19–20 (1987).
[264] H.R. Rep. No. 100–989 (1988) (Conf. Rep.).
[265] For the full text of this law, see *National Defense Authorization Act, Fiscal Year 1989*, Pub. L. No. 100–456, Title XIV, Part D, 102 Stat 1918, September 29, 1988.
[266] Defense Nuclear Facilities Safety Board, *Report to Congress on the Role of the Defense Nuclear Facilities Safety Board Regarding Regulation of DOE's Defense Nuclear Facilities* (Washington, DC, November 1998), 2, http://www.dnfsb.gov/pub_docs/dnfsb/rc_199811.pdf.
[267] Interview, Mansfield.
[268] S. Rep. No.100–232, at 10 (1987).
[269] George, 115.

with a demonstrated competence and knowledge relevant to the independent investigative and oversight functions of the Board."[270] The statute preserved the elements of independence for the Board, empowering it to set its own agenda, rather than to have its topics of inquiry assigned by the secretary of energy. In defining primary Board functions, the statute identified five, ordering them slightly differently from S. 1085's six. The Board's specific duties and responsibilities were delineated in Chapter 21, Section 312, of the Atomic Energy Act of 1954, "Functions of the Board," which stated, "The Board shall perform the following functions":

> **(1) Review and evaluation of standards.—**The Board shall review and evaluate the content and implementation of the standards relating to the design, construction, operation, and decommissioning of defense nuclear facilities of the Department of Energy (including all applicable Department of Energy orders, regulations, and requirements) at each Department of Energy defense nuclear facility. The Board shall recommend to the Secretary of Energy those specific measures that should be adopted to ensure that public health and safety are adequately protected. The Board shall include in its recommendations necessary changes in the content and implementation of such standards, as well as matters on which additional data or additional research is needed.
>
> **(2) Investigations.**
>
> **(A)** The Board shall investigate any event or practice at a Department of Energy defense nuclear facility which the Board determines has adversely affected, or may adversely affect, public health and safety.
>
> **(B)** The purpose of any Board investigation under subparagraph (A) shall be—
>
> **(i)** to determine whether the Secretary of Energy is adequately implementing the standards described in paragraph (1) of the Department of Energy (including all applicable Department of Energy orders, regulations, and requirements) at the facility;
>
> **(ii)** to ascertain information concerning the circumstances of such event or practice and its implications for such standards;
>
> **(iii)** to determine whether such event or practice is related to other events or practices at other Department of Energy defense nuclear facilities; and
>
> **(iv)** to provide to the Secretary of Energy such recommendations for changes in such standards or the implementation of such standards (including Department of Energy orders, regulations, and requirements) and such recommendations relating to data or research needs as may be prudent or necessary.
>
> **(3) Analysis of design and operational data.—**The Board shall have access to and may systematically analyze design and operational data, including safety analysis reports, from any Department of Energy defense nuclear facility.

[270] Pub. L. No. 100–456, Section 1441(a), 102 Stat 1918, 2076; this new language became chapter 21, Section 311(b) of the Atomic Energy Act of 1954 (42 USC 2011 et seq.).

> **(4) Review of facility design and construction.—**The Board shall review the design of a new Department of Energy defense nuclear facility before construction of such facility begins and shall recommend to the Secretary, within a reasonable time, such modifications of the design as the Board considers necessary to ensure adequate protection of public health and safety. During the construction of any such facility, the Board shall periodically review and monitor the construction and shall submit to the Secretary, within a reasonable time, such recommendations relating to the construction of that facility as the Board considers necessary to ensure adequate protection of public health and safety. An action of the Board, or a failure to act, under this paragraph may not delay or prevent the Secretary of Energy from carrying out the construction of such a facility.
>
> **(5) Recommendations.—**The Board shall make such recommendations to the Secretary of Energy with respect to Department of Energy defense nuclear facilities, including operations of such facilities, standards, and research needs, as the Board determines are necessary to ensure adequate protection of public health and safety. In making its recommendations, the Board shall consider the technical and economic feasibility of implementing the recommended measures.[271]

The statute provided a plethora of means to facilitate the Board's performance of its oversight functions. The Board was authorized to hire up to 100 staff and to contract for additional expertise. To pursue investigations and gather facts, the Board was given broad latitude to conduct inspections and special studies, to hold hearings, and to subpoena evidence and witnesses. It was empowered to establish reporting requirements for DOE. The statute enjoined DOE, along with its contractors, to "fully cooperate with the Board and provide the Board with ready access to such facilities, personnel, and information as the Board considers necessary to carry out its responsibilities."[272] The Board could also secure assistance from other government agencies, from the scientific community and industry, and from public interest groups. At the same time that the Board was given unhindered access to the information it needed to assist DOE, the Board was obliged to establish systems to provide public access to its findings and recommendations, as well as many of its deliberations. The statute emphasized the Board's accountability to Congress, and made provision for the Board to report to it at least annually. In case the statute's provisions proved to be framed too cautiously, and gave the Board insufficient authority, the statute provided for a future review and the possibility of its own

[271] Pub. L. No. 100–456, Section 1441(a), 102 Stat 1918, 2077–78; this new language became chapter 21, Section 312 of the Atomic Energy Act of 1954. See also Defense Nuclear Facilities Safety Board, [First] *Annual Report to Congress* (Washington, DC, February 1991), 3, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/ar_1991.html.

revision.[273] The legislation said that the very question of the Board's value would be revisited in five years, at which time the Board was required to provide an assessment of whether its authority was sufficient, whether stronger regulatory powers, such as enforcement powers, were necessary, and whether the Board had enhanced the safety of operations in the nuclear weapons complex.

Challenges Grow in the Year Preceding the Board's Start-up

With the enactment of the Board's' enabling statute, the stage was set for the first steps in the Board's launch—the selection, nomination, and confirmation of its inaugural members. These activities occupied nearly a year, with the nominations by the new president, George H.W. Bush, in August 1989, Senate hearings and confirmation in October, and the start of operations on October 18, 1989. In the meantime, during the year that transpired for these activities, uncertainties and turmoil related to the nuclear weapons complex escalated on a number of fronts—in Congress, in the media, and at DOE—magnifying the challenges the inaugural Board members would face in their initial operating environment.

In Congress, hearings and investigations by various oversight committees continued in the final several months of the Reagan administration and throughout the 101st Congress.[274] Among the results of these congressional activities was an early proposal to amend the enabling statute of the Board to give it enforcement powers and broaden its jurisdiction. Drafted by Representative David E. Skaggs (D–Colorado) in 1989 and favored by other early House supporters of strong Board authority, such as Representative Ron Wyden, the amendment was debated in a House Armed Services subcommittee.[275] At the confirmation hearings for the Board members, Glenn, who referred to the Board's enabling statute as "a scaled-down version of my

[272] Pub. L. No. 100–456, Section 1441(a), 102 Stat 1918, 2080; this new language became chapter 21, Section 314 of the Atomic Energy Act of 1954.
[273] Interview, Mansfield. This provision to revisit the legislation after five years served to assuage Glenn and others, still uneasy about the whether the Board's statutory powers were sufficiently strong.
[274] Schwartz, "Congressional Oversight of the Bomb,"501. The House Armed Services Committee was especially active in investigating safety issues in the DOE weapons complex, with various panels and subcommittees holding 15 hearings in 1989, and an additional large number between 1990 and 1992. Thereafter, congressional interest in the issues slackened greatly.
[275] U.S. Congress, House of Representatives, Committee on Armed Services, Subcommittee on Procurement and Military Nuclear Systems and Department of Energy Defense Nuclear Facilities Panel, *Hearings on National Defense Authorization Act For Fiscal Year 1990—H.R. 2461 and Oversight of Previously Authorized Programs:*

proposal," mentioned his own intention "to continue my legislative efforts to strengthen and expand the role of the safety Board."[276] Besides contemplating amendments, Congress also documented in ever-greater detail the safety and environmental hazards to which DOE's nuclear facilities had exposed the country. For example, the Senate Governmental Affairs Committee produced an historical report, *Early Health Problems of the U.S. Nuclear Weapons Industry and Their Implications For Today*, showing that senior officials responsible for the DOE nuclear complex had been aware of serious public health problems arising from worker exposure to high radioactivity levels. According to the authors of this report, between 1947 and 1954, the AEC knew of such problems at several facilities, most notably, Hanford. The report also claimed that a CDC panel had learned of Du Pont Company findings on excess cancers among workers—excess leukemia rates at the Savannah River Site, increased risk of cancer death due to radiation exposures at the Oak Ridge National Laboratory, and cancer deaths at Rocky Flats that rose with increasing plutonium exposures. The findings included the observation that DOE's long-standing concern over legal liability had significantly inhibited its safety and health research.[277]

The continuing focus of Congress on hazards in the DOE nuclear complex contributed, in turn, to unprecedented media attention, fueling the media alarm that reached the level of a "crusade," as one observer put it, in late 1988 and in the first year of the Bush administration.[278] The trigger for the crusade was a joint House-Senate hearing held a day after the Board's enabling legislation became law.[279] Co-chaired by Senator Glenn and Representative Mike Synar (D–Oklahoma), the hearing released a 1985 Du Pont memo that "offered the first public details

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Department of Energy Modernization Study and Department of Energy Defense Programs, 101st Cong., 1st sess., February 21, 24, March 13, 20, 21, April 3, 6, 13, 26, May 9, 16, 23, 24, June 6, July 18, 1989, 1955–63.

[276] For the confirmation hearings on Board members, see U.S. Congress, Senate, Committee on Armed Services, *Nominations Before the Senate Armed Services Committee, First Session*, *101st Congress,* March 14, 16, April 5, 18–19, May 3, 4, 16, 18, June 22, July 31, August 3, September 7, 8, 20, October 6, 17, November 7, 9, 20, 1989, 722.

[277] U.S. Congress, Senate, Committee on Governmental Affairs, *Early Health Problems of the U.S. Nuclear Weapons Industry and Their Implications for Today,* 101st Cong., 1st sess. (Comm. Print, 1989).

[278] On heightened media coverage, see Terrence R. Fehner and Jack M. Holl. *Department of Energy, 1977–1994: A Summary History* (Washington, DC: U.S. Department of Energy, November 1994), 50, http://www.osti.gov/bridge/servlets/purl/10106088-mgIkuD/webviewable/10106088.PDF.

[279] See U.S. Congress, House of Representatives, Committee on Government Operations, Subcommittee on Environment, Energy, and Natural Resources, and Senate Committee on Governmental Affairs, *Nuclear Reactor Safety at the Department of Energy's Savannah River Plant,* 100th Cong., 2d sess., September 30, 1988, 1–51, 193–222.

of 30 serious accidents" at the Savannah River Site's nuclear reactors.[280] The environmentalist Alvarez, Glenn's "media-savvy aide," was given the memo in mid-September while preparing a DOE witness for the hearing.[281] After the *New York Times* broke the Du Pont memo story on the front-page in October, the weapons complex and its problems became a major national story, with sustained coverage in major newspapers, and "a drumbeat of coverage" in national news magazines and the network's evening news programs.[282] The predominant angles of the coverage in this media barrage included not only the safety and environmental legacy of the arms race, but also the potential for that legacy to threaten national security by prompting a permanent tritium cutoff that could make maintaining the nuclear weapons stockpile impossible.

Three months into the period of maximum media attention to the nuclear weapons complex, DOE received new nuclear safety–focused leadership with the appointment in January 1989 of Admiral James D. Watkins, U.S. Navy [Retired], as secretary of energy. Watkins, a leader of the nuclear submarine program, brought to the post the Nuclear Navy's stringent and widely respected approach to the safety of operations.[283] He repeatedly declared safety the top priority of DOE's nuclear program and charged that DOE's old "way of doing business" amounted to "trust the contractors." As he characterized the "old way," it was:

> Trust the contractors to carry out all nuclear operations on their own and avoid both direct D.O.E. line management responsibility and accountability and D.O.E. independent internal oversight for safety violations and accidents.[284]

To remedy this "old way," he undertook a major restructuring of DOE's approach to safety management. He established site resident Environment, Safety, and Health (ES&H) inspectors at key DOE facilities, and formed "Tiger Teams" to inspect nuclear facilities. He reorganized DOE, creating in September 1989 a new internal oversight unit, the Office of Nuclear Safety, which was independent of the Office of Environment, Safety, and Health and reported directly to the secretarial level.[285] As Watkins described the office of nuclear safety, it had "independent status,

[280] Lanouette, *Tritium and the Times*, 6.
[281] Lanouette, *Tritium and the Times*, 15.
[282] Lanouette, *Tritium and the Times*, 16.
[283] Ackland, 213–14.
[284] Matthew L. Wald, "Energy Dept. Shift in Safety Faulted," *New York Times*, May 2, 1993, http://query.nytimes.com/gst/fullpage.html?res=9F0CE0DE1E38F931A35756C0A965958260&sec=&spon=&pagewanted=all.
[285] Fehner and Holl, 53–56.

reporting directly and freely to me, to insure that nuclear safety matters could be brought to me and other senior managers in a timely and unfiltered manner."[286]

Under Watkins, DOE also demonstrated commitment to environmental cleanup by establishing the Office of Environmental Management (EM), commonly referred to as the Environmental Management program.[287] The office consolidated responsibility for environmental management activities, including nuclear- and non-nuclear-related cleanup and environmental restoration, waste management, technology development, and facility transition.[288] The creation of the EM office signaled a continuing change in DOE priorities, with greater emphasis on cleanup, as expectations of a sharp reduction in stockpile requirements increased. Watkins underscored the new priority of cleanup when addressing DOE's budgetary needs. He provided startling cost estimates of between $100 billion and $200 billion over several decades for radioactive contamination cleanup, repair, and construction.[289] At the same time, although national policy remained undecided about further nuclear materials production and about plant refurbishment versus new construction, Watkins indicated that safety would not take a backseat to production, when he supported further shutdowns in the chain of weapons production. For example, after a restart temperature spike in August 1989 at the Savannah River Plant's tritium-producing P-reactor, he announced the postponement of any restart until at least September 1990, despite defense establishment concerns about a possible tritium shortage.[290]

Formation of the Board

The greater emphasis on safety of the DOE nuclear complex under Watkins, the continuing media and congressional agitation about its safety deficiencies, and ongoing questions about production and construction needs in view of likely imminent stockpile reductions all shaped the context in which the Board's inaugural members were questioned in their confirmation hearing, sworn in, and undertook their first activities. As the Board's enabling

[286] Wald, "Energy Dept. Shift in Safety Faulted," 1993.
[287] U.S. Congress, Congressional Budget Office, *Cleaning Up the Department of Energy's Nuclear Weapons Complex (*Washington, DC, May 1994), http://www.cbo.gov/ftpdocs/49xx/doc4914/doc26.pdf. See also Gosling and Fehner, 5.
[288] Fehner and Holl, 53–56.
[289] Arjun Makhijani, Stephen I. Schwartz, and William J. Weida, "Nuclear Waste Management and Environmental Remediation," in Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Washington, DC: Brookings Institution Press, 1998), esp., 384–86. See also Wald, "Energy Dept. Shift in Safety Faulted," 1993.

statute required, all of the five initial Board members were "respected experts in the field of nuclear safety," appointed "from civilian life." They had decades of scientific, technical, and legal experience in the fields of nuclear operations and safety. Together they brought, in the words of Senator Exon, chair at their October 17, 1989, confirmation hearing, "the talent and experience of the Nuclear Regulatory Commission, the Atomic Energy Commission, the former Joint Committee on Atomic Energy, the International Atomic Energy Agency, and our National Laboratories."[291] As a group, they met the statutory requirement that not more than three "be of the same party." Only two stated a party preference, John T. Conway, Democrat, and Andrew J. (A.J.) Eggenberger, Republican.

Conway, named as chairman by the president, in accordance with the Board's authorizing statute, was an engineer and an attorney.[292] He worked from 1956 to 1968 on the staff of the Joint Committee on Atomic Energy, six years as assistant staff director and six years as executive director, and later served as executive vice president with Consolidated Edison Company of New York. He was also involved during the 97th Congress in legislative efforts to establish a permanent repository for nuclear waste. Eggenberger, designated as vice chairman by the president, was a Ph.D. engineer with expertise in nuclear safety and earthquake engineering. He had worked as a private-sector consultant, with clients including the International Atomic Energy Agency. He had served as a seismic specialist and program director at the National Science Foundation. John W. Crawford Jr., a retired navy captain, had served as deputy manager of the Naval Reactors Program under Admiral Rickover and as DOE's principal deputy assistant secretary of energy for nuclear energy. He had expertise in the engineering and construction of nuclear reactors acquired during four decades of government service.[293] In the aftermath of the Three Mile Island accident, he chaired the DOE committee charged with assessing DOE reactor safety, producing a comprehensive safety survey known as the Crawford Report.[294] Herbert J.C. Kouts, a Ph.D. physicist and internationally known nuclear safety expert, had been a director of

[290] Gerber, 5.
[291] Senate, Committee on Armed Services, *Nominations*, 723.
[292] Biographical sketches indebted to official biographies published by the Board and DOE; Senate, Committee on Armed Services, *Nominations*, 717–89; and George, 114.
[293] Defense Nuclear Facilities Safety Board, *Eighth Annual Report to Congress* (Washington, DC, February 1998), 1/11, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.
[294] Senate, Committee on Armed Services, *Nominations,* 725. For the report, see U.S. Department of Energy, *A Report on a Safety Assessment of Department of Energy Nuclear Reactor: Report of the Crawford Committee,* DOE/US–0005 (Washington, DC, March 1981).

the Brookhaven National Laboratory, and had served as chair of the International Safety Advisory Group at the International Atomic Energy Agency. Edson G. Case had served under Admiral Rickover in the Naval Nuclear Propulsion Program, followed by 30 years at the AEC and NRC, where he became director of the Office of Nuclear Reactor Regulation.[295] As Conway recently summarized the nature of the inaugural Board members' backgrounds, all had been involved in either the AEC or the Rickover program.[296]

After receiving Senate confirmation without difficulty, the new Board members were sworn in at the White House on October 25, 1990, officially by the chief clerk in the basement, and unofficially by John Sununu, White House Chief of Staff and a supporter of the Board, along with his assistant, Andrew Card.[297] Senators John Glenn, Strom Thurmond, and J. James Exon were among those present to witness the oath-taking. Conway later wryly observed to Glenn that the swearing in was undoubtedly memorable to him not only because he had been instrumental in creating the Board, but also because Glenn had been mugged that day.[298]

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[295] Case died on September 16, 1991. See Defense Nuclear Facilities Safety Board, [Second] *Annual Report to Congress* (Washington, DC, February 1992), n.p., http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php. His successor, nominated in May 1992, was Joseph J. DiNunno. DiNunno had worked 17 years for the Navy Department, including under Rickover in the Naval Reactors program. He then spent 13 years with the AEC, eventually heading the agency's first Office of Environmental Affairs. Finally, he worked for two decades in private industry in a variety of nuclear safety and environmental roles. See U.S Department of Energy, Office of Health, Safety, and Security, "Biography: Mr. Joseph John DiNunno," http://www.hss.doe.gov/deprep/dnfsb/members/jjdinn.htm.

[296] Interview, John T. Conway, Board chairman (October 1989–April 2005), Arlington, VA, March 26, 2008. See also U.S. Congress, Office of Technology Assessment. *Dismantling the Bomb and Managing the Nuclear Materials*, OTA–O–572 (Washington, DC, September 1993), 42, http://govinfo.library.unt.edu/ota/Ota_1/DATA/1993/9320.PDF.

[297] Interview, A.J. Eggenberger, Board chairman (since 2005; vice chairman, 1989–2005), Washington, DC, July 9, 2008.

[298] Interview, Conway. See also U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1997 and the Future Years Defense Program*, 104th Cong., 2d sess., March 6, 13, 20, 25, 29, 1996, 71.

CHAPTER 3: THE BOARD'S OPERATIONS IN THE EARLY YEARS

When the inaugural Board members were confirmed and the Board officially began operations in late October 1989, more than one year had passed since the Board's enabling statute had become law. The Board was under intense scrutiny by those who believed that the creation of the Board was insufficient to achieve their goal of independent oversight of DOE defense nuclear operations and facilities. This delay in nominating and confirming the Board members heightened suspicions about the potential effectiveness of the Board. Recognizing this suspicion, the Board members were in agreement that the Board must begin to conduct its health and safety oversight mission in the DOE defense nuclear complex immediately. Moreover, all actions taken by the Board would support the Board's independence from DOE and avoid any appearance of a conflict of interest wherever possible.

Simultaneously, the Board also needed to address the plethora of managerial issues associated with the start-up of an independent federal agency. In its first year of operations, the Board divided its time between reviews of nuclear safety issues at priority sites and building a federal agency from the ground up, giving special attention to hiring staff, acquiring suitable office space, establishing financial operations, and determining an efficient organizational structure for its mission.

THE START-UP OF BOARD OPERATIONS

From the start of operations, the Board members worked together as a team of experts in a collegial manner to insure that the Board presented a united front in pursuing its independent oversight mission. A prime example of their bipartisan and collegial spirit of cooperation was their decision not to have their own personal staff. The Board members relied on the Board's technical, legal, and administrative staff for their information and support needs, saving valuable resources. The Board members were recognized experts in nuclear safety and as such, the need for personal staff was viewed as an unnecessary expense.

Chairman Conway was quick to recognize not only the challenges facing the Board in executing its safety oversight mission, but also the opportunities. As a new agency, the Board did not inherit any staff, organizational structure, or internal regulations governing the conduct of business. Therefore, the Board was free to create a streamlined organization, specifically tailored to meet its specialized scientific and technical mission, without the encumbrances often associated with traditional government operations, such as vertical layering and duplication of functions. Conway set the standard for having a "no frills" approach to conducting Board business, and in his words, getting the job done by promoting efficiency throughout the organization and maximizing the utility of each employee.[299] The limited resources of the Board were to be focused solely on its mission respecting the adequate protection of public and worker health and safety. Administrative expenses were carefully reviewed for absolute necessity before expenditures were allowed. For example, the Board did not employ government drivers or own/lease executive motor vehicles, and carefully enforced the Federal Travel Regulations, including the restrictions on the use of first class travel.

Adopting the principle of economies of scale for obtaining needed administrative support services, the Board negotiated Interagency Agreements with the U.S. Nuclear Regulatory Commission, the National Science Foundation, the General Services Administration, and the Public Health Service to obtain immediate support for accounting, procurement, personnel, and payroll services. Resources that normally are diverted to fully support these vital administrative functions remained dedicated to supporting the Board's health and safety mission.

Staff recruitment efforts were underway immediately, yielding a skeletal staff at first, with Kenneth M. Pusateri, the first non-Board member, appointed in mid-November as general manager of operations.[300] Pusateri had a proven record of accomplishments in managing the start-up and operation of executive branch agencies, having served in line and staff positions in the U.S. Atomic Energy Commission, the Nuclear Regulatory Commission, and the Department of Energy. He undertook the numerous administrative tasks of a fledgling agency, including the expenditure of funds, personnel matters, and congressional staff interface.[301] In addition to administrative staff, the Board sought quickly to build up its technical staff. The need for competent technical employees was "acute," in view of the urgency of addressing the safety concerns that prompted the Board's creation in the first place. The Board was statutorily

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[299] Letter to The Honorable Leon Panetta, Director of the Office of Management and Budget, from Chairman Conway, December 1, 1993, 3.
[300] Interview, Kenneth M. Pusateri, Board general manager (1989–2006), Washington, DC, January 3, 2008.
[301] Pusateri served as general manager from November 1989 until his retirement from the Board on June 2, 2006. He was succeeded as general manager by Brian Grosner.

authorized to hire up to 100 permanent staff members, as well as to contract for assistance from organizations and consultants.

To help in the recruitment and leadership of its scientific/technical staff and outside consultants, the Board recruited Dr. George W. Cunningham to serve as the Board's technical director. Dr. Cunningham had previously served as the assistant secretary for nuclear energy in DOE, and also held senior leadership positions in the U.S. Atomic Energy Commission's and the Energy Research and Development Administration's nuclear energy programs. Robert Andersen was recruited from the National Science Foundation to serve as the Board's General Counsel. Andersen had a wealth of experience in environmental law and understood the legal issues associated with scientific research. Richard Azzaro was selected as the Board's Deputy General Counsel. Recruited from the Federal Energy Regulatory Commission, Azzaro was an accomplished trial attorney based on his work in the federal courts and in his mastery of the legal practices associated with the operation of federal regulatory agencies. Joseph Neubeiser was recruited from the Federal Energy Regulatory Commission to serve as Deputy General Manager. His knowledge of logistics and information technology proved to be invaluable to the Board in its quest to rapidly start up operations.

Despite the urgent need for technical staff, the Board encountered serious hiring problems in its first year. The problems were of sufficient magnitude that the Board for a time consisted, as Board Chairman John T. Conway quipped in a 2008 interview, of "all chiefs, and no Indians."[302] The aptness of his remark was reflected in the presence of only 10 permanent technical staffers as of December 10, 1990.[303] During the first year, the Board relied heavily on consultants and contracts for technical expertise.[304]

The Board attributed its "difficulty in obtaining permanent staff" to its lack of the requisite hiring authority to attract first-rate technical and scientific employees. The Board was advised shortly after its startup that, unlike the NRC, it could not hire such personnel outside the rules and procedures that ordinarily apply in federal hiring. That is, the Board was not statutorily exempt from the requirements of Title 5 of the U.S. Code governing appointment of employees

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[302] Interview, John T. Conway, Board chairman, October 1989–April 2005, Arlington, VA, March 26, 2008.
[303] U.S. General Accounting Office, *Nuclear Safety: The Defense Nuclear Facilities Safety Board's First Year of Operation*, GAO/RCED-91-54 (Washington, DC, February 5, 1991), 3–4, http://archive.gao.gov/t2pbat7/143684.pdf.
[304] Defense Nuclear Facilities Safety Board, [First] *Annual Report to Congress* (Washington, DC, February 1991), 32, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.

and classification of employee positions in the competitive service.[305] The Board, as Conway pointed out on a number of occasions, had originally been under the opposite impression, expecting that it would have the same hiring authority as the NRC.[306] The NRC had the excepted service authority that Congress grants to federal programs that require scarce skills or special expertise. In cases of such special need, Congress exempts agency employees from standard classification procedures and salary limitations (subject to an overall pay cap). Such excepted service authority decouples the otherwise obligatory link between an employee's grade level and responsibility to supervise a given number of employees.[307] The AEC enjoyed such excepted service authority, pursuant to the Atomic Energy Act, section 161(d), which recognized the scarcity of technical expertise in the nuclear field and the competition with the private sector for this expertise. The NRC inherited this authority from the AEC, but DOE retained it only in limited form (i.e., for 200 positions)—a development much to the disadvantage of DOE, according to Board member John W. Crawford Jr. and other Board members.[308]

The Board, on finding that its own lack of excepted service authority would hamper its hiring efforts, requested it from Congress. Conway brought up the Board's hiring problems in each of the early congressional hearings in which the Board's activities were scrutinized. Senator Glenn, who stood ready to revisit questions about the Board's legal authority, took up the issue in a Senate Armed Services Committee hearing, directly questioning Board members about whether the Board's enabling legislation needed revision.[309] On the issue of hiring, he asked, "What did we goof on in that enabling legislation?"[310] Both House and Senate Armed Services

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[305] U.S. Congress, Senate, Committee on Armed Services, Subcommittee on Strategic Forces and Nuclear Deterrence, *Plans, Progress, and Experience to Date of the Defense Nuclear Facilities Safety Board,* 101st Cong., 2d sess., March 28, 1990, 5.
[306] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 5.
[307] Glenn Russell George, "Negotiated Safety: Intragovernmental Risk Regulation in the U.S. Nuclear Weapons Complex" (Ph.D. diss., Harvard University, May 1995), 123–24 (accessed via Proquest).
[308] John W. Crawford Jr., *An Assessment Concerning Safety at Defense Nuclear Facilities: The DOE Technical Personnel Problem*, DNFSB/TECH-10 (Washington, DC: Defense Nuclear Facilities Safety Board, March 1996), 26, http://www.dnfsb.gov/pub_docs/dnfsb/tr_199603.html. On the scope of DOE's excepted appointment authority, see especially Appendix H, "Statement by Robert M. Andersen, General Counsel, Defense Nuclear facilities Safety Board," H/7–H/10. See also, Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 5 and 35.
[309] See U.S. Congress, Senate, Committee on Armed Services, *Nominations Before the Senate Armed Services Committee, First Session, 101st Congress,* March 14, 16, April 5, 18–19, and May 3, 4, 16, 18, 1989, 722. During the nomination hearing, Glenn said, "I will certainly be paying very careful attention to the establishment of the Safety Board and its performance over the next year. I also intend to continue my legislative efforts to strengthen and expand the role of the Safety Board."
[310] Senate, Armed Services Subcommittee on Strategic Forces, *Plans. Progress, and Experience to Date*, 48.

Committees saw to the needed amendment. In November 1990, Congress granted the Board excepted service authority with the passage of Pub. L. No. 101-510, National Defense Authorization Act for Fiscal Year 1991, the first of a number of amendments over the years to the Board's enabling statute. Pub. L. No. 101-510 amended the Atomic Energy Act of 1954 to authorize the Board to establish the rates of compensation for the Board's scientific and technical personnel.[311] Under this new authority, as Conway later said, thanking the Senate Armed Services Committee, "We are able to hire without going through a lot of red tape and difficulties."[312] The Board, allowed greater flexibility in hiring, could bypass the previously applicable salary restraints of the General Schedule. The Board established instead a five-band, performance-based pay system. The system permitted the Board to offer salaries sufficient to attract permanent staff with special technical expertise—salaries at a GS-16, -17, -18 level—even absent managerial responsibility, through compensation packages that were, by public-sector standards, generous.[313] The development pleased Conway, who said, "We do not want the normal 'manager' type that has to justify his or her salary on the basis that he or she has X number of people reporting to them."[314] The Board also established a performance-based bonus system and a technical intern program, setting itself apart from agencies without excepted service authority.[315]

Another challenge affecting hiring, besides the Board's initial lack of the requisite hiring authority, was the Board's need to avoid potential conflict of interest situations in hiring—conflicts that could compromise the impartiality of advice offered to the Board. The Board's enabling statute called for hiring and contractual arrangements that avoided such situations, for example, those in which the Board's outside technical experts had connections with DOE or DOE contractors in the weapons complex. However, avoiding conflict of interest situations was difficult, insofar as the Board was obliged, especially early on, to make heavy use of contracts for technical expertise, as well as interagency support. This reliance on outside help manifested itself in the allocation of the Board's expenditures in its startup period. The Board's fiscal year 1990 funding availability was $8,865,000, with expenditures totaling $6,956,000. Out

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[311] GAO, *Nuclear Safety: The Defense Nuclear Facilities Safety Board's First Year of Operation*, 3–4.
[312] U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Years 1992 and 1993,* 102d Cong., 1st sess., April 23, May 9, 17, 22, 23, June 5, 12, 13, 19, 20, 1991, 593.
[313] George, 123–24.
[314] Senate, Armed Services Subcommittee on Strategic Forces, *Plans. Progress, and Experience to Date*, 49.
[315] George, 124.

of these expenditures, contracts amounted to $3.9 million or almost 56 percent.[316] This heavy reliance on contracts was a hurdle to engaging expert help while maintaining the requisite "arm's length" relationship with DOE, because the nuclear experts the Board wanted to use typically had an employment history or connections with DOE or its contractors. As the GAO report assessing the Board's performance in its first year observed,

> [The] nuclear industry is to some extent a closed community; few available nuclear experts are not in some way connected to DOE or its operating contractors.[317]

Conway illustrated the challenge that the Board faced by citing the case of a Board consultant on the Hanford waste tanks whose services the Board had to forgo on finding that a DOE contractor would use his assistance.[318] The challenge of avoiding potential conflicts of interest persisted for the Board at a significant level until it was able, thanks to its new hiring authority, to step up its hiring of permanent staff. Given the sensitivity on this issue, the Board developed and subsequently issued its organizational and consultant conflicts of interest regulations on September 29, 1992.[319]

Apart from staffing difficulties, the second early administrative challenge was locating office space.[320] Even though the Board and DOE agreed at the outset that the Board, as an independent organization, should not share quarters with DOE, the Board was obliged to operate for three months out of two rooms in the basement of DOE's Forrestal Building in Washington, DC. In September 1990, after almost a year of operations and a period in another temporary location, the Board began to carry out its activities from its new headquarters and permanent office space at 625 Indiana Avenue NW, Suite 700, Washington, DC.[321] The space was designed to accommodate the Board's technical, legal, and administrative staff and to provide space for meetings and hearings, as well as the technical library and the public reading room that the Board established in 1991.

During these early start-up years, the Board received the full support of the White House staff in locating suitable office space to conduct Board operations, and in pushing for and

[316] DNFSB, [First] *Annual Report to Congress*, 31–32.
[317] GAO, *Nuclear Safety: The Defense Nuclear Facilities Safety Board's First Year*, 26.
[318] U.S. Congress, Senate, Committee on Governmental Affairs, *Accident and Explosion Risks at Department of Energy High-Level Radioactive Waste Facilities*, 101st Cong., 2d sess., July 31, 1990, 41.
[319] Personal communication, Kenneth M. Pusateri, Washington, DC, May 30, 2009.
[320] Interview, Conway.

ultimately receiving excepted service hiring authority. Andrew Card, the assistant to the President and deputy to the chief of staff, played a leading role in ensuring that key support agencies within the executive branch, such as the Office of Personnel Management and the General Services Administration, were sensitized to the importance of the Board's mission and worked with the Board in a cooperative manner.

ESTABLISHING THE BOARD'S OVERSIGHT PROGRAM

Site Visits and Other Fact-Gathering Activities

Upon taking their oaths of office, the Board immediately undertook an intensive program of oversight activities. As Conway said, speaking of the very early period when the Board still consisted of only the five Board members, "We . . . did not want to wait until we were staffed up to begin our safety-related work."[322] In taking up its oversight tasks, the Board simultaneously tackled urgent safety shortcomings in the weapons complex and began to define its tasks and its own manner of proceeding in the accomplishment of its mandate—the mandate to identify safety problems by reviewing facilities, operations, practices, and occurrences, and to evaluate the content and implementation of health and safety standards.

The first practice that the Board inaugurated in pursuit of its oversight responsibilities was that of site visits throughout the weapons complex. Within less than two weeks of its swearing in, the Board used its broad statutory latitude for fact- and information-gathering, and launched an ambitious program of visits to priority DOE sites. These site visits, which became a regular and major part of the Board's safety review efforts, began with an exploratory visit to the Savannah River Site (SRS) near Aiken, South Carolina, from November 7–9, 1989. As Conway reported in the first congressional hearing on the Board's activities, held in March 1990,

> One of the first acts we undertook prior to obtaining staff was for the five members to personally visit and tour the Savannah River site to learn first-hand what health and safety problems existed there.[323]

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[321] Interview, A.J. Eggenberger, Board chairman (since 2005; vice chairman, 1989–2005), Washington, DC, July 9, 2008.
[322] U.S. Congress, House of Representatives, Committee on Natural Resources, Subcommittee on Energy and Mineral Resources, *Federal Nuclear Facilities Licensing and Regulation Act,* 103d Cong., 2d sess., March 1 and 8, 1994, 229.
[323] House, Natural Resources Subcommittee on Energy and Mineral Resources, *Federal Nuclear Facilities Licensing and Regulation Act*, 229.

He observed that the goal of the initial visits "at each of these locations was basically to orient ourselves to the work being done there." Crawford added, with reference to the Board's pursuit of "knowledge at first hand," "We, the Board, are actually the people that go out and do the spade work and sometimes do so together."[324] In their early tours of site facilities, the Board members familiarized themselves with their physical features and conditions, and observed the manner in which operations were being carried out, all with a view to identifying areas on which the Board would concentrate its reviews and evaluations. The site visits were a means by which the Board furthered its early task of setting oversight priorities—exercising its "best judgment to determine precisely which facilities it [would] oversee," and sharpening its "focus on the important issues with which it [would] be dealing." [325] The Board proceeded to select facilities for visits, and to set priorities in its oversight agenda, on the basis of the urgency and scale of risks and hazards, with cognizance also to the concerns of the relevant congressional committees and of the priorities of DOE in its undertakings in the weapons complex. Mentioning the initial coordination of Board activities with DOE priorities, Conway said in a Senate hearing,

> One of the things we tried to do, Senator, is to set our agenda, set our priorities in concert with the Secretary of Energy.[326]

In the case of the Savannah River Site, the Board's firsthand information gathering was predicated on the expectation that DOE would soon restart the facility's production reactors, the K-, L-, and P- reactors. Although the Board had been created in a period of a nearly complete cessation of production in the weapons complex, the prevailing expectation for the Board's first two years of operations was that the shutdown was still temporary.[327] DOE was giving priority to restarting several critical facilities, most notably, Savannah River's three reactors, as well as certain production buildings at Rocky Flats, and the PUREX facility at Hanford.[328] Thus, the focus of the Board at Savannah River was the activities of DOE and the contractor in preparing

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[324] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 38. For a non-Board account of the early site visits, see Bert Chapman, "The Defense Nuclear Facilities Safety Board's First Decade," *Journal of Government Information* 27 (2000): 353–54, http://docs.lib.purdue.edu/lib research/70.
[325] Defense Nuclear Facilities Safety Board, [First Three Months] *Annual Report to Congress* (Washington, DC, February 1990), 5, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.
[326] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 47.
[327] At the time, in addition, it was expected that new production reactors would be built. DOE was working on them, and the Board's duties included reviewing their design. See Terrence R. Fehner and Jack M. Holl, *Department of Energy, 1977–1994: A Summary History* (Washington, DC: U.S. Department of Energy, November 1994), 48–49, http://www.osti.gov/bridge/servlets/purl/10106088-mgIkuD/webviewable/10106088.PDF.
[328] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 2, 17–18.

for the planned restart of that facility's reactors. Of particular concern was the progress toward restart of the K-reactor—in Board Vice Chairman Eggenberger's words, "a 1952 vintage plant," shut down in 1989 "for major changes in culture and in hardware."[329] The Board began examining safety-related aspects of DOE's upgrades at that facility, paying attention to safety issues that might hold up its restart. Prominent targets of Board scrutiny included DOE's efforts to improve the capabilities and qualifications of the reactor operators. The Board also began to review DOE's evaluations of engineering issues, such as the capability of the reactor to withstand earthquakes, and thermal hydraulic performance in the event of a loss of coolant accident.[330]

Other early site visits took Board members to Rocky Flats, Hanford, and the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico. At Rocky Flats, as at Savannah River, the Board approached the plant with an eye to assessing DOE's resumption activities, specifically, its efforts to ready the plant's plutonium-processing foundry to restart operations. The Rocky Flats visit, postponed from December to allow DOE to complete its own review of resumption activities, took place in mid-January 1990. During the visit, the Board's attention turned particularly to the accumulation of radioactive material in ventilation ducts. In the preceding month, from December 11–12, 1989, three Board members visited the Hanford site, where the Board first began to address the safety question that had been repeatedly brought up by Glenn, including at the Board's confirmation hearing—the question of the susceptibility of certain high-level waste storage tanks to explode. In January 1990, Board members and staff visited WIPP—slated to be the national disposal site for transuranic defense waste and the world's largest deep geologic repository. They examined the waste handling building and repository rooms excavated in a huge salt formation 2,000 feet underground.[331]

During each of the early site visits, the visiting Board members were accompanied by outside expert consultants, who could supplement the Board's own capabilities in its reviews of particular managerial and engineering issues pertinent to safety. The Savannah River contingent,

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[329] *Public Meetings and Hearings, 1991, Before the Defense Nuclear Facilities Safety Board*, vol. II of II (Washington, DC: Defense Nuclear Facilities Safety Board, 1991), 535 and 545.
[330] DNFSB, [First] *Annual Report to Congress*, 19. See also Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 17–18.
[331] See U.S. Congress, House, Committee on Interior and Insular Affairs, Subcommittee on Energy and the Environment, *Proposals Relating to the Operation of the Waste Isolation Pilot Plant (WIPP) in New Mexico,* 102d Cong., 1st sess., April 16, 1991, 1–5, 182–84.

for example, included experts in the requirements of training and in seismic engineering. After the initial visits to sites by the full Board or a majority of its members, there were numerous "follow-up visits . . . by specialist teams selected and led by Board members."[332] In monitoring the restart activities at Savannah River, the Board, its staff, and outside technical experts in various combinations made more than 100 site visits during the two-year period, 1990 to 1991.[333] By June 1992, as Eggenberger noted in a Senate Armed Services Committee hearing, "if one only considers the Savannah River site, the Rocky Flats site, and the Hanford site, our staff have made 247 visits to these facilities. The Safety Board itself has made 65 site visits."[334] After each of the visits by the specialist teams, the Board's staff summarized their findings in trip reports, which were incorporated into the data files that the Board's staff accumulated on safety issues at the various DOE nuclear facilities. The Board used the trip reports mostly as internal working papers, which served as the basis for briefings by the staff that the Board members periodically requested to inform their deliberations on specific safety issues.

Describing how site visits typically proceeded, Conway said, "Each time we have visited a specific site, we have given advance notice to the Department of Energy and specified the particular items we wished to discuss and review."[335] DOE and contractor personnel at the sites made presentations on the current status and planned activities of facilities. During the first visit to Hanford, for example, DOE officials at the Richland Operations Office and Westinghouse contractors provided briefings on the issue of the high-level waste tanks, as well as on preparations for restarting operations at the PUREX plant, on activities involved with the N-reactor's dry standby status, on work on the Plutonium Finishing Plant, and on ongoing site cleanup activities.[336] At WIPP, DOE and Westinghouse personnel made presentations on the project's history and current management issues.

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[332] DNFSB, [First Three Months] *Annual Report to Congress*, 5.

[333] Site visits remained a major element of Board oversight. The *Ninth Annual Report to Congress* (Washington, DC, February 2000, 5/2, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php) stated that between "October 1989 through the end of 1998 . . . the board, its staff, and its contractor experts have collectively made 1,398 site visits to DOE's defense nuclear facilities."

[334] U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1993* and *the Future Years Defense Program,* 102d Cong., 2d sess., March 18, 24, 27, April 9, 28, May 20, June 3, 11, 1992, 235.

[335] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 38.

[336] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 19–20. See also Chapman, 354.

The Board expressed general satisfaction with the working relationship with DOE when it came to its provision of the means for effective safety oversight, including unhindered Board access to DOE facilities and data. Conway, noting DOE's initial opposition to the creation of the Board, acknowledged that DOE, as charged by the Board's statutory mandate, provided the wide and ready access needed to review safety issues,

> I think the Department of Energy has come around now, and I think we have a good cooperative arrangement with them and we're finding ourselves in a position where any and all information we're requesting, we're getting promptly.[337]

Besides the interactions with DOE officials, workers, and contractor personnel at the sites, the site visits also often involved meetings with concerned members of the public. Actively reaching out to the public, the Board identified, solicited, and met with elected public officials, labor unions, public interest groups, state, federal, and regional officials, Native American representatives, and other interested parties, as well as members of the media. The Board actively sought the participation and input of such parties, as Conway noted,

> We have notified the legislative representative at the Federal and State level at each of those facilities. We have notified in the case of Colorado the Governor because he has shown a particular interest that we were coming. We have informed organizations . . . and the legislative representatives . . . that we would be available to meet with any groups or individuals that wanted to see us while we were at these locations . . . .
>
> We have also notified the press, both the written media and the T.V. media. We have made ourselves available to answer their questions.[338]

Such outreach efforts produced results, as, for example, during the Board's first visit to Rocky Flats. Board members met with Colorado Governor Roy Roemer, Representative David Skaggs (D–CO), labor union officials representing Rocky Flats workers, and representatives from various citizen organizations with environmental and nuclear proliferation concerns.[339]

The Board also solicited input—"comments, technical information, and data"—from interested individual citizens, whether they wanted to speak in announced public meetings held at the Board's discretion in conjunction with the site visits or in more private circumstances. As Conway said,

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[337] *Public Meetings and Hearings, 1991,* vol. II of II, 22.
[338] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 46.

> Now, obviously when we visit the site . . . [t]hey are classified sites . . . [w]e do not take with us members of the public . . . But back at the hotels where we stay we let it be known who we are, what we are looking for, and anyone that has any information we encourage them to come to us.[340]

The Board's practice of soliciting information from the citizenry included the explicit invitation to meet to confer with the Board in private, as he added,

> We also let it be known that if anyone wants to come and see us and for whatever reason does not want to do it in public, then we will meet with them in private . . . We have encouraged the labor leaders to come to us with any of the problems that they may have and they have done that.[341]

The Board's constant and personal availability to the public came to be popularly characterized with an expression used by Conway, "We are as close to you as your phone." All meetings, as the Board's General Counsel Richard A. Azzaro stated, were "without preconditions except those that would facilitate open and complete communication of the concerns about DOE operations to the Board." The Board made reporting health and safety issues easy and risk-free from reprisal, and the Board quickly gained and kept a reputation for protecting communications and concerned sources. As Azzaro added, "Protecting sources had a singular importance. The Board worked tirelessly and creatively to ensure and enforce confidentiality: through its General Counsel's Office who created special practices and procedures."[342]

In addition to spontaneous outreach in the course of site visits, the Board also convened officially announced public meetings and hearings—the meetings that involved a number of the Board members. The meetings were held at times and locations selected by the Board after careful surveys, to ensure maximum opportunity for attendance and presentation of information to the Board. Conway described one such meeting,

> I will give you Rocky Flats as an example—we rent . . . .a meeting room in the hotel where we are staying. We announce ahead of time that on such and such a date we will be there for anyone who wants to come to that meeting and it is open to the public. We had such a meeting at the Rocky Flats area where it was standing room only and each and every person that came there we gave an opportunity to meet with us and discuss with us their concerns.[343]

[339] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 19. See also Chapman, 353.
[340] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 46.
[341] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 46.
[342] Personal communication, Richard A. Azzaro, June 15, 2009.
[343] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 46.

Such meetings served as a two-way communication tool, both conveying information to the public and furthering the Board's investigative process at a site. During calendar years 1990 and 1991, the Board held a total of 15 such public meetings, seven of which were held at or near DOE sites and eight at the Board's Washington, DC, offices.

Interaction with DOE and the Recommendation Process

The site visits that the Board conducted by way of information gathering were central to the Board's performance of its mission to identify safety problems and formulate recommendations and other advisories to DOE on corrective actions. Other bases for the formulation of the Board's advice, according to one Board list, included,

(1) review of documentation concerning particular problems at a site;
(2) review of staff or Board contractor reports;
(3) briefings by DOE officials and DOE contractors; and
(4) deliberation and technical review by the Board.[344]

In furtherance of its mission, the Board could also conduct studies and establish reporting requirements for DOE. In addition, the Board had at its disposal certain more coercive statutory powers that it did not exercise. Such latent investigative capabilities included subpoena power and the authority to hold adjudicatory hearings.[345]

Deploying the various elements of the investigative toolkit that Congress included in the Board's enabling legislation, the Board translated its broad mandate to provide advice on nuclear safety to DOE into two forms of advice—informal communications and the issuance of formal recommendations to the secretary of energy.

The informally proffered advice was a "natural consequence" of the extensive interaction and frequent conversation on specific safety-related technical matters that the Board, its technical staff, and DOE personnel had both at DOE headquarters and at DOE defense nuclear sites. As the Board pursued its reviews and investigations, the members and staff met regularly with DOE officials and field staff, as well as contractor personnel, and engaged in extensive informal information exchange not necessarily related to the development of formal safety recommendations. Such direct, in-depth dialogue and continual mutual feedback, as the Board

[344] U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996 and the Future Years Defense Program,* 104th Cong., 1st sess., March 28, April 25, May 2, 16, 18, 1995, 100.

saw it, were indispensable to addressing the technical complexity of the safety-related issues the nuclear complex posed. As a matter of course, such dialogue often yielded informal agreements with DOE. Safety findings and concerns conveyed orally by the Board, based on information provided orally by DOE, were understood as informal recommendations, "often producing . . . self-initiated corrective action." by DOE. As the Board's 1991 annual report put it,

> Board technical analysis and review of safety problems, site visits, observations, and discussions with DOE and its contractors may trigger their initiating further review or corrective action without a formal recommendation even having been contemplated.[346]

The Board welcomed such commitments to corrective action outside of the formal recommendation process, viewing self-initiated corrective action as "a very productive and efficient means of effectuating change" at defense nuclear facilities.[347] One significant aspect of such informality that troubled some observers, however, was that advice transmitted and corrective action undertaken informally could occur without disclosure to the public. Identifying safety problems and effecting changes without the issuance of a formal recommendation to the secretary of energy did not trigger the legislative provision requiring the public disclosure and public comments procedures that applied to the Board's recommendations and the secretary's responses.[348]

Although the Board welcomed corrective measures taken by DOE that preempted formal actions by the Board, the Board also made frequent use, especially in its early years, of its primary tool for gaining the attention of DOE, the formal recommendation. Judging situations on a case-by-case basis, the Board members found that some issues warranted the formulation of

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345 George, 133, 163.

346 Defense Nuclear Facilities Safety Board, [Second] *Annual Report to Congress* (Washington, DC, February 1992) 46, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.

347 DNFSB, [Second] *Annual Report to Congress*, 46.

348 After 1994, the Board issued fewer formal recommendations, placing more reliance on gaining DOE's attention through the issuance of letters that required DOE to report to the Board on matters of concern. For a discussion of the use of these reporting requirement letters, see Defense Nuclear Facilities Safety Board, *Thirteenth Annual Report to Congress* (Washington, DC, February 2003, 1/3, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php):

> The Board's recommendation authority has been used most fruitfully for gaining DOE response to broad, cross-cutting matters that affect much of the defense nuclear complex . . . . In contrast, a mandatory reporting requirement has been an effective tool in compelling DOE to respond in a more expeditious manner to important safety issues. Comparison of the Board's use of these two methods shows a marked shift beginning in 1994 toward much greater reliance on reporting requirements. Prior to 1995, the Board had issued 31 recommendations and 17 reporting requirement letters. For the 7-year period from 1995 through 2002, the Board issued 14 recommendations and 72 reporting requirement letters.

Board advice as a recommendation, in actuality, usually a set of related individual recommendations under one overall title. The Board wielded this tool when a majority of the voting members, exercising their expertise and judgment, determined the facts to support a finding that a recommendation was "necessary" to protect health and safety.

Such recommendations encompassed a wide range of activities and issues in DOE's nuclear complex, and varied widely in scope.[349] Many Board recommendations were site-specific, dealing with relatively narrow technical or operational issues at individual facilities, while many applied more broadly, even complex-wide. Among the Board's early site-specific recommendations were, for example, recommendations 90-7, *Safety at Single-Shell Hanford Waste Tanks*, and 91-2, *Closure of Safety Issues Prior to Restart of the K-Reactor at the Savannah River Site*. Such site-specific recommendations were sometimes occasioned by the identification of a threat or risk or by hitherto unrecognized or underestimated safety problems, e.g., problems in Hanford's double-walled waste tanks. When not confronted with specific immediate risks, the Board "made a special effort to evaluate safety issues that appeared to be generic in nature." It pursued its investigations with an eye to determining whether a practice or event reflected systemic problems affecting other DOE facilities. Examples of generic issues were "lack of training, lack of written procedures, or a lack of formalized disciplined approach to the operation of facilities and the safety of workers."[350] The Board expected that the guidance it offered on such issues for a particular facility would set the stage for corrective actions elsewhere, sometimes without and sometimes with the issuance of further, more broadly framed formal recommendations. Among such early recommendations by the Board that applied broadly were 91-1, *Strengthening the Nuclear Safety Standards*; 91-6, *Radiation Protection for Workers and the General Public at DOE Defense Nuclear Facilities*; and 92-6, *Operational Readiness Reviews*.

In addressing such generic issues, the Board often first issued a recommendation on the topic as it pertained to a specific site, following up later with a more general version.[351] For example, the Board's very first recommendation preliminarily formulated advice on the training

[349] U.S. Congress, Office of Technology Assessment, *Dismantling the Bomb and Managing the Nuclear Materials*. OTA-O-572 (Washington, DC, September 1993), 40, http://govinfo.library.unt.edu/ota/Ota_1/DATA/1993/9320.PDF.
[350] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Years 1992 and 1993*, 609.

and qualification of technical personnel as these pertained to reactor operators at the Savannah River Site K-reactor. The training and qualification issue was later formulated in more general terms in Recommendation 92-7, *Training and Qualification*, which in turn was embraced by an even broader-based Board recommendation, Recommendation 93-3, *Improving DOE Technical Capability in Defense Nuclear Facilities Programs*, on the education, training, recruitment and retention of personnel. The Board's second recommendation, 90-2, on standards at a number of sites, was followed by Recommendation 91-1, *Strengthening the Nuclear Safety Standards Program for DOE's Defense Nuclear Facilities.*

Such subsequent, related recommendations pertinent to multiple sites or the entire complex frequently drew upon the experience gained in implementation efforts prompted by earlier site-specific recommendations. Recommendation 92-6, for instance, which urged improvement of DOE's operational readiness review (ORR) process throughout the DOE complex, drew upon lessons learned from the Board's site-specific monitoring of, and recommendations on, the readiness review process for the restart of Rocky Flats facilities, for the resumption of plutonium-238 processing in the HB-Line at the Savannah River site, and for the start of testing for waste disposal procedures at WIPP.[352] On finding common weaknesses in ORRs at these sites, the Board formulated 92-6 urging DOE to develop effective standards to govern the safety aspects of ORRs complex-wide. The recommendation called upon DOE both to identify the required features of a satisfactory ORR—with guidelines for the selection of ORR teams, the scope of ORRs, and documentation of ORR results—and to specify criteria for determining when an ORR should be performed.[353]

By generalizing and disseminating particular safety advice and gains, the Board sought to promote stepped-up DOE adherence to formal processes and standards. The thrust of many recommendations, as pointed out by Congress's Office of Technology Assessment (OTA), was

[351] On this dynamic, see Crawford, esp. H/3, where the Board's first general counsel, Robert M. Andersen, describes the emergence of increasingly broad recommendations on a topic.
[352] On the HB-Line at the Savannah River Site, see Defense Nuclear Facilities Safety Board, *Recommendation 92-3*, *Operational Readiness Reviews for the HB-Line at the Savannah River Site, SC,* 1, http://www.dnfsb.gov/recommendations/srs/rec_1992_03.txt. On WIPP, see Defense Nuclear Facilities Safety Board, *Recommendation 91-3*, *DOE's Comprehensive Readiness Review Prior to Initiation of the Test Phase at the Waste Isolation Pilot Plant (WIPP)*, 1–2, http://www.dnfsb.gov/recommendations/srs/rec_1991_03.txt.
[353] Defense Nuclear Facilities Safety Board, *Recommendation 92-6, Operational Readiness Reviews*, 2–3, http://www.dnfsb.govlrecommendations/all/rec_1992_06.txt. The Board closed this recommendation when DOE eventually revised its Order on Operational Readiness Reviews.

to urge upon DOE greater formality in its practices and processes, whether operator training programs, the conduct of its operations, standards development, or other. As the OTA stated,

> Many DNFSB recommendations and site visits focus on increasing the formality of written procedures and directions in DOE operations and in its training of workers. This emphasis may be a reflection of the background of many DNFSB staff in commercial and naval nuclear reactors.[354]

Whatever the nature of a formal recommendation, when the Board decided that its oversight should take that form, the decision augmented the weight of the Board's advice. In offering advice either formally or informally, the Board exercised authority that effectively went beyond mere advice, while not carrying the full weight of regulatory authority. The U.S. Court of Appeals for the District of Columbia Circuit, interpreting the Board's statutory authority, held that the Board was not "strictly advisory" . . . but rather "decision-forcing" on public health and safety issues."[355] The court described the Board as an agency with decision forcing or action forcing powers, stating,

> The Board does considerably more than merely offer advice . . . It has at its disposal the full panoply of investigative powers . . . and forces public decisions about health and safety.[356]

With the issuance of a formal recommendation, this "action forcing" power was further strengthened by the statutory requirements that such an issuance triggered. Upon issuance to the secretary of energy, the recommendation had to be made public through publication in the *Federal Register*.[357] The recommendation then demanded a response or a report from the secretary according to procedures outlined in the Board's enabling legislation. The secretary was required to respond with acceptance or rejection within 45 days. In the case of "any Board recommendation not accepted by DOE," the secretary had to "to justify rejection . . . in formal reports to cognizant Congressional Committees."[358] In the case of accepted recommendations, s/he had to submit within 90 days an implementation plan, in which s/he committed to corrective

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354 Office of Technology Assessment, *Dismantling the Bomb*, 42.
355 House, Natural Resources Subcommittee on Energy and Mineral Resources, *Federal Nuclear Facilities Licensing and Regulation Act,* 240.
356 U.S. Congress, House of Representatives, Committee on Commerce, Subcommittee on Energy and Power, *Legislation to Improve Safety and Security in the Department of Energy*, 106th Congress, 2d sess., March 22, 2000, http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=106_house_hearings&docid=f:64031.pdf.
357 George, 132.
358 Defense Nuclear Facilities Safety Board, *Sixth Annual Report to Congress* (Washington, DC, March 1996), 25, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.

actions. The implementation plan for an accepted recommendation, like the recommendation itself, had to be made public through publication in the *Federal Register*.

In the exchanges that occurred between DOE and the Board in the recommendation process, the problem never arose that some framers of the Board's enabling law, notably, Glenn, had feared, namely, that the secretary of energy would resist or reject Board recommendations outright. Over the course of the Board's history, the secretary rejected none of its recommendations, accepting all of them in full. While not mounting the kind of resistance that some had feared, however, DOE had some problems in the early period of the Board's operations in obtaining the Board's approval for its implementation plans. In a number of cases early on, the Board was not fully satisfied with the plans, considering them "not adequately responsive," or insufficiently specific. In those cases, the Board called upon DOE to improve upon its proposed implementation plans, sometimes requiring successive drafts. Recognizing the need for a better understanding of its wishes, the Board worked with DOE during the first years of Board operations to develop an understanding of what the Board judged to be adequate responses and implementation plans. For example, with respect to Recommendation 91-6 on upgrading compliance with DOE's orders, the Board's general counsel, Robert Andersen, took a lead role in the Board's efforts to review DOE's standards. As Crawford said,

> Now, we regarded that [recommendation as] so important that we put our general counsel in charge of the task force of the Board's in eliciting from DOE a really responsive implementation plan.[359]

Drawing upon the experience of such DOE–Board interaction, the Board developed a Board Policy Statement, "Criteria for Judging the Adequacy of DOE Responses and Implementation Plans for Board Recommendations."[360] These efforts helped DOE to develop implementation plans that obtained Board approval with fewer major problems, with the notable exception of the implementation plan for Recommendation 90-2, concerning DOE's standards program. For that key recommendation, Conway remarked in March 1994, "Obtaining a

[359] *Public Meetings and Hearings, 1994, Before the Defense Nuclear Facilities Safety Board* (Washington, DC: Defense Nuclear Facilities Safety Board, 1994), 31.
[360] DNFSB, [First] *Annual Report to Congress*, 11.

satisfactory implementation plan from DOE has proved to be a nearly insuperable task."[361] DOE submitted five versions of implementation plans over 51 months before receiving approval.[362]

Whatever the difficulties DOE had initially with its implementation plans, the recommendation process as a whole—recommendation and plan in response—lived up to its characterization as more than "strictly advisory." The process proved a mechanism that was "action forcing," not because recommendations were binding, but because ignoring them would mean ignoring highly competent technical advice, and doing so in the public eye.

Interfacing with the Public

In the course of carrying out its mission to provide oversight to DOE on safety issues, the Board simultaneously addressed another aspect of its mandate, which was to improve the openness to public scrutiny of DOE nuclear activities and, as a by-product, of the Board's own processes. A major rationale for creating the Board was to restore public confidence in DOE's stewardship of defense nuclear facilities by improving the transparency of DOE's operations. In response to its mandate to restore trust, the Board was committed from the outset to developing a system to provide as much public access as possible to the Board's findings and recommendations about safety issues.[363] As Board General Counsel Azzaro characterized the effort,

> The Board developed a multi-pronged outreach strategy that combined the formal services required by law and informal initiatives and matched them with highly experienced service-oriented personnel. Ever present in all of these efforts was the Board's commitment to meaningful Board availability to concerned members of the public or workers on their safety and health concerns.[364]

As the Board undertook to make good on its obligation to enhance openness in the weapons complex and improve public trust, the issue of transparency was still highly charged for public interest and citizens groups and other interested parties, such as the GAO and relevant congressional committees. Such groups had spearheaded criticism of the abuse of secrecy in the weapons complex. They remained wary of the potential for further abuse of national security

[361] House, Natural Resources Subcommittee on Energy and Mineral Resources, *Federal Nuclear Facilities Licensing and Regulation Act*, 237.
[362] Defense Nuclear Facilities Safety Board, *Fifth Annual Report to Congress* (Washington, DC, February 1995), 79–80, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc/php. See also George, 155.
[363] On the Board's effort to contribute to transparency, see George, 129–33.
[364] Personal communication, Azzaro.

claims to frustrate public access to information about environmental, safety, and health problems in the complex. Glenn gave voice to this wariness at the Board's confirmation hearings, where he expressed determination

> [T]o make sure that we never again drift into the secrecy, and the abuse of secrecy, that occurred in the nuclear weapons complex in the past. We all hid behind this problem, "the Russians are coming, the Russians are coming," "we need more production, we need more production."[365]

He added that the aim of avoiding further cover-up of problems accounted for the inclusion in the Board's enabling legislation of the requirement to adhere to "different aspects of public access law," stating,

> [The inclusion] was not done just to be nasty, It was done because … [e]verything with regard to the nuclear weapons complex had been secret, We got into all this waste problem because it was easier to put it in that pit out behind the plant and not say anything about it for a while. Now is after a while, and we have to deal with it …
>
> [T]hings were covered up that have gotten us into problems that are now going to cost maybe a couple of hundred billion dollars to get ironed out over a 20-year period, something like that, all because of secrecy.[366]

The atmosphere of public distrust that Glenn's words reflected made the Board subject to close scrutiny concerning certain aspects of the way it conducted business, and whether they accorded with the Board's statutory obligations to provide public access. It was against this backdrop of public distrust that the Board undertook to demonstrate its commitment to public information access by developing policies, arrangements for public outreach, and a system to augment the transparency of the health and safety aspects of the DOE nuclear complex. To the degree that the Board members thought was allowed under the Board's enabling legislation, they emphasized communicating with the public through a variety of avenues.

One aspect of the Board's ongoing effort to inform the public was the Board's careful adherence to its statutory requirements for the public disclosure of its recommendations and of the secretary's responses, including commitments to corrective actions. In its annual reports to Congress, the Board regularly highlighted its actions to inform members of the public after the issuance of recommendations, and to receive their comments and incorporate their views in the process of health and safety oversight. As required by law, the Board published the full text of its

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[365] Senate, Committee on Armed Services, *Nominations*, 721–22.
[366] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 36 and 38.

recommendations in the *Federal Register* and distributed all recommendations to DOE regional public reading rooms and to its own, once this was established in 1991. Each *Federal Register* notice solicited public comments, and the Board considered all comments received. The Board also announced its issuance of recommendations by mail to numerous individuals and organizations, e.g., congressional committees and representatives, federal and state officials and committees, public interest groups, and interested individuals.

In addition to the required public outreach attendant upon the publication of a formal recommendation, the Board made available voluminous written materials and papers on Board activities, providing extensive technical files for public perusal at the Board's offices in Washington, DC. Indicating the eventual scale of this endeavor, a 1997 estimate put the volume of records available for viewing at 1.75 million pages.[367] Materials included the Board's annual reports and other statutorily mandated reports, the Board's formal recommendations, letters, technical reports, staff reports on visits to DOE sites, bound transcripts of public meetings, transcripts of hearing testimony, and statements of Board policies.[368] Most of this material was made available in electronic form on the agency's Web site (http://www.dnfsb.gov/), including all correspondence from the Chairman, all technical reports, all staff issue reports, and all weekly reports from the Board's site representatives.

In furtherance of the transparency of Board activities, the Board responded to numerous public requests for information and documents under the Freedom of Information Act (FOIA), committing substantial resources and assigned highly experienced personnel to the effort.[369] The Board issued regulations governing the availability of information on Board activities through

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[367] See Defense Nuclear Facilities Safety Board, *Strategic Plan: FY 1997–2002,* (Washington, DC, 1997), 3, http://www.hss.doe.gov/deprep/1997/bm97s30b.htm. See also Chapman, 375.

[368] On the public availability of the transcripts of meetings, see *Public Meetings and Hearings, 1991,* vol. II of II, 490, which stated,

> Publicly releasable portions of the record will be made available for public inspection after an appropriate review by DOE for classified or controlled nuclear information, and review by the Board for other disclosure exemptions under the Freedom of Information Act. All documents will be handled in accordance with the Board's regulations implementing the Freedom of Information Act.

Although not required by the Government in the Sunshine Act, transcripts were prepared of the open public meetings. These transcripts, along with documents developed for the meetings by the Board and its staff were publicly available.

[369] Pub. L. No. 89-487. See Office of Technology Assessment, *Dismantling the Bomb*, 119. The Freedom of Information Act (FOIA) allows requests for access to government information not made generally available and permits challenges to the denial of such requests. FOIA has an exemption for "properly classified' information, but places the burden on the "owner" agency to justify the withholding of access. FOIA requests are sometimes answered with an unclassified version of the restricted material with blacked-out sections.

the reading room or pursuant to a FOIA request, promulgating the final regulations on May 8, 1991.[370] In its FOIA program, the Board "not only met the letter but the spirit of the law."[371] None of the Board's responses to FOIA requests or a request for public documents was judicially challenged. As Azzaro stated, speaking of the FOIA initiative, its "singular success [was] documented in letters from citizens, public interest groups, members of Congress and testimony before the board and Congress."[372]

Another avenue by which the Board disseminated information to the public was through the written reports and oral testimony that it provided to Congress pursuant to reporting requirements imposed by Congress in the performance of its own oversight over Board activities. Reporting requirements included, for example, the Board's statutorily required annual report provided directly to Congress for each calendar year. These reports were prepared by the Board without any contribution from contractors and were among the materials made available in public reading rooms.[373] Over the years, Congress imposed additional reporting requirements, some as one-time requests and some more enduring. A further means of keeping Congress informed was through testimony by Board members before a number of congressional committees to which the Board was required to report. Depending on the topic under examination, Board members were called upon to testify before the appropriations, armed services, and energy committees of both the House and Senate, as well as an occasional additional committee.[374] The Board members' first congressional appearance subsequent to their confirmation hearing took place five months after the Board's startup, before the Senate Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence.[375]

Public Meetings and Hearings

The Board further demonstrated its commitment to keeping the public informed through its practice of convening meetings open to the public, with advance notice given in the *Federal*

[370] See Defense Nuclear Facilities Safety Board, "Rules Implementing the Freedom of Information Act," 56 *Fed. Reg.* 21259–21266 (May 8, 1991).
[371] Personal communication, Azzaro.
[372] For additional perspectives on the Board and the FOIA program, see *Public Meetings and Hearings, 1991,* vol. II of II, 204; and Office of Technology Assessment, *Dismantling the Bomb*, 120.
[373] Another, similar yearly report provided directly to Congress, the Government Performance and Results Act (GPRA) Report, covered the fiscal year (FY), rather than the calendar year.
[374] Interview, Pusateri. See also Chapman, 375.
[375] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*.

Register, in accordance with Pub. L. No. 94-409, the Government in the Sunshine Act.[376] The Board inaugurated public meetings and open hearings in early 1990, beginning with public discussions in January and February in the vicinity of the Rocky Flats plant near Boulder, Colorado. Such meetings, besides being posted in the *Federal Register*, were advertised in various media venues. Speaking of the meetings, Eggenberger said in a 1992 hearing before the Senate Armed Services Committee,

> An important part of our business is interfacing with the public in the form of public meetings and hearings. To date, we have conducted public meetings and hearings for the WIPP site, the Savannah River site, the Rocky Flats plant, Hanford, and generic issues throughout the complex.[377]

Totaling up the public meetings held by the Board by 1997, a Board strategic plan authored that year reported 29 public meetings in communities near DOE facilities and an additional 29 in Washington, DC.[378] By the end of 2007, the Board had convened 96 public hearings/meetings.[379]

These meetings provided opportunities for interested groups or persons, public and private, to learn and express their views about DOE facilities in informal, open discussions. Many of the meetings were held in communities near the facilities, allowing the Board and other presenters to focus on the safety issues and Board activities of concern to the local communities. The meetings varied in specific purpose and format. The Board experimented with different hearing formats ranging from on the record legislative hearings to the less formal "town meeting."

In some meetings, the Board members and the Board's technical experts heard detailed presentations from and put questions to representatives of DOE, the contractor at the site, and other knowledgeable presenters. Often the aim was to question DOE witnesses on DOE's implementation plan commitments and the progress that DOE and its contractors had made in accomplishing them. For example, in an August 1990 evening hearing in Westminster, Colorado, with 200 people in attendance, DOE and its contractor made presentations on the status of Board recommendations, 90-2, 90-4, 90-5, and 90-6, pertinent to the Rocky Flats plant, and on the secretary of energy's actions following their receipt. The recommendations under discussion at the meeting addressed such issues as the standards applicable to specific buildings, operational

[376] DNFSB, [First] *Annual Report to Congress,* 34.
[377] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1993*, 235.
[378] Chapman, 375.

readiness reviews for the buildings, criticality safety in the ducts, and the systematic evaluation program. Experts brought in by DOE on the operational readiness review each presented on their area of expertise. To ensure that responsible government officials were kept informed, such briefing events often included, by special invitation of the Board, representatives of elected officials and government agencies. Briefings in 1990 on the potential dangers to the public of the Hanford waste tanks, for example, included representatives of the governors of Oregon and Washington, as well as of EPA, GAO, and state environmental agencies.

Such informational meetings served not just to apprise the public of progress in implementing Board recommendations, but also as a vehicle to exert pressure on DOE "to increase DOE's responsiveness to Board safety initiatives and to explore roadblocks to expeditious and competent implementation for accepted recommendations."[380] As the Board stated, "Questioning in public forums creates an atmosphere of accountability—that the Board intends to use every available vehicle to achieve safety progress."[381]

At another kind of public meeting, the Board members themselves made statements to the public in their areas of particular interest, communicating with interested parties about how the Board saw its oversight activities and findings. Typically, as the chairman called each of a series of technical matters for discussion, he identified the lead Board member tracking the review and analysis of that particular matter. For example, Crawford often spoke on operator qualification or on the discipline of operations, Eggenberger addressed the ability of systems to withstand seismic events, and Kouts focused on thermal hydraulic performance, the piping and the emergency cooling capability of the plant, which were relevant to maximum reactor power. In still another public meeting format, the Board's technical staff briefed the Board on particular technical issues, for example, plutonium vulnerabilities throughout the complex.

At most informational meetings, the Board provided the opportunity for spokespersons of organizations and interested citizens to voice their concerns about DOE facilities or Board oversight, and to add to the record. Some meetings, generally evening meetings held in the locale where DOE nuclear facilities were located, were almost solely devoted to the receipt of citizen and community group input.

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379 Defense Nuclear Facilities Safety Board, "DNFSB Public Meetings, 1990–2007" (Board document).
380 George, 205.
381 DNFSB, *Fifth Annual Report to Congress*, 76.

The feedback that the Board received on its efforts to communicate with the public through meetings and hearings was strongly appreciative, with some qualifications. Representative David Skaggs (D–CO), for example, praised the Board's outreach in public meetings for enabling the citizenry to judge safety questions based on information they could count on—information they saw as from an independent and technically expert source. Long caught up in the contentious issues involving Rocky Flats, he laid out his understanding of what the Board's outreach accomplished, observing,

> This openness is terribly important. It reassures the public that there is really someone independent of the Department of Energy who is overseeing plant operations.[382]

Speaking specifically of activities to prepare for restarts at Rocky Flats, he emphasized the degree to which the Board's presence improved public confidence, stating,

> When the Department of Energy says they are ready to restart Rocky Flats, the public in this state is going to turn to you and to the Ahearne Committee and ask is it really safe. And we will be counting on you to tell us yes or no.[383]
>
> Unless the public is shown clearly that independent observers have checked things out, it will have no reason to believe yet another Department assurance that "things have changed at Rocky Flats."[384]

In addition, Skaggs praised the Board for its prompt disposition of reported concerns, stating, "I am extremely impressed with your speed of getting on top of the issues." Others also noted the efficiency and promptness of the responses to and disposition of the concerns on health and safety issues raised by the public. Azzaro, noting this rapid response to the reported concerns of the public, credited it to the high-level expertise of Board personnel and to the Board's organization,

> Building upon its unique capability in investigations, litigation, integrity in government, administrative law, environmental law, and substantial expertise and technical depth in the sciences, engineering, and nuclear operations, the General Counsel's Office was hard linked to the Technical Director and the General Manager, which facilitated almost immediate disposition of reported concerns.[385]

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[382] *Public Meetings and Hearings, 1990, Before the Defense Nuclear Facilities Safety Board* (Washington, DC: Defense Nuclear Facilities Safety Board, 1990), 589.
[383] *Public Meetings and Hearings, 1990,* 590.
[384] *Public Meetings and Hearings, 1990,* 594.
[385] Personal communication, Azzaro.

With reference to the Board's outreach practices, the main qualm that Skaggs expressed was that the Board was excessively low key in its approach to advertising meetings and arousing public interest. He urged the Board to step up prior media notification efforts, indicating that greater public interest and pressure would strengthen his hand in seeking government resources for improvements and site cleanup.[386] The urging by Skaggs and others that the Board make its advertising efforts "more prominent and repetitive" met with some resistance by the Board members. In response to the urging to seek more media exposure, Conway stated in a revealing comment, "Unfortunately, it has been my limited experience that the media will show an interest if you are willing to frighten the people."[387] Taking an analytical/technical approach to safety questions, the Board expressed reluctance to play upon people's fears, whatever the benefits.[388]

Although appreciation, such as that expressed by Skaggs, predominated in feedback the Board received on its conduct of public meetings, Board meetings met with some criticism, mostly regarding the scope of discussions and, specifically, their limitation to technical safety matters. Criticism generally focused not on what the Board did in the meetings but on its exclusion of issues as beyond the scope of its jurisdiction. Such issues included broad questions of national security policy or U.S. nuclear policy, such as what nuclear materials or weapons were needed and what nuclear facilities should be built, or environmental questions that clearly fell under the jurisdiction of the EPA. In holding its public meetings, the Board members anticipated criticism for not including such questions on the agenda, and undertook to spell out the limits of the Board's responsibilities. The Board chairman made a practice of beginning meetings with a statement about the Board's jurisdiction and statutory charge. In particular, the Board underscored that its purview was technical questions as to the safety of DOE nuclear operations and not questions of national security policy.[389] For example, speaking about the restart of the K-reactor at Savannah River, Conway said,

> [T]his Board has no legal responsibility of determining what the tritium requirements are or whether or not it's in the Government's . . . security interest to proceed with the opening of the Plant. By law, that is the responsibility of the Department of Energy, the Secretary of Energy, specifically, and the President of

[386] On the activities of Representatives Skaggs in connection with Rocky Flats, see Len Ackland, *Making a Real Killing: Rocky Flats and the Nuclear West* (Albuquerque: University of New Mexico Press, 2002), esp., 205–6.
[387] *Public Meetings and Hearings, 1990,* 599.
[388] Interview, Joseph J. DiNunno, Board member, Annapolis, MD, Septmber 16, 2008.
[389] Interview, A.J. Eggenberger, Board chairman (since 2005; vice chairman, 1989–2005), Washington, DC, July 9, 2008.

> the United States. Our responsibility, as members of this Board, and our staff, our responsibilities are to assure that if and when the Plant is operated that it would not constitute an unreasonable risk to the public.[390]

He added, as he regularly did, that by "public" he meant workers, as well as people beyond site boundaries,

> And when we use the term "public," we included the workers at the Plant. That term, "public," is all-inclusive, off site, on site, workers and non-workers.[391]

The explicit definition of workers as a population of concern for the Board was a jurisdictional decision that Conway had made at the very outset of the Board's operations.[392] As Conway later observed,

> From the time this Board was established, right from the very beginning . . . this Board pointed out that as far as it was concerned, the health and safety of the public, by definition, we included worker within the public and we looked upon the law as requiring that.[393]

Despite the Board's efforts to explain the scope of the Board's jurisdiction as not extending to national security and nuclear deterrence policy, some participants in public meetings were unwilling to lay aside policy questions. Although they commonly acknowledged the technical expertise of the Board members and the thoroughness of their safety review efforts, such participants either did not heed, or did not accept the validity of, the separation of technical and policy questions. A spokesperson for the Energy Research Foundation at a Savannah River meeting, for example, prefaced her challenge of the Board with the statement, "I personally do not enjoy standing up and questioning the assurances of a group of men whose combined experience in the nuclear energy amounts to millions of years."[394] She then went on to explain why she insisted on questioning the need for any tritium-producing reactor, in view of the ongoing U.S. and Soviet arms reductions, rather than confining herself to technical questions on the readiness for restart of the Savannah River production reactor,

> Now we recognize that you don't consider that it's within your purview to consider the national security needs, but it is certainly obvious tonight . . . that many of us consider this to be the most pressing issue; the waste of resources,

[390] *Public Meetings and Hearings, 1991,* vol. II of II, 201.
[391] *Public Meetings and Hearings, 1991,* vol. II of II, 201.
[392] Interview, John E. Mansfield, Board vice chairman (since 2007; Board member, 1997–present), Washington, DC, August 25, 2008.
[393] *Public Meetings and Hearings, 1995, Before the Defense Nuclear Facilities Safety Board,* vol. I of II (Washington, DC: Defense Nuclear Facilities Safety Board, 1995), 184.
[394] *Public Meetings and Hearings, 1991,* vol. II of II, 216.

> prioritization, . . .the absence of any meaningful cost benefit analysis here. There is no forum for us to express that, unfortunately. Therefore, . . .we can [only] bring it up in hearings where it is expressly inappropriate, supposedly, like this one. Many of us have to overcome a great reluctancy.[395]

Others at the meeting similarly criticized or strayed beyond the topical boundaries defined by the Board. A private citizen broached the policy issue of the need for the construction of a new reactor, stating a preference for that alternative, if need be, over the restart of "those old decrepit reactors."[396] A spokesperson from an environmental group voiced objection to the readiness review's neglect of the issue of continuing environmental releases of hazardous materials. Such indications of discontent about the limits of the Board's agenda in its public meetings remained a feature of the meetings, notwithstanding the general appreciation of the Board's augmentation of transparency regarding the safety of operations in the weapons complex.[397]

Early Criticisms for Insufficient Transparency in the Board's Operations

More direct challenges to the Board came from parties still not fully satisfied with the openness to public scrutiny that the Board's manner of conducting business provided. Although the Board was assiduous in providing for the public openness of formal recommendations and the actions that followed their issuance, some critics found wanting the transparency of two aspects of Board activity. These were the internal deliberations among Board members and staff as they contemplated the issuance of a formal recommendation, and informal Board interactions with DOE yielding advice that did not culminate in the issuance of anything formal—that is, anything that needed to be made public.

The GAO articulated the latter concern—the concern about the Board's interaction with DOE—in a report requested by the Senate Governmental Affairs Committee on the first year of the Board's operations.[398] In this report, *Nuclear Safety: The Defense Facilities Nuclear Safety Board's First Year of Operation*, the GAO was on the whole very positive in its assessment of

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[395] *Public Meetings and Hearings, 1991,* vol. II of II, 218. The Savannah River Site was the nation's sole producer of tritium, the hydrogen isotope that increases the explosive yield of thermonuclear weapons. Decaying about 5 percent a year, it must be periodically replenished in nuclear weapons. The end of the Cold War and the arms control agreements to reduce nuclear arsenals eliminated any immediate need to produce new tritium. To support the nation's enduring stockpile, existing tritium was recovered and recycled, mostly from decommissioned weapons.
[396] *Public Meetings and Hearings, 1991,* vol. II of II, 211.
[397] George, 132.
[398] GAO, *Nuclear Safety: The Defense Nuclear Facilities Safety Board's First Year of Operation*, 2–3ff.

the Board and its early accomplishments. However, the GAO took the Board to task for the degree to which its interaction with DOE and its operating contractors took place outside the public eye—in oral communications with DOE, undocumented briefings, and informal meetings. The GAO granted that such informal communications could prompt DOE to take needed corrective action. The report cited as an example DOE's change in its approach, based on its discussions with the Board, to reviewing and ensuring the seismic capability of the Savannah River reactors. The GAO was uneasy, however, that the needed change resulted from behind-closed-doors interaction between DOE and the Board. Such informal interaction limited the public's awareness of the Board members' health and safety concerns and of DOE's actions. According to the report, limiting the public's awareness could also jeopardize the Board's mission of restoring public confidence,

> [T]he public would have little more basis for confidence in the safety of DOE's defense nuclear facilities than it did when overseeing safety and health was an internal DOE function.[399]

Leaving the public without the assurance that the Board was independent in its decision-making, the lack of openness "could convey the impression that the Board is not operating 'at arm's length' from DOE."[400]

The GAO proposed several remedies to ensure the public's awareness of safety issues and its perception of the Board's independence, mainly, that the Board more intensively document all of its safety review activities in ways that would better capture them for the public record and congressional oversight. The GAO urged that the Board keep fuller records of conversations with DOE and information provided orally by DOE, and document all meetings, analyses and informal "commitments and agreements."[401] It also suggested that the Board establish written criteria to specify when findings about safety problems would result in the issuance of a formal recommendation.

In responding to the GAO report, the Board acknowledged the need to develop fuller publicly accessible records of its informal transactions—of its concerns and DOE's position on correcting safety and health problems. However, the Board was less amenable to the GAO report's suggestion that it pursue a more "arms length" relationship with DOE or that it

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399 GAO, *Nuclear Safety: The Defense Nuclear Facilities Safety Board's First Year of Operation*, 25.
400 GAO, *Nuclear Safety: The Defense Nuclear Facilities Safety Board's First Year of Operation*, 23.
401 GAO, *Nuclear Safety: The Defense Nuclear Facilities Safety Board's First Year of Operation*, 23–32.

formulate formal criteria for the issuance of recommendations. In defending its methods of operating in relation to DOE, the Board held that curtailment of its informal interaction would be self-defeating. Such curtailment would be at odds with the very kind of cooperative and intensive interaction that the Board considered a most appropriate and productive manner of dealing with highly complex technical issues—as well as a manner of operating fully compatible with independence.[402] As the Board stated in its first annual report to Congress,

> The GAO Report's admonishment to stay "at arms length" with DOE . . . obscures the fact that oversight organizations, including the GAO, IG Offices, and Committees of the Congress, are able to accomplish much of their mission when they work in cooperation with the officials of the agency being scrutinized. The fact that DOE has given the Board open access to its defense nuclear facilities, has frequently briefed the Board extensively on safety problems at sites, and has not resorted to an adversarial relationship with the Board does not mean the Board has failed to maintain its independence or desire to exercise judgment at "arms length." The Board's activities in closely reviewing the programs and practices of DOE and its contractor do not violate the principles of independence of judgment—in fact, our enabling statute demands a level of attention that could not be achieved if Board activities were limited to those that result only in formal recommendations.[403]

The Board's defense of its methods of operating in relation to DOE struck themes that also figured in its defense of its manner of conducting its own internal deliberations. Just as the Board valued its non-confrontational relationship with DOE, it affirmed the value of its internally collegial mode of interacting—interaction amongst the Board and its staff and other experts unencumbered by excessive formality and record-keeping.[404] In affirming its way of working, the Board answered an early challenge to its internal manner of operating, specifically, criticism that its internal workings were beyond public scrutiny. This challenge was more involved than the GAO's mild and never repeated rebuke, in that the challenge took the form of litigation whose final resolution spanned several years. The litigation centered on how open the Board needed to make its own deliberative processes prior to the issuance of a formal recommendation.[405] As Conway stated in the first appearance before the Senate Armed Services Committee five months into the life of the Board, "We have been sued by two organizations that

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[402] Interview, Richard A. Azzaro, Board general counsel, Washington, DC, August 20, 2008. See also George, 141–42.
[403] DNFSB, [First] *Annual Report to Congress*, February 1991, 45–47.
[404] George, 115.
[405] George, 133.

have demanded that we have all of our meetings open to the public as we prepare our recommendations."[406]

In early 1990, the environmental groups, the Energy Research Foundation and the National Resources Defense Council (NRDC), challenged the Board's position that it was not an "agency" for purposes of the Sunshine Act and the Freedom of Information Act. These parties initially sought an injunction against Board activities, including site visits, until the Board promulgated regulations implementing these information statutes. The United States District Court for the District of Columbia ruled in favor of the Board on all issues, finding that the Board was not an agency.[407] On appeal, the Court of Appeals for the District of Columbia reversed, ruling that "the Board . . . must be considered an 'agency' within the meaning of both statutes."[408]

Following the Court of Appeals decision, the Board wrote and published a proposed Sunshine Act rule. After receipt of public comments on the proposed rule, the Board promulgated a final rule, which was promptly challenged by the same parties. The challenge focused on a single provision of the Board's rule, which allowed closure of Board meetings involving formal recommendations to the secretary of energy or the president. Oral argument was conducted by the Court of Appeals on November 14, 1991. On July 24, 1992, the court held that the Board's enabling statute permitted closed Board meetings on formal recommendations.[409] The court relied on the express language of the Board's enabling statute that recommendations were to be made public "after receipt by the Secretary of Energy" or the president in appropriate cases.[410] Therefore, the court concluded that the Board's Sunshine Act rule was legally sound.

On October 9, 1992, the Court of Appeals refused a petition for rehearing en banc. Petitioners then sought a writ of certiorari from the United States Supreme Court. On May 17, 1993, the Supreme Court issued an order denying the petition, thus terminating the litigation.[411]

Prevailing in court relieved the Board of pressures to alter its internal manner of operating in ways that it viewed as negative. As the Board understood their legal opponents'

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[406] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 4.
[407] *Energy Research Foundation v. Defense Nuclear Facilities Safety Board,* 734 F. Supp 27 (D.D.C. 1990).
[408] *Energy Research Foundation v. Defense Nuclear Facilities Safety Board,* 917 F.2d 581, 585 (D.C. Cir. 1990).
[409] *NRDC/ERF v. Defense Nuclear Facilities Safety Board*, No. 91-1199 (D.C. Cir. 1992).
[410] 42 U.S.C. Section 2286d(a);g(3).

demands, they would have stood in the way of conducting meetings in private, and required advance public notice to be given of deliberations involving more than two Board members, an agenda to be published, and the deliberative meetings to be held in public. As Conway said, if required to "follow the letter of the law under the so-called Sunshine Act," "no more than two of us at any one time could ever meet and discuss something without it being a violation."[412]

The Board members shared the view that their exercise of effective safety oversight required their ability to confer freely amongst themselves and with DOE personnel without formal notification. As the Board members described the advantages of their way of working, they mentioned their capacity to respond quickly to issues as they came up, and their ability to elicit the information they needed from DOE without formal procedures. They also valued their freedom to operate unhindered as a team of experts, delving personally and collaboratively into the technical specifics of issues, sometimes via multiple informal interactions throughout the work day or while touring sites. As Conway said,

> We . . . bring our expertise to bear, and we meet daily and more than once per day as we review the papers, as we discuss among ourselves . . . where we think we have to move and what areas we should focus on. If, as we develop our recommendations . . . we would not be able to work as a collegial group preparing and working on our recommendations … [w]e would have to get staff to do that work.[413]

Board member Kouts elaborated on Conway's points, emphasizing timely action as a benefit of the Board's methods,

> I would reinforce what our chairman has said concerning the ability to meet and act together as a collegial group. This is absolutely necessary for the way we operate.
>
> You have heard various statements made concerning the Hanford waste tanks and the hydrogen problem. This problem came to our attention on one day. We met on it the same day. We got the Department of Energy in to talk to us the next day. We got our consultants in, in between, and we made arrangements to go to Hanford again with an agenda established the next day. All like that. And this would be absolutely impossible if we had to publish notices of our meetings 2 weeks in advance or 1 week in advance with agendas stated.

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[411] *Natural Resources Defense Council* v. *Defense Nuclear Facilities Safety Board*, 969 F.2d 1248 (D.C. Cir. 1992), cert. denied, 508 U.S.906 (1993).
[412] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 32.
[413] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 32.

> We operate collegially. We work together collegially. We supplement each other's capabilities, and this is precisely why, as we come here before you, our chairman can speak for us.[414]

Conway added that the effect of more rule-bound operations and public notification procedures would be the transformation of the Board into something like a panel of judges, a "quasi-judicial . . . as opposed to a working unit." Without the ability of the Board members to meet freely, he said,

> It would be the staff that would be doing the preparing of the documents, and … and then we would meet like five judges, a judicial group, and listen to staff or someone else present their opinion and recommendations to us, and then make our decisions.
>
> We now are doing the work, and we are working on a daily basis as a team.[415]

For Conway, as well as for the other Board members and staff, any such shift in the direction of a "judicial group" went against the grain. They shared the general view of adjudicative processes as ill suited to technical complexities and to making the kind of substantive technical and scientific judgments that the Board's safety mission required. As they saw it, echoing the sentiments of the Senate Armed Service Committee, adjudicative processes could result in adversarial hearings, in opportunities for judicial appeals by activist groups bent on delaying action, and in an emphasis on legal processes at the expense of identifying and finding substantive solutions to nuclear health and safety issues.[416] The Board members' preferred alternative—in-depth informal dialog and non-confrontational, hands-on proceedings—need not, in their view, compromise either their commitment to transparency or their independence.[417]

[414] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 47.
[415] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 32.
[416] Interview, Azzaro.
[417] DNFSB, [Second] *Annual Report to Congress*, 31–34.

CHAPTER 4: TECHNICAL NUCLEAR SAFETY ACTIVITIES OF THE BOARD

As the Defense Nuclear Facilities Safety Board (DNFSB or the Board) confronted and addressed various issues concerning its operating procedures, its technical oversight activities went on at an energetic pace, yielding seven sets of formal recommendations in the first year, and six sets in the second.[418] In conjunction with each of the sets of recommendations, the Board continued to work intensively with DOE on follow-up and to convene numerous public meetings to inform the public.

SITE-SPECIFIC SAFETY OVERSIGHT

In 1990 and 1991, the Board focused primary attention on the Savannah River Site, the Rocky Flats plant; the Hanford, Washington, site, specifically, the waste storage tanks; and the Waste Isolation Pilot Plant (WIPP) in New Mexico. Other sites received attention through the Board's coverage of generic issues and staff/contractor reviews.

Savannah River Recommendations: Readiness for Safe Reactor Restart

The Savannah River Site's production reactors ranked high among the Board's oversight priorities, because of the expected resumption of production activities. As the Board began operations, restart of the site's K-reactor was anticipated to occur in the near term. While in the end, Secretary of Energy Watkins delayed the startup of the K-reactor, not authorizing it until December 13, 1991, the Board, DOE, and its contractors worked under the assumption of a shorter time frame, and the Board spent considerable time from 1990 through 1991 monitoring DOE's progress toward restart.

As the Board members, staff, and consultants continuously tracked restart activities, they also held a series of eight public hearings/meetings, which generally involved the full Board, as well as the Board's General Counsel, Robert Andersen, and the Technical Director, Dr. George

[418] In accordance with a congressional mandate, the Board included a discussion of each year's recommendations in its annual report to Congress. For non-Board descriptions of the Board's early recommendations, see U.S. General Accounting Office, *Nuclear Safety: The Defense Nuclear Facilities Safety Board's First Year of Operation*, GAO/RCED–91–54 (Washington, DC, February 1991), 1–33, http://archive.gao.gov/t2pbat7/143684.pdf; and Bert Chapman, "The Defense Nuclear Facilities Safety Board's First Decade," *Journal of Government Information* 27

Cunningham. The meetings addressed the proposed actions and implementation of the three early recommendations that applied solely to the Savannah River Site, 90–1, on operator training; 91–2, on the process for closing outstanding safety issues; and 91–5, on the power limits question, as well as more broadly applicable recommendations—e.g., on standards and on radiation protection—which had portions pertinent to Savannah River's restart efforts.

The first of the Board's formal recommendations, 90–1, issued on February 22, 1990, called for training and qualifications upgrades of the operating personnel for the three Savannah River reactors.[419] According to the Board, DOE standards for training the reactor plant operators and supervisors were not adequately determined and specified. The Board recommended that DOE determine the qualifications operators must demonstrate before restarting the reactors and modify its training procedures to ensure that the workforce was qualified. In determining the requisite qualifications, DOE was advised to identify any differences between those it demanded and the qualifications prescribed by the NRC for analogous positions in civilian nuclear power plants. DOE was further urged to assess the current state of knowledge of each reactor operator and supervisor—using both written and oral examinations—in order to learn how to reshape the training program to instill the requisite skills for restart. In addition, the recommendation called for the training of operators in the revised procedures that would be sanctioned for normal operations and emergency situations. Finally, the Board called for the provision on an accelerated basis of as-built drawings of safety-related systems and procedures.[420]

The Board received DOE's plan to implement this recommendation from Secretary Watkins on July 13, 1990, and, later, a supplement that remedied a number of plan deficiencies identified by the Board. As stipulated in the final plan, the secretary kept the Board abreast of progress on the implementation of training improvements. DOE effected extensive retraining, focusing on K-reactor personnel, since the K-reactor was scheduled to restart first and, eventually, was the only reactor slated for restart. The Board continually monitored the retraining efforts, considering them critical to operational readiness. As Board member, John W. Crawford Jr., typically the lead Board member on technical personnel issues, pointed out, the Board

(2000): 355–62, 347, http://docs.lib.purdue.edu/lib research/70. The following discussions of Board recommendations are indebted to both the Board and non-Board sources.

[419] Defense Nuclear Facilities Safety Board, *Recommendation 90–1, Operator Training at Savannah River Site Prior to Restart of K, L, and P Reactors* (Washington, DC, February 22, 1990), 1, http://www.dnfsb.gov/pub_docs/recommendations/srs/rec_1990_01.txt.

[420] DNFSB, *Recommendation 90–1,* 1.

members, staff, and consultants devoted "more than 300 man hours of direct observation of the operating crews in the plant or the central control room simulator."[421]

Another recommendation issued in conjunction with Savannah River operations, Recommendation 91–2, *Closure of Safety Issues Prior to Restart of the K-Reactor at the Savannah River Site*; issued on March 27, 1991, concerned the process by which DOE would document the resolution or "closure" of safety issues prior to the anticipated restart of the K-reactor. The safety issues requiring resolution were compiled in the Reactor Operations Management Plan (ROMP) issued by the site's contractor. The ROMP identified some safety improvement measures as a precondition for the restart, because they related to the safe shutdown of the reactor in case of untoward events, e.g., a loss of coolant accident, or an earthquake, fire, or flood.[422] Other candidates for safety upgrades were not part of a safe shutdown system and not a potential impediment to restart, but were part of the post-restart safety improvement program. In either case, when progress on a problem culminated in closure of the issue, an issue closure package was drawn up. The Board monitored progress on settling issues in the ROMP partly through review of these issue closure packages. The Board's recommendation called for their improvement through fuller descriptions of the bases for closure claims and urged DOE to perform fuller reviews of the packages and the supporting evidence for the resolution of each issue.[423]

The third Savannah River recommendation, 91–5, grappled with the power limits question for K-reactor operations.[424] The recommendation was issued on December 19, 1991, six days after Watkins's announcement that the K-reactor would restart, resuming operations at 30 percent of what had historically been its full operating power. As the recommendation made clear, the Board concurred in the view that the reactor could be operated at the 30 percent level without undue risk to the public. After reviewing information provided in numerous briefings and documents, including the safety analysis report, the Board judged 30 percent power (720

[421] *Public Meetings and Hearings, 1991, Before the Defense Nuclear Facilities Safety Board*, vol. II of II (Washington, DC: Defense Nuclear Facilities Safety Board, 1991), 541.
[422] *Public Meetings and Hearings, 1991,* vol. II of II, 496.
[423] Defense Nuclear Facilities Safety Board, *Recommendation 91–2, Closure of Safety Issues Prior to Restart of K-Reactor at the Savannah River Site* (Washington, DC, March 27, 1991), 1, http://www.dnfsb.gov/pub_docs/recommendations/srs/rec_1991_02.txt.
[424] Defense Nuclear Facilities Safety Board, *Recommendation 91–5*, *Power Limits for K-Reactor Operation at the Savannah River Site* (Washington, DC, December 19, 1991), 1, http://www.dnfsb.gov/pub_docs/recommendations/srs/rec_1991_05.txt.

megawatts) to be acceptable, provided that the list of identified prerequisite improvements for startup was accomplished. The Board rendered a different judgment about higher power levels,

> The Board is of the opinion that the existing information on the effectiveness of the engineered safety features, especially those that would be relied on in the event of a large loss-of-coolant accident, does not at present support operation at a power level much above the 30 percent value.[425]

The Board added that if higher power levels were contemplated, the assurance of safe operations would require further improvement efforts, starting with more definitive studies on the thermal hydraulic methodology used in analyzing the K-reactor's core cooling performance under unusual conditions,

> The Board considers that justification of any increase in power would require further refinement of the thermal-hydraulic evidence on the cooling capability of the emergency cooling systems under accident conditions.[426]

Further recommended prerequisites for greater power levels included revised accident analysis and the implementation of controls for the models that the contractor developed, with the help of Los Alamos research programs, to analyze accidents.[427]

As the postponed restart of the K-reactor loomed closer on the horizon, the Board shifted its emphasis from highlighting safety-related shortcomings that needed to be fixed to assessing the progress in addressing them, and to assessing the reviews of safety issues performed by DOE and the contractor. As part of this assessment endeavor, the Board held several public meetings at the site in late 1991, to review the safety deficiencies and corrective actions in an open forum. In these meetings, the Board operated with a reduced number of members. Only four Board members were present to question DOE and contractor personnel and to make presentations and field questions, because of the death in September 1991 after a brief illness of Board member Edson Case. Case's successor, Joseph J. DiNunno, nominated in May 1992, was not confirmed until August 1992.

Proceeding as a team of four, the Board focused in these meetings specifically on the operational shortcomings that had to be resolved before restart, while acknowledging that other safety-related improvements would be ongoing, and their progress monitored. In the public meeting convened on December 9, 1991, just before the go-ahead for the K-reactor's restart was

[425] Defense Nuclear Facilities Safety Board, [Second] *Annual Report to Congress* (Washington, DC, February 1992), 11, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.
[426] DNFSB, [Second] *Annual Report to Congress*, 11.

announced, the Board members asked in detail about preparations for the restart, inquiring both about the formality and conduct of operations and about specific technical engineering issues. The meeting was largely devoted to questioning the team of experts that conducted the operational readiness review (ORR) for DOE.[428] The Board went through a list of issues one-by-one, putting questions to the ORR team and asking that the team members in turn spell out the process by which each issue had been closed. Crawford pointed out that this exercise of spelling out the closure process not only helped the Board in its evaluation of the safety situation, but also served the "knowledgeable public."[429]

As the Board looked in succession at safety-related elements in the ORR team's review, each Board member, as usual, took the lead on particular issues. Crawford, for example, was the lead questioner on training, a critical element in DOE's operational readiness reviews.[430] Reviewing the progress made in training programs, he remarked on substantial improvement,

> Board members, their staff and outside experts have witnessed progressive improvement in discipline, conduct of operations, formality of face-to-face communications and procedural compliance. Understanding by the operating crews of the importance of this operating philosophy and practice . . . [and] this sense of personal responsibility for safe plant operation is a significant improvement over the read-and-do approach that predominated . . . at plant shutdown and it is approaching the level that one customarily finds in a Navy nuclear plant.[431]

Eggenberger inquired closely about the seismic qualification of various systems and components of the K-reactor, and also about a longer-term "phased approach to seismic upgrades."[432] And Kouts focused on thermal hydraulics and reactor piping.[433] In pursuing their point-by-point questioning about safety issues and their handling, the Board members frequently framed questions in comparative terms, using various reference points. Crawford commonly brought up

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427 DNFSB, *Recommendation 91–5*, 1.
428 Interview, John E. Mansfield, Board vice chairman (since 2007, Board member, 1997–present), Washington, DC, August 25, 2008. As Mansfield stated, "In general, the Board considered DOE's conduct of ORRs to be in bad shape."
429 DNFSB, *Recommendation 91–5*, 1.
430 Crawford also contributed substantially to the Board's activities in the standards area and paid close attention to radiation protection issues. Personal communication, Kenneth M. Pusateri, Board general manager (1989–2006), Washington, DC, June 16, 2009.
431 *Public Meetings and Hearings, 1991,* vol. II of II, 541.
432 U.S. Congress, Senate, Committee on Governmental Affairs, *Accident and Explosion Risks at Department of Energy High-Level Radioactive Waste Facilities*, 101st Cong., 2d sess., July 31, 1990, 39.
433 *Public Meetings and Hearings, 1991,* vol. II of II, 541.

practices in the Naval Reactors Program as his reference point, and others brought up practices sanctioned by the NRC in the commercial sector.

Speaking generally about the Board's findings in its questioning of DOE and contractor personnel, Kouts remarked on a "turnaround in attitude" among operations personnel since "the beginning of this process of improving the situation at Savannah River."[434] He spoke of "substantial resistance" initially to the change of culture that the secretary of energy had long urged, and remarked,

> At the outset, it was more common to say, "Why are you people bothering us? We've run a safe plant all these years. Why are you trying to change us?" But now you find that, really, people are enthusiastic about the changes that have been made and they feel they are accomplishing something?[435]

The final Board actions on the readiness of the K-reactor to resume operations took place in Washington, DC, where the Board met for further point-by-point examination of the adequacy of the measures taken to correct deficiencies with the potential to threaten public safety. In 1992 the K-reactor operated briefly for the last time, until, in 1993, it was placed in cold standby condition as the nation's tritium source, and, in 1996, in shutdown condition.[436] In 2000 the K-reactor building was converted to K Area Materials Storage Facility.

Rocky Flats Recommendations: Resuming Plutonium Operations

Besides Savannah River, another priority focus of the Board's attention throughout its first two years was DOE's Rocky Flats plant, where plutonium components of nuclear weapons—"plutonium pits"—were produced until the plant's 1989 shutdown for safety, health, and environmental problems.[437] The Board took up its oversight responsibilities at the plant as it moved toward the resumption of plutonium and other weapons-related fabrication activities. According to the plan at that time,

> [A] succession of facilities would be readied for renewed operation, beginning with Building 559 (the analytical chemistry laboratory), and followed by Building 707 and then others. This process was to include systematic upgrading of the quality of operations in each case, including Operational Readiness Reviews by

[434] *Public Meetings and Hearings, 1991,* vol. II of II.
[435] *Public Meetings and Hearings, 1991,* vol. II of II.
[436] Savannah River Site, "Savannah River History Highlights," May 20, 2008, http://www.srs.gov/general/about/history1.htm.
[437] For expansive historical background on Rocky Flats and its problems, see Len Ackland, *Making a Real Killing: Rocky Flats and the Nuclear West* (Albuquerque: University of New Mexico Press, 2002).

> the contractor and by DOE to verify that the desired improvements had been accomplished by line management.[438]

In connection with this restart plan, Congress gave the Board explicit special legal authority, stipulating that no plutonium production facility at Rocky Flats could resume operations without a determination by the Board that public health and safety were adequately protected.[439]

Rocky Flats' resumption of operations activities and the Board's oversight proceeded against a background of serious environmental and safety deficiencies at the site, as well as legal troubles. Several fires had occurred at the plant over the years, most notably, the major fires in 1957 and 1969, which got into the ventilation system and released radioactive contamination. The 1969 fire, the "second largest industrial fire in the United States in terms of dollar value," and eventually prompted fire-safety upgrades across the DOE nuclear complex.[440] By 1989, Rocky Flats was embroiled in legal troubles over environmental violations, with the contractor, Rockwell, under investigation by EPA and the Federal Bureau of Investigation (FBI).[441] This investigation, which lasted five years, found that DOE and Rockwell had failed to produce an adequate waste disposal analysis plan, and failed to store waste with a permit as required by the Resource Conservation Recovery Act (RCRA). They also had failed to maintain an accurate operations record and to provide written notification of incidents requiring a contingency plan.[442] These and other Rocky Flats problems culminated in a June 1992 plea bargain agreement between Rocky Flats contractor, the Rockwell Corporation, and the U.S. Department of Justice.

The charged history of problems at Rocky Flats provided the context of the Board's oversight activities at the site and dictated their intensity. The Board members not only knew that

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[438] Defense Nuclear Facilities Safety Board, *Recommendation 92–5*, *Discipline of Operation in a Changing Defense Nuclear Facilities Complex* (Washington, DC, August 17, 1992), 1, http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1992_05.txt.

[439] *National Defense Authorization Act for Fiscal Years 1992 and 1993*, Pub. L. No. 102–190, Section 3133, 105 Stat 1290, 1574, December 5, 1991. For discussion of this legal authority, see also a hearing on the proposed Federal Nuclear Facilities Licensing and Regulation Act, U.S. Congress, House of Representatives, Committee on Natural Resources, Subcommittee on Energy and Mineral Resources, *Federal Nuclear Facilities Licensing and Regulation Act,* 103rd Cong., 2d sess., March 1, 8, 1994, 240.

[440] *Public Meetings and Hearings, 1995, Before the Defense Nuclear Facilities Safety Board* (Washington, DC: Defense Nuclear Facilities Safety Board, 1991), 20. See also U.S. Department of Energy, Assistant Secretary for Defense Programs, *Assessment of Plutonium Storage Safety Issues at Department of Energy Facilities* (Washington, DC, 1994), 16.

[441] Ackland, 214–24.

[442] U.S. Congress, House, Committee on Science and Technology, Subcommittee on Investigations and Oversight, *Environmental Crimes at the Rocky Flats Nuclear Weapons Facility,* 102d Cong., 1st sess. ,Vol. 1, executive session: September 10, 11, 17, 18, 23, 24, 25, 30, 1992; public session: September 23, October 2, 5, 1992, 9. See also Vol. 2, September 17, 18, 1992.

they faced the site's numerous safety problems, but also believed that restarts of idled facilities after extended outages demanded special vigilance to ensure safety. Expressing a view often advanced by the Board, its Recommendation 92–5 stated,

> Experience shows that the resumption of operations at a facility that has been idle for an extended period, or the operation of a facility in a new mode created an above-average possibility of mistakes, equipment failures, and violations of safety requirements, all of which could cause accidents.[443]

Of immediate concern at Rocky Flats, as the Board ascertained during its first site visit in January 1990, was the accumulation of radioactive material, mainly plutonium, in the facilities' ventilation ducts and related systems. The Board issued a recommendation, 90–6, *Criticality Safety at the Department of Energy's Rocky Flats Plant, CO*, the third in its string on Rocky Flats, on June 4, 1990, on this debris accumulation.[444] In April 1990, DOE had revealed that some 62 pounds of plutonium had collected in the ducts. The Board's recommendation advised DOE, prior to resuming plutonium operations at the plant, to prepare a written program with commitments to address the problem. The proposed program's immediate objective was to evaluate and mitigate the hazards associated with the ducts' radioactive accumulation and, in particular, to address the risk of a criticality accident, an accident involving sufficient radioactive material to produce a self-sustaining nuclear fission chain reaction. The Board's concern was that the reported 60 pounds of fissile material posed the possibility of a criticality event, with the attendant threat of excessive radiation exposure, particularly to on-site operating personnel. Although DOE and several contractors had examined the criticality safety problem, they had not completed full characterization of the situation or plans for remediation actions.

The Board's recommendation called for an initial reduction of the amount of fissile material in a "prior to resumption" building-by-building duct cleanup, to ensure the prevention of criticality accidents. Stating an assumption of the cleanup, a DOE official at Rocky Flats said, "Under the most conservative assumptions, there can by no criticality event if the total quantity of plutonium involved is less than 400 grams."[445] The longer-term objective of the recommended program was to remove additional duct debris and to minimize the possibility of future

[443] DNFSB, *Recommendation 92–5,* 1.
[444] Defense Nuclear Facilities Safety Board, *Recommendation 90–6*, *Criticality Safety at the Department of Energy's Rocky Flats Plant, CO* (Washington, DC, June 4, 1990), 1–2, http://www.dnfsb.gov/pub_docs/recommendations/rfets/rec_1990_06.txt.
[445] *Public Meetings and Hearings, 1990, Before the Defense Nuclear Facilities Safety Board* (Washington, DC: Defense Nuclear Facilities Safety Board, 1990), 577.

accumulation of plutonium deposits in the ducts, "so that we don't get another sixty pounds of the stuff up there in the future."[446] The program was to prioritize specific remediation actions, including duct design and operational changes, and to assess criticality safety for individual lines, systems, and components. The program also needed to include justification of the techniques, modeling, and methodology used to study systems and to estimate gamma ray and fast neutron radiation levels in occupancy areas.[447] In responding to the Board's recommendation, the secretary instituted a debris removal program that involved systematic inspections, sample analyses, the use of a mock-up facility for a cleanup rehearsal, and the development of unique procedures for each duct.

Other important Board recommendations on Rocky Flats concerned operational readiness reviews prior to the resumption of plutonium processing. In the first ORR-related recommendation, 90–4, the Board urged DOE to conduct ORRs at Rocky Flats on a facility-by-facility basis, viewing them as important both to ensure the safety of the restart and to provide a well-documented public record attesting to the preparedness of DOE and the operating contractor safely to resume operations.[448] The Board followed closely the implementation of the ORR process at Rocky Flats, because it was expected to be a source of lessons learned and a model for the conduct of further ORRs. As the Board stated,

> The contractor, DOE, and the Board each recognized that the first ORR conducted at Rocky Flats would establish an important precedent for future ORR's, both at Rocky Flats and other defense nuclear facilities.[449]

On receiving DOE's implementation plan for 90–4, the Board suggested improvements. Subsequently, it found that DOE's ORR for Building 559, "the first building that DOE intends to start up" was conducted prematurely, that is, before known safety deficiencies were corrected or near closure.[450] Because of the status of the Rocky Flats ORR process as a model, the Board insisted that the ORR for the building be performed with close adherence to the implementation plan. To further this end, the Board issued Recommendation 91–4 on September 30, 1991, calling upon DOE to complete the operational readiness review for Building 559 only after

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[446] *Public Meetings and Hearings*, *1990*, 595.
[447] DNFSB, *Recommendation 90–6*, 1–2.
[448] Defense Nuclear Facilities Safety Board, *Recommendation 90–4*, *Operational Readiness Review at the Department of Energy's Rocky Flats Plant, CO* (Washington, DC, May 3, 1990), 1–2, http://www.dnfsb.gov/pub_docs/recommendations/rfets/rec_1990_04.txt.
[449] DNFSB, [Second] *Annual Report to Congress*, 7.
[450] *Public Meetings and Hearings*, *1990*, 638.

safety problems were closed or nearly closed and the contractor had issued a Readiness to Proceed Memorandum. DOE's follow-on operational readiness review for Building 559 was completed in January 1992 and the resumption of operations authorized. Considered adequate by the Board, the readiness review addressed the elements that 91–4 had specified as necessary features of a satisfactory ORR. These elements included an assessment of the knowledge levels achieved during operator requalification, an examination of test records and safety systems, verification that plant modifications affecting safety systems were reviewed for any impacts on training and operating procedures, a review of accident analyses, and a description in the ORR team's final safety analysis report of issues still needing resolution before restart.[451]

Besides addressing ORRs, a feature of near-term restart preparations, the Board also recommended another type of review for Rocky Flats, a Systematic Evaluation Program (SEP) to assist planning for longer-term site upgrades of design and operations. The SEP that the Board envisioned resembled a program undertaken by the Nuclear Regulatory Commission in the early 1980s. That program, as the Board noted in its May 1990 Recommendation 90–5, was a means of evaluating older facilities against current safety standards, in order to prioritize and integrate potential plant modifications to assure safe operations. The Board urged that DOE conduct a similar SEP site-wide at Rocky Flats to review systematically outstanding safety issues and to assess the design adequacy and capacity of facilities to provide a reasonable assurance of safety under a variety of conditions. The Board advised that Rocky Flats' SEP address "over about the next four years" the potential effects on structures and equipment of severe external developments, e.g., natural phenomena, such as seismic events and high winds, and the effects of severe internal events, particularly fire. A particular focus was to be the capability of the ventilation systems under severe external and internal events. Additionally, the SEP would consider the basis and procedures for deciding which facilities would be backfitted and on what schedule.[452]

The Board underscored that its intent in calling for this "systematic and integrated" long-term planning mechanism was to ensure that safety-enhancing design improvements "should be

[451] Defense Nuclear Facilities Safety Board, *Recommendation 91–4*, *DOE's Operational Readiness Review Prior to Resumption of Plutonium Operations at the Rocky Flats Plant* (Washington, DC, September 30, 1991), 1–4, http://www.dnfsb.gov/pub_docs/recommendations/rfets/rec_1991_04.txt.
[452] Defense Nuclear Facilities Safety Board, *Recommendation 90–5, Systematic Evaluation Program at Department of Energy's Rocky Flats Plant, CO* (Washington, DC, May 17, 1990), 1–2, http://www.dnfsb.gov/pub_docs/recommendations/rfets/rec_1990_05.txt.

considered in an integrated manner to ensure that a balanced and integrated level of safety is achieved."[453] Integrated review could help ensure, for example, that enhancements of the seismic resistance of safety equipment were balanced in relation to improvements to the seismic capability of the building housing such equipment. In addition, as Recommendation 90–5 stated, "Use of an integrated program also would permit appropriate emphasis to be placed on improving defense in depth as a means for enhancing safety at the plant."[454] Under the concept of "defense in depth," as the Board used it, "Safety is assured through robust systems that use multiple layers of protection such that no single layer is depended upon to ensure safety."[455]

The Board's attention to the Rocky Flats SEP, like its focus on the site's ORRs, had ramifications that ultimately went beyond that particular site. Meant to further the enhancement of safety through design improvements, the Systematic Evaluation Program figured among the approaches the Board recommended to promote design adequacy in an integrated fashion. One Board member, Edson Case, remarked on a potential disadvantage of the SEP, namely, that its implementation could provide an excuse for deferring action on immediate safety issues, and he questioned DOE officials at Rocky Flats accordingly.[456] However, the Board members agreed on the SEP's general value as a mechanism to ensure that changes would not be haphazard and wasteful. The Board later linked the SEP more explicitly with other processes designed to ensure integration in planning, emphasizing, for example, that an effective SEP required a more thorough application of the systems engineering approach. Planning founded on the principles of systems engineering took into account the entire life cycle of a facility, including the phases of design, construction, operation, decommissioning and site restoration. The Board also later became more explicit about the types of studies that needed to be conducted as part of a SEP, for example, studies related to the assessment of seismic capabilities, such as site geologic fault investigations, vibratory ground motion studies, dynamic building analyses, and soil-structure interaction analyses.

[453] DNFSB, *Recommendation 90–5*.
[454] DNFSB, *Recommendation 90–5*.
[455] Defense Nuclear Facilities Safety Board, *Strategic Plan: FY 2003–2009* (Washington, DC: November 17, 2003), http://www.dnfsb.gov/pub_docs/dnfsb/rcsp_2003.pdf.
[456] *Public Meetings and Hearings*, *1990*, 616.

Hanford Recommendations: Nuclear Waste Safety and Waste Characterization

Besides the Board's Rocky Flats and Savannah River activities, which were predicated on the sites' resumption of production, the third major focus of the Board's attention in its early years of operation was DOE's Hanford facility, more specifically, the threats posed by Hanford's tank farm and waste operations.[457] The tank farm consisted of 177 tanks holding in total more than 50 million gallons of radioactive waste. Storage tanks at the Hanford site had been used since 1944 to hold wastes generated by Hanford's plutonium production—both radioactive and non-radioactive hazardous wastes and both liquids and solids.[458] For several years prior to the Board's start of operations, these tanks have been the subject of concern related to leaks, "'events' leading to worker exposure to tank vapors," and ill-defined risks of explosions and accidents.[459] With respect to the leakage, a November 1986 GAO study reported that the tank farm's 149 older, single-walled tanks, built from 1943 to 1964, had leaked approximately 500,000 gallons of high-level radioactive waste into Hanford soil.[460] With respect to explosion risk, debate had been ongoing for some time, notably, in the Senate Governmental Affairs Committee, about the susceptibility of the site's old single-shell high-level waste tanks to spontaneous explosion. It was feared that such an explosion could disperse a large amount of radioactive material to the environment.

When the members of the Board visited Hanford in December 1989 to investigate the waste tank issues, with specific attention to the possible explosion hazard, they were informed of an analysis conducted by the Hanford contractor, arguing that the possibility of an explosion in the tanks was low.[461] Technical experts retained by the Board reinforced this conclusion in March 1990, when they visited the Hanford site to continue the Board's investigation. They found no imminent risk of explosion posed by the single-shell tanks. The uncertainty about the chemical composition of the contents and physical conditions within the tanks were identified as matters of concern requiring further study. In addition, they reported on the problem of slurry growth and

[457] For an in-depth historical account of the Hanford facility and its problems, see Michele Stenehjem Gerber, *On the Home Front: The Cold War Legacy of the Hanford Nuclear Site* (Lincoln: University of Nebraska Press, 1992).
[458] Interview, John E. Mansfield, Board vice chairman (since 2007; Board member, 1997–present), Washington, DC, September 10, 2008.
[459] U.S. Congress, Office of Technology Assessment, *Hazards Ahead: Managing Cleanup Worker Health and Safety at the Nuclear Weapons Complex*, OTA–BP–O–85 (Washington, DC, February 1993), 55.
[460] U.S. General Accounting Office, *Nuclear Waste: Unresolved Issues Concerning Hanford's Waste Management Practices*, RCED–87–30 (Washington, DC, November 1986), http://archive.gao.gov/t2pbat23/131661.pdf. Other sources put the leakage at 1 million gallons of high-level waste.

associated hydrogen generation in some of the 28 double-walled tanks, an issue that had surfaced as a result of questions they had asked—an issue "potentially more serious than the questions related to the single-shell tanks."[462] These newer million-gallon double-walled carbon steel tanks, built from 1967 to 1986, were meant to replace Hanford's single-shelled tanks.

The serious concerns about the Hanford waste tanks prompted the Board to issue the third of its early recommendations, Recommendation 90–3, *Future Monitoring Programs at the Department of Energy's Hanford Site, WA* on March 27, 1990. Proposing a surveillance program, the recommendation called upon DOE to:

- study the chemical reactions in the single-shell tanks that could generate heat, potentially elevating the temperature sufficiently to trigger explosive ferrocyanide reactions;
- develop a program of continuous monitoring to detect conditions in the single-shell tanks that might signal the onset of instability in their contents, e.g., conditions such as rising temperature, physical deformation of the waste surface, or unusual components, such as hydrogen, in the tanks' cover gas;
- provide alarm indicators in the monitoring instruments to signal abnormalities;
- and develop an action plan to neutralize the conditions signaled by the alarms.[463]

The recommendation also made clear that the Board considered as potentially serious the conditions in the double-walled tanks experiencing slurry growth and associated hydrogen generation.

Following the issuance of its first recommendation on Hanford's waste storage tanks, the Board received DOE's implementation plan on August 10, 1990, and found it to be "insufficiently responsive," on the grounds that it did not reflect the urgency of the waste tank situation. The Board stated,

> It did not reflect the urgency that was merited by the circumstances . . . . It also did not appear that the contractor involved had been required to marshal the

[461] Senate, Committee on Governmental Affairs, *Accident and Explosion Risks*, 35.
[462] Interview, A.J. Eggenberger, Board chairman (since 2005; vice chairman, 1989–2005), Washington, DC, July 9, 2008.
[463] Defense Nuclear Facilities Safety Board, *Recommendation 90–3*, *Future Monitoring Programs at the Department of Energy's Hanford Site, WA* (Washington, DC, March 27, 1990), 1–2, http://www.dnfsb.gov/pub_docs/recommendations/hanford/rec_1990_03.txt. The Board held a public meeting on this recommendation at its Washington, DC, headquarters on January 14, 1991.

> managerial and technical resources required, nor to focus those resources on the problem in a measure commensurate with its gravity.[464]

After further site visits and discussions between the Board and DOE staff, the Board issued Recommendation 90–7, *Ferrocyanide Tank Safety at the Hanford Site*, on October 11, 1990, which addressed the same issues in greater detail and pressed DOE to step up its corrective actions. DOE was advised to accelerate its tank-sampling program, to expand its study of the chemical properties and explosive behavior of the tank contents, and to develop an emergency plan in the event of an airborne release of radioactive material from the tanks.[465]

The Board's concern with the uncertain characterization of the heterogeneous contents of the Hanford tanks persisted well beyond the Board's first two years of operations. Recommendation 93–5, issued on July 19, 1993, once again addressed Hanford waste tank characterization studies, citing a newly released DOE audit that found significant weaknesses in Hanford's sampling, laboratory, and core management activities. In Recommendation 93–5, the Board advised DOE to undertake a thorough reexamination of Hanford characterization efforts and a prioritization of the tank-sampling schedules, to expand laboratory capacity for tank sample analysis, and to assess the necessity of all the chemical analyses performed.[466] The Board's persistence in its push for waste characterization in the Hanford tanks reflected the members' view that knowledge of the contents of such tanks both at Hanford and elsewhere was crucial to the mitigation of their dangers in both the short and long run. As the Board stated,

> Characterization is essential for ensuring safety in the near-term during custodial management and remedial activities, and also in the long-term for advancing the development of permanent solutions to the high level waste problems at Hanford.
>
> The wastes in the Hanford tanks differ markedly from tank to tank. Without timely characterization of the wastes, the nature of the risks associated with the tanks cannot be fully assessed and, where necessary, mitigated. Further, until the characteristics of the wastes are known, final methods for monitoring, retrieval, transport, and treatment of wastes now in tanks cannot be realistically planned.[467]

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[464] Defense Nuclear Facilities Safety Board, [First] *Annual Report to* Congress (Washington, DC, February 1991), 9, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.
[465] Defense Nuclear Facilities Safety Board, *Recommendation 90–7*, *Ferrocyanide Tank Safety at the Hanford Site* (Washington, DC, October 11, 1990), 1–3, http://www.dnfsb.gov/pub_docs/recommendations/hanford/rec_1990_07.txt.
[466] Defense Nuclear Facilities Safety Board, *Recommendation 93–5*, *Hanford Waste Tanks Characterization Studies* (Washington, DC, July 19, 1993), 1–3, http://www.dnfsb.gov/pub_docs/recommendations/hanford/rec_1993_05.txt. See also Chapman, 359, and Gerber, 254–55.
[467] Defense Nuclear Facilities Safety Board, [Fourth] *Annual Report to Congress* (Washington, DC, February 1994), 32, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.

The systematic monitoring and characterization of the contents of the waste tanks for which the Board called were a prerequisite for other tank waste remediation activities the Board would address, e.g., stabilization of the wastes for near-term custodial management, preservation of the integrity of the existing tanks, and planning for the construction of new tanks, as well as for the eventual development of permanent waste disposal solutions.[468]

COMPLEX-WIDE SAFETY ISSUES

In addition to the Board's site-specific review activities in its early years, the Board took up generic topics and issued recommendations applicable to most or all sites. Foremost among these were recommendations on the key topical areas of nuclear safety standards, and training and qualification of technical personnel.

Development and Application of Standards Related to Nuclear Safety: Key Problem Area

One of the earliest and most important Board recommendations was 90–2, *Design, Construction, Operation and Decommissioning Standards at Certain Priority DOE Facilities*, issued on March 8, 1990. The recommendation aimed to spur DOE toward an improved standards-based nuclear safety program through the development and revision of nuclear safety standards at selected priority sites, mainly, Savannah River, Rocky Flats, Hanford, and WIPP.[469] Recommendation 90–2 also proved to be the most problematic when it came to getting a satisfactory implementation plan from DOE.

The Board's early and persistent attention to the issue of standards was in keeping with the emphasis given to it in the Board's authorizing legislation. The Board's first statutory duty was to "review and evaluate the content and implementation of the standards relating to the design, construction, operation, and decommissioning of defense nuclear facilities of the Department of Energy (including all applicable Department of Energy Orders, regulations, and requirements) at each Department of Energy defense nuclear facility."[470] The Board shared the

[468] For a general account of tank waste remediation activities at Hanford, see Gerber, 248–58.
[469] Defense Nuclear Facilities Safety Board, *Recommendation 90–2, Design, Construction, Operation and Decommissioning Standards at Certain Priority DOE Facilities* (Washington, DC, March 8, 1990), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1990_02.txt.
[470] Pub. L. No. 100–456, Section 1441(a), 102 Stat 1918, 2077; this new language became chapter 21, Section 312(1) of the Atomic Energy Act of 1954. For a list of the orders subject to Board oversight in its first years, see U.S. Congress, Office of Technology Assessment, *Dismantling the Bomb and Managing the Nuclear Materials*,

recognition of its congressional oversight committees that "DOE did not have a well-developed set of requirements or a fully functional standards-based nuclear safety program."[471] In its initial work on standards at the four priority DOE facilities, the Board confirmed this recognition of deficiency, finding that standards and requirements to be used for safety reasons had not been established, were highly variable, or were far less specific than corresponding NRC standards.[472]

The first among the Board's recommendations urging DOE to correct the situation, 90–2, set forth three fundamental requirements. The first was to identify the applicable safety standards, DOE orders, technical standards, and other requirements. The Board also recommended that DOE provide its view on the adequacy of the standards. As in the case of other DOE improvement efforts, the Board recommended a comparative approach, stating a number of reasons,

> An important aspect of this standards assessment will be a comparative evaluation between nuclear and other standards used by the DOE for safety purposes and those which are used in the licensing and regulation of commercial nuclear power reactors.
>
> The Board in its review of requirements set forth in DOE's safety related Orders (and more recently Rules) has always used industry-wide regulatory standards as a frame of reference. The Board's reasons for doing so are two fold: (1) The collective experience of the Board and its staff is that compliance with such standards is essential for ensuring protection of public health and safety. (2) Congress has stated its expectation that the Board endeavor to bring nuclear safety at defense nuclear facilities up to the level of the commercial nuclear industry.[473]

Explaining its advocacy of a comparative approach further, the Board mentioned one additional reason in a public meeting,

> The Board has . . . proceeded on the assumption that the public wants to know, very importantly in an assessment of standards, how the standards the DOE . . . has used compare to those that pertain to analogous operations in the domain of

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OTA–O–572 (Washington, DC, September 1993), 41, http://govinfo.library.unt.edu/ota/Ota_1/DATA/1993/9320.PDF.

[471] Joseph J. DiNunno, "Fundamentals for Understanding Standards-Based Safety Management of DOE Defense Nuclear Facilities," DNFSB/TECH–5 (paper prepared for the Defense Nuclear Facilities Safety Board Public Meeting On Standards-Based Safety Management, Washington, D.C., May 31, 1995), n.p., http://www.dnfsb.gov/pub_docs/dnfsb/tr_19950531.html.

[472] GAO, *Nuclear Safety: The Defense Nuclear Facilities Safety Board's First Year*, 15.

[473] U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996 and the Future Years Defense Program,* 104th Cong., 1st sess., March 28, April 25, May 2, 16, 18, 1995, 100.

> commercial nuclear power reactors and other nuclear activities in the commercial domain.[474]

The third action that Recommendation 90–2 urged upon DOE was to determine the extent of the implementation in the field of the identified standards. In response to 90–2, despite difficulties in drafting an acceptable plan, DOE committed to a comprehensive DOE-wide review of nuclear safety standards and to providing reports on progress to the Board. Regarding DOE's plan, especially for the key management tool to document standards, Standards/ Requirements Implementation Documents (S/RIDs), the Board later explained,

> The principal product of implementation was to be a set of facility-specific documents that set forth the applicable standards and requirements for a selected set of DOE's defense nuclear facilities. These were termed Standards/ Requirements Implementation Documents (S/RIDs). The S/RID was to contain those requirements considered necessary and sufficient for ensuring safety in the particular application. These were to be principally extracted from DOE Orders, appropriate standards, NRC guides, and similar sources. The S/RID was envisioned as the basis upon which work controls would be developed and implemented.[475]

Embarking on its promised actions, DOE strengthened its arrangements for managing its nuclear standards program and briefed the Board on its modifications. It also produced a prioritized list of nuclear safety orders needing upgrading or development, noting that the process would be "arduous,"

> The first set of Orders chosen for priority development includes: Personnel Selection and Training, Conduct of Operations, Occurrence Reporting, Safety Analysis Reports, Technical Safety Requirements, Unreviewed Safety Questions, Radiation Protection, Maintenance Management, and Quality Assurance. The process for issuing these upgraded Orders and Rules includes review by all Department of Energy elements that would be affected including DOE Field Offices, review by the Department's operating contractors, and finally, approval by the senior nuclear managers of the Department . . . . It is not unusual to receive 800 or more comments on a revised Order or Rule.[476]

DOE's implementation effort lagged behind the pace to which DOE committed in its implementation plan, prompting the Board on May 20, 1991, to write a stern letter to Secretary

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[474] *Public Meetings and Hearings*, *1990*, 610.

[475] Defense Nuclear Facilities Safety Board, *Recommendation 95–2, Safety Management* (Washington, DC, October 11, 1995), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1995_02.html. The recommendation superseded Recommendations 90–2 and 92–5.

[476] *Public Meetings and Hearings, 1991, Before the Defense Nuclear Facilities Safety Board*, vol. I of II (Washington, DC: Defense Nuclear Facilities Safety Board, 1991), 482.

Watkins on the inadequacy of the effort with respect to all three of the Board's recommended actions. In its ongoing review of DOE's response to the Board's recommendation to assess the adequacy of standards, for example, the Board found that DOE has evaluated only two, and "then in only a limited and non-specific fashion,"

> These assessments appear to be quite superficial in content and in general convey the impression that a thorough review of even this limited group of Orders has not been undertaken. Finally, no criteria for determining the adequacy of Orders in general has been presented.[477]

The unimpressive content and pace of DOE's efforts on standards identification, assessment, and implementation provoked "continuing frustration" on the part of the Board, and prompted it to issue a number of additional recommendations in this key problem area, beginning with 91–1, *Strengthening the Nuclear Safety Standards Program for DOE's Defense Nuclear Facilities*.[478] Dated March 7, 1991, this recommendation applied broadly to all DOE defense nuclear facilities. It urged, among other things, improvement of the process by which DOE developed and implemented nuclear safety standards through upgrades of the standards development infrastructure "at Headquarters, in the field, and at contractors."[479] The Board also continued to issue recommendations addressing specific standards topics, e.g., 91–6, which urged DOE to compare its radiation protection standards to commercial industry standards, and 92–6, which called upon DOE to develop standards on operational readiness reviews.[480]

As DOE pursued its upgrades of standards and the standards development program, it made measurable progress in circumscribed spheres. As the Board noted, specific facilities managed to identify applicable DOE orders and ensure compliance as part of the operational readiness review process.[481] However, just the task of identifying requirements was formidable. At Rocky Flats, for example, just one element of the larger Standards Program—the Historic

[477] U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Years 1992 and 1993,* 102d Cong., 1st sess., April 23, May 9, 17, 22, 23, June 5, 12, 13, 19, 20, 1991, 615.
[478] DNFSB, [Second] *Annual Report to Congress*, 17.
[479] *Public Meetings and Hearings, 1991,* vol. I of II, 485.
[480] Defense Nuclear Facilities Safety Board, *Recommendation 91–6, Radiation Protection for Workers and the General Public at DOE Defense Nuclear Facilities* (Washington, DC, December 19, 1991), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1991_06.txt; and *Recommendation 92–6, Operational Readiness Reviews* (Washington, DC, August 26, 1991), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1992_06.txt.
[481] Defense Nuclear Facilities Safety Board, *Fifth Annual Report to Congress* (Washington, DC, February 1995), 79, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php. With reference to standards on ORRs, the *Fifth Annual Report* acknowledged adequate progress by DOE, stating, "In response to several Board recommendations, DOE has now developed and issued a nuclear safety order on operational readiness which, when properly used, is an

Building Standards Program—involved a considerable effort, as a manager with the contractor, EG&G Rocky Flats, Inc., reported,

> The Historic Buildings Program consisted of a broad "sweep" to identify source documents that were used as a design basis for the nine plutonium facilities . . . This sweep included selective searches of AEC/ERDA/DOE files; and of permanent federal record storage including project files; and, discussions with construction contractors, and RFP staff and retirees. The report, which has been submitted to the DOE, found reasonable records for buildings constructed since 1970 (Buildings 371 and 374) and weak records for buildings constructed between 1952 and 1970 (Buildings 771, 774, 776, 777, 779, 707, and 991). No decommissioning standards were identified.[482]

In the face of such challenges in a single standards-related task at one site, DOE continued to have difficulties in its far more comprehensive task of identifying, assessing and implementing standards complex-wide. DOE was long unable to produce an acceptable implementation plan, managing to do so only with a fifth draft of the plan in November 1994—a draft produced only with "the assistance of the [Board's] own Technical Director and General Counsel in order to get progress."[483]

After several years in which DOE continued to develop and implement facility-specific Standards/Requirements Identification Documents (S/RIDS), the Board closed Recommendation 90–2, consolidating the schedule for their issuance with Recommendation 94–5, *Integration of DOE Safety Rules, Orders, and Other Requirements*.[484] This recommendation urged DOE to continue issuing S/RIDS, while integrating them into a clear, coherent, and consistent standards-based nuclear safety program. In early 1996, after again addressing DOE standards in the still broader Recommendation 95–2, *Safety Management*, the Board notified DOE that 90–2 commitments would remain in effect until the ultimate disposition of outstanding actions were addressed in DOE's implementation plan for 95–2.[485]

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effective tool for ensuring adequate protection of public health and safety prior to startup or restart of nuclear facilities."

482 *Public Meetings and Hearings, 1991,* vol. I of II, 492.

483 John W. Crawford Jr., *An Assessment Concerning Safety at Defense Nuclear Facilities: The DOE Technical Personnel Problem*, DNFSB/TECH–10 (Washington, DC: Defense Nuclear Facilities Safety Board, March 1996), 15, http://www.cnfsb.gov/pub_docs/dnfsb/tr_199603.html.

484 Defense Nuclear Facilities Safety Board, *Recommendation 94–5, Integration of DOE Safety Rules, Orders, and Other Requirements* (Washington, DC, December 29, 1994), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1994_05.txt.

485 DNFSB, *Recommendation 95–2*. The *Fifth Annual Report* offered a number of observations on progress on Recommendation 90–2, including: "(1) both Secretary Watkins and Secretary O'Leary have committed the Department to a requirements-based safety program; (2) DOE has made some progress in moving towards a

As the Board continued to press DOE in its standards effort, it attributed the Department's slow pace and difficulties to a number of causes, some very long-standing and some more recent. A near-term potential hindrance of concern to the Board was DOE's decision under Admiral Watkins to transition from the use of the Orders system to the "promulgation of nuclear safety requirements through rulemaking"—a process that tended to be time-consuming.[486] DOE adopted this approach after the Price-Anderson Amendment Act of 1988 (Pub.L. No. 100–408) gave DOE new authority to impose penalties on its indemnified contractors for violations of nuclear safety requirements when these requirements were promulgated in accordance with the Administrative Procedure Act (Pub.L. No. 89–55). The Board acknowledged the benefits that DOE anticipated from the transition to notice and comment rulemaking, namely, "uniform, enforceable requirements and . . . greater opportunities for public input into the process for establishment of requirements."[487] However, the Board repeatedly urged DOE, including in 94–5, not to allow this transition to delay or relax the ongoing effort to upgrade requirements and to incorporate them into the terms of management and operations (M&O) contracts. [488] As 94–5 advised,

> Impending developments should not be taken as cause for a slow-down on compliance efforts or the upgrading of applicable requirements now in Orders and contracts.[489]

Among more long-standing hindrances to the timely upgrade of standards were, as Crawford said in a hearing, "a mentality and a culture that had tended to deprecate the need for standards."[490] A continual theme of the Board was that DOE had long manifested an "expert-based" culture, rather than a '"standards-based" culture. That is, DOE relied for the achievement of safety on the expertise of individuals, rather than on standards that provided a definite and

requirements-based safety program; (3) unrelenting attention by the Board caused DOE to achieve an adequate level of compliance with standards before restarting several facilities shut down for safety reasons . . . . (5) a great deal of work remains to be done, both to erect a complete, adequate set of safety requirements for DOE's diverse operations and to implement these requirements at the field level."

486 DNFSB, *Recommendation 94–5*. See also DiNunno, "Fundamentals for Understanding Standards-Based Safety Management."

487 DNFSB, *Recommendation 94–5.*

488 U.S. Department of Energy, *Annual Report to Congress, Department of Energy Activities Relating to the Defense Nuclear Facilities Safety Board: Calendar Year 1995*, DOE/S–0115 (Washington, DC, March 1996), II–3. By the end of 1995, the conversion of nuclear safety directives to rules had produced four rules, with eight others in process.

489 DNFSB, *Recommendation 94–5.*

490 Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1993*, 243.

uniform set of explicit expectations. DiNunno touched upon this reliance on expertise, when publicly questioning a readiness review team member about the basis for his judgments about order compliance in a facility. DiNunno observed,

> I am left with the feeling that I'm relying on your judgment as an expert. And I am not diminishing that in any way, but it isn't quite as regularized and criteria-based as we are stressing in an order compliance review.[491]

This expert-based culture that the Board confronted in DOE was deeply ingrained, particularly at Los Alamos, Lawrence Livermore, and Sandia National Laboratories. The laboratories' high concentration of scientists and engineers, as opposed to production personnel, contributed to their disinclination to be bound by standards.

Notwithstanding the resistance to change at the laboratories, Conway made the case there as elsewhere for a shift from an "expert based" culture, making explicit one key reason in a public discussion of a review of order compliance at Los Alamos. He connected the need to establish a "standards-based" culture in the weapons complex with one aspect of "technical personnel problem"—the dearth and ongoing loss of technical expertise as the DOE nuclear complex downsized.

> One of the concerns that this Board has had, and we've expressed it in recommendations to the Secretary, is that particularly now with the encouragement by the laboratory for many of your personnel to take early retirement, we are losing much of the experience that the lab has had over the years, where you were able to operate facilities because of the technical know-how and experience of personnel.
>
> But as new people come in, new technicians come in, without having the mentoring of the older experienced personnel, we're liable to lose some of that technical capability. The only way we know . . . to assure ourselves . . . is to have certain standards, requirements and orders that are complied with and procedures to do so.
>
> So that's one of the reasons that this board is giving a great deal of attention to the need to have written procedures and that they be rigidly adhered to.[492]

In short, the Board viewed the establishment of a standards-based nuclear safety program as a means to ameliorate to a degree the loss of unique technical know-how in the weapons complex.

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[491] *Public Meetings and Hearings, 1994*, *Before the Defense Nuclear Facilities Safety Board* (Washington, DC: Defense Nuclear Facilities Safety Board, 1994), 85.
[492] *Public Meetings and Hearings, 1994*, 39.

The Board's Concern for Technical Personnel Quality in the DOE Nuclear Complex

Although the Board always underscored the benefits of standards-based operations, it also regularly emphasized that standards could be effective only if there were trained and qualified, technically competent personnel to use them. In all of its early annual reports, the Board flagged the "technical personnel problem" as the "most important and far-reaching problem affecting the safety of DOE defense facilities."[493] As with the Board's sustained involvement in urging DOE to discharge its commitments in the standards area, the Board applied persistent pressure on DOE to upgrade the technical qualifications of personnel throughout the DOE nuclear complex. In addressing the technical competency issue, the Board sometimes referred to the technical levels of both DOE personnel and the workforce in contractor organizations. More often, the Board's advice was directed to strengthening the technical capabilities of DOE personnel specifically, as those responsible for directing the work of contractors, including their training initiatives.

The Board issued a succession of recommendations on various aspects of the technical competency issue, beginning with the Board's very first recommendation calling upon DOE to upgrade the training and qualification of operating personnel at Savannah River. The Board acknowledged progress achieved at Savannah River. Crawford, for example, who brought from his leadership position in the Naval Reactors Program a strong interest and expertise in personnel matters, applauded DOE's initiatives to provide reactor operators with technical primers modeled on educational materials in the navy nuclear program. He also approved of the oral examinations that DOE instituted to supplement written tests in its assessment of operator knowledge.[494] However, the Board was disappointed in its expectation that training successes in the restart efforts at Savannah River would prompt DOE to take similar technical personnel initiatives elsewhere. As Crawford recalled,

> The Board soon discovered that DOE had not profited from the lesson it should have learned at K-Reactor. As other facilities at the Savannah River Site were being readied for operation, the Board repeatedly found it necessary to use its own personnel to make sure that operators were properly trained and qualified. The

[493] DNFSB, *Recommendation 93–3*, *Improving DOE Technical Capability in Defense Nuclear Facilities Programs* (Washington, DC, June 1, 1993), 1–4, http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1993_033.txt. See also George, 137.
[494] *Public Meetings and Hearings, 1991*, 100–101.

Board was spending too much time doing work that was DOE's responsibility, but which DOE was not doing due to a lack of qualified technical personnel.[495]

After the Board had a chance to observe the actions undertaken in response to its first recommendation, it followed up with the broader generic Recommendation 92–7, *Training and Qualification*, which dealt with training and qualifications programs complex-wide.[496] The recommendation found that technical personnel and supervisors at the facilities often lacked sufficient understanding of the fundamentals of engineering, chemistry, nuclear physics, and radiation protection to operate safely. At the same time, as at Savannah River's K-reactor, the tools to appraise operator understanding consisted largely of unchallenging written examinations. The Board urged that DOE take corrective measures, including the expansion of senior management's involvement in nuclear safety training at all levels in DOE and contractor organizations, and the strengthening of organizational units responsible for training and qualification.[497]

A third key recommendation on the personnel problem, Recommendation 93–3, *Upgrading DOE Technical Capability*, focused exclusively on raising the "in-house" technical capability of the DOE organizations responsible for safety in the nuclear complex—both the line and oversight organizations operating both at headquarters and in the field. The recommendation called upon DOE to establish as a primary agency goal the attraction and retention of exceptional scientific and technical personnel. Such strengthening of technical expertise within DOE was one of the primary congressional assignments for the Board, as the Senate Conference Report that accompanied the Board's enabling legislation stated: "The Board is expected to raise the level of technical expertise in the Department substantially."[498] Congress recognized, as had other evaluators, that DOE lacked sufficient technical capabilities to provide effective management of contractor personnel in the weapons complex. Many pointed to an imbalance between DOE and

[495] Crawford, 24.
[496] Defense Nuclear Facilities Safety Board, *Recommendation 92–7*, *Training and Qualification* (Washington, DC, September 22, 1992), 1–2, http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1992_07.txt.
[497] DNFSB, *Recommendation 92–7*, 3–4. Line and oversight positions involved with nuclear safety were found in the office of the assistant secretary for defense programs (DP) and in the offices of the assistant secretaries for environmental management (EM) and for environment, safety, and health (EH). In 1992 a reorganization consolidated oversight and enforcement of nuclear safety functions within EH, placing the oversight of DOE field offices and contractors in the hands of DOE employees outside of line management.
[498] S. Rep. No.100–232 (to accompany S. 1085), at 20–21 (1987).

the contractors, in which the latter's superior technical capabilities forced DOE to place "inordinate reliance on contractor intentions and capabilities"[499]

The origins of this DOE–contractor disparity in technical skills lay in the past, in the division of functions between DOE's predecessor organization, the AEC, and the contractors. As Crawford explained,

> The technical aspects of programs and activities were, for the most part, handled by the AEC's laboratories and industrial contractors. Government organizations confined their activities mostly to contractual, budgetary, and administrative matters.[500]

Carrying forward this traditional division of functions, Crawford observed, "DOE did not build up the cadres of strong technical capability "in-house" to the degree needed to provide effective technical line management direction and guidance."[501] He added, "Without an equivalent level of technical competence, DOE managers cannot effectively engage in technical dialogue with their laboratory and contractor counterparts."[502] He contrasted the unequal DOE–contractor relationship with the situation that prevailed in "the Naval Reactors organization,"[503]

> The U.S. Navy, under Admiral Rickover . . . had a small, but superb . . . cadre of people, well educated technically . . . always in a position of ascendancy vis-à-vis the contractors. We were never, ever dependent for technical choices by deferring to Westinghouse or General Electric or whomever . . .you have to have interior, in-house capability.[504]

In the terminology that Admiral Rickover had used, the strong technical qualifications of personnel in the Naval Reactors Program allowed the navy to perform as a "demanding customer" vis-à-vis its participating contractors. For Crawford and others on the Board, DOE needed to build similar technical strengths, in order similarly to act as a demanding customer.

After the issuance of 93–3, the Board complained of insufficient progress on the commitments that DOE made in response to it and other admonitions about the technical personnel problem. The Board ascribed DOE's personnel problem, in part, to the DOE's lack of excepted appointment authority for technical personnel. As Crawford said,

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[499] DNFSB, [First] *Annual Report to Congress*, 30.
[500] Crawford, 3.
[501] Crawford, 3.
[502] Crawford, 6.
[503] DNFSB, [First] *Annual Report to Congress*, 30.
[504] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1993*, 246.

> In a market of limited numbers of highly competent nuclear technology personnel, it has long been evident that government agencies have difficulty hiring and retaining such personnel under the Civil Service System.[505]

The Board urged DOE to seek from Congress, as the Board had earlier successfully done for itself, a legislative change granting DOE additional hiring authority. The Board's general counsel, Robert M. Andersen, described the actions taken by the Board on DOE's behalf, stating,

> Obtaining this legislative change for DOE took many months and the combined efforts of the Board and some within DOE . . . some DOE officials were reluctant and slow to initiate action. The Chairman of the Board met with the Secretary of Energy, officials in the Congressional Affairs Office, and the Assistant Secretary of Energy for Human Resources on numerous occasions to try to jump start the proposal. Mr. Conway used every opportunity to testify before Congress regarding the need for DOE excepted appointment authority and the Board's successful use of its excepted authority in attracting fully capable people to staff positions.[506]

Andersen added that he and the Board's general manager, Kenneth M. Pusateri,

> Slowly overcame opposition to the proposal within DOE, the Office of Management and Budget, and Office of Personnel Management. A draft legislative proposal was prepared and given to DOE.[507]

With the Board's assistance and "prodding," as Crawford put it, DOE sought and was finally granted expanded excepted service personnel authority. Congress increased DOE's excepted service authority, effective in 1995, from 200 to 400 technical personnel positions. DOE's corrective actions on the technical personnel problem, however, continued to disappoint the Board. Among other things, DOE failed to use of its augmented hiring authority "aggressively and effectively" to raise the technical expertise of its staff.[508] Crawford's overall assessment, seconded by the rest of the Board, of DOE's corrective action on the technical personnel problem was blunt, "DOE's efforts to attract and retain highly technically competent scientists and engineers . . . have been unsuccessful."[509]

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[505] Crawford, 26.
[506] Statement of Robert M. Andersen, General Counsel, Defense Nuclear Facilities Safety Board, Public Meeting, January 23, 1996, http://www.dnfsb.gov/pub_docs/dnfsb/tr_199603_09.html. Also included as Appendix H in Crawford, H/1–H/17.
[507] Statement of Robert M. Andersen, in Crawford, H/7–H/8.
[508] Crawford, 26.
[509] Crawford, 26.

CHAPTER 5: POST–COLD WAR REDIRECTION OF THE DEFENSE NUCLEAR COMPLEX AND IMPLICATIONS FOR THE BOARD'S WORK

DOWNSIZING AND MISSION CHANGE IN THE COMPLEX: NEW DUTIES FOR THE BOARD

For the first several years that the Board was in operation, Board recommendations and Department of Energy (DOE) implementation plans had been predicated upon resumption of production at a number of major sites in the DOE nuclear complex. In the course of 1992, however, a different trajectory for those sites and the entire complex became clear. The abrupt declaration of the end of the Cold War in November 1990 and the dissolution of the Soviet Union in late 1991 had already signaled a rapid reduction in U.S. nuclear weapons stockpile requirements and a sharp curtailment of the processing of nuclear materials. Then, in late 1992, the Senate's ratification of the historic Strategic Arms Reduction Treaty (START I), and congressional passage of a moratorium on nuclear weapons testing, brought about the cessation of the production and testing of nuclear weapons.[510] With these changes, the mission and activities of DOE's weapons complex shifted sharply away from its primary mission for nearly half a century, weapons production and testing.[511] The new mandate of the DOE nuclear weapons complex in regard to weapons was to manage the remaining weapons stockpile, to dismantle thousands of surplus nuclear weapons, and to pursue alternatives to the testing of nuclear weapons, while maintaining testing capability. DOE also faced the tasks of bringing many sites and facilities to a safe shutdown condition and of preparing decaying and contaminated facilities for decontamination and decommissioning (D&D). As Board Chairman John T. Conway noted,

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[510] A. Costandina Titus, *Bombs in the Backyard: Atomic Testing and American Politics* (Reno: University of Nevada Press, 1986), 144. When the Soviet Union dissolved into 15 republics in December 1991, the Soviet nuclear stockpile was dispersed among four of the successor states—Russia, Ukraine, Belarus, and Kazakhstan. The United States and the four nuclear states entered into the first Strategic Arms Reduction Treaty (START I), which reduced the U.S. inventory of intercontinental nuclear weapons from roughly 12,000 to 9,000 and the combined former Soviet force from 10,000 to 6,500. On the testing moratorium, see Titus, 146, and Jonathan Medalia, "Nuclear Testing and Comprehensive Test Ban: Chronology Starting September 1992," *CRS Report for Congress*, Order Code 97–1007 F, Updated June 9, 2005 (Washington, DC: Congressional Research Service, Library of Congress, 2005). The moratorium on testing, initially for nine months, was enacted on October 2, 1992, in the form of an amendment to the Energy and Water Development Appropriations Act (Pub.L. No. 102–377). The United States conducted its last U.S. test in 1992, just before START I and the testing moratorium became effective. Extended several times during the Clinton administration, the moratorium remained in effect throughout the Clinton presidency, as President Clinton unsuccessfully pushed the Senate, with its Republican majority after 1994, for ratification of a comprehensive test ban treaty.

"Such nuclear materials processing as [would] still be done would be to convert residue, semi-processed materials to more stable chemical forms for safe storage."[512] DOE's new tasks entailed a mammoth cleanup of the radioactive contamination that had accumulated over 50 years—a cleanup projected to require decades and hundreds of billions of dollars.[513]

Broadened Board Jurisdiction and Activities

The realignment and downsizing of the weapons complex and the change in DOE's mission shifted the focus of the Board's oversight away from the now abandoned restart activities at various production facilities. However, as the decision to halt production eliminated some weapons-production activities from the Board's purview, the Board acquired new responsibilities related to nuclear weapons oversight. Concurrently with the transition from the Cold War production system in the weapons complex, Congress broadened the scope of the Board's jurisdiction, with the passage of the National Defense Authorization Act for Fiscal Years 1992 and 1993 on December 5, 1991.[514] Congress amended the Board's authorizing statute, adding the assembly, disassembly, and testing of nuclear weapons to the Board's health and safety responsibilities. With this amendment, the Board acquired new safety oversight responsibilities for the Nevada Test Site, and for the Pantex facility in Amarillo, Texas, where most of the newly expanded activities of weapons dismantlement would take place. With this broadened jurisdiction, the Board's mandate included most nuclear weapons facilities and activities, with the exception, still, of the navy's nuclear programs.[515] To accommodate the

[511] Terrence R. Fehner and Jack M. Holl. *Department of Energy, 1977–1994: A Summary History* (Washington, DC: U.S. Department of Energy, November 1994), 94–95, http://www.osti.gov/bridge/servlets/purl/10106088-mgIkuD/webviewable/10106088.PDF.

[512] U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996 and the Future Years Defense Program,* 104th Cong., 1st sess., March 28, April 25, May 2, 16, 18, 1995, 98.

[513] Since the late 1980s, numerous estimates of cleanup costs had appeared, usually placing the costs in the $100–$150 billion range. In 1996, in response to a congressional charge, DOE produced a report on costs, which proposed the figure of $227 billion. See U.S. Department of Energy, Office of Environmental Management, *1996 Baseline Environmental Management Report: Executive Summary* (Washington, DC, July 1996), http://www.em.doe.gov/bemr/pages/bemr96.aspx.

[514] *National Defense Authorization Act for Fiscal Years 1992 and 1993*, Pub.L. No. 102–190, 105 Stat 1290 (1991).

[515] Interview, John W. Crawford, Jr., Rockville, MD, September 21, 2008. Crawford ascribed the exemption of the navy's nuclear programs from Board oversight largely to the navy's record of, and reputation for, strong safety management.

Board's added responsibilities, which would substantially increase its workload, Congress raised the Board's statutory personnel ceiling from 100 to 150 full-time employees.[516]

The addition of weapons-related activities to the Board's jurisdiction involved the Board in the safety aspects of nuclear weapons dismantlement. As a result of the national commitment to nuclear weapons reduction, approximately 2,000 weapons per year were slated for dismantlement, mostly at Pantex, but also at the Y–12 plant at Oak Ridge, Tennessee, with input in both cases from the national weapons laboratories.[517] The Board's increased responsibilities also included safety oversight of activities involved in the maintenance of the smaller nuclear weapons stockpile and in preparations to expand the storage of strategic fissionable materials retrieved from dismantled weapons—e.g., weapons-grade plutonium and enriched uranium. Finally, the Board took up additional tasks related to stockpile stewardship, which involved increased activities by the weapons laboratories carried on as an alternative to nuclear weapons testing.

In addition to the new duties associated with its expanded jurisdiction in the weapons arena, the Board acquired augmented responsibilities having to do with the expansion of DOE's remediation of nuclear residues, wastes, and other legacies of the nuclear arsenal buildup.[518] The Board was already engaged in considerable efforts to address the threats posed by such wastes and residues of production, most notably, in its push at Hanford to remedy the uncertain characterization of the radioactive wastes in the storage tanks, and in its initiatives at Rocky Flats to address radioactive materials accumulated in ventilation ducts.[519] However, with the higher priority now given to waste stabilization and cleanup/decontamination throughout the complex, the Board's mandate in the area of the residues of nuclear materials production became even

[516] For additional amendments to the Board's authorizing legislation, see *Energy Policy Act of 1992* (Pub. L. No. 102–486, 106 Stat 2776, Oct. 24, 1992), and *National Defense Authorization Act for Fiscal Year 1994* (Pub. L. No. 103–160, 107 Stat 1547, Nov. 30, 1993).
[517] U.S. Congress, Office of Technology Assessment, *Dismantling the Bomb and Managing the Nuclear Materials*. 42–49, OTA–O–572 (Washington, DC, September 1993), http://govinfo.library.unt.edu/ota/Ota_1/DATA/1993/9320.PDF.
[518] For background on nuclear waste and environmental remediation as viewed in 1994, see U.S. Congress. Congressional Budget Office, *Cleaning Up the Department of Energy's Nuclear Weapons Complex* (Washington, DC, May 1994), http://www.cbo.gov/ftpdocs/49xx/doc4914/doc26.pdf.
[519] For an extensive non-Board, non-DOE account of cleanup issues at Rocky Flats, see Len Ackland, *Making a Real Killing: Rocky Flats and the Nuclear West* (Albuquerque: University of New Mexico Press, 2002), esp., 203, 220–42.

more encompassing.[520] The Board's oversight responsibilities extended to all of the major sources of radiological threat throughout the DOE defense nuclear complex, including waste tanks apart from Hanford's, deteriorating reactor fuel in storage basins, and radioactive materials left in production lines. In addition, the Board's purview included the decontamination and decommissioning of facilities—activities that were expected to grow as DOE reconfigured the complex, consolidating and shutting down certain facilities, e.g., at Fernald, the Mound Laboratory, Savannah River, and Hanford.

Cutoff of Defense Production, Heightened Safety Challenges Requiring Board Oversight

The Board regularly noted that the changed mission and downsizing of the weapons complex had a significant impact on the Board's safety-related activities, shifting their focus. At the same time, the Board members also frequently pointed out that this shift of focus would not entail any reduction in the need for safety oversight or in the technical challenges that ensuring safety entailed. For example, as Chairman John T. Conway said in congressional testimony, "It is tempting to conclude that the reduction of weapons production activities at DOE facilities means that safety oversight can be reduced."[521] However, as he added on another occasion,

> The reduction of weapons production activities at DOE facilities does not mean that safety management and oversight can be reduced. The reality is that independent technical oversight continues to be needed in order to ensure that both the workers and the public are adequately protected.[522]

Indeed, far from diminishing safety problems requiring technical solutions, the new situation in the DOE complex magnified safety challenges. Conway said,

> With the shut down of many DOE facilities, the conditions and hazards being faced by DOE are potentially more urgent and present a more serious safety problem than when the facilities were in operation.

[520] On DOE's view of the cleanup task, see Fehner and Holl, 87–88. See also Titus, 157–59. As Titus recounts, under the Energy and Water Development Act for 1992, Congress created the Defense Environmental Restoration and Waste Management Account to specify the level of funding for the cleanup program. Additional accounts were set up in 1998 and 1999 to expedite the remediation of 113 contaminated sites—all but 10 by FY 2006. The 10 sites, the largest and most contaminated, were slated for long-term remediation not to be completed until 2070, at an additional estimated cost of $147 billion.

[521] U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1995 and the Future Years Defense Program,* 103rd Cong., 2dt sess., February 8, March 2, 3, 8, 9, 15, 23, April 20, 1994, 920.

[522] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 99.

Conway elaborated on the heightened risks involved in the processes of "shutting down," explaining,

> Many technical issues arising from the DOE's change in mission have never been addressed before; others involve operations and processes that are new to the nuclear weapons industry. For example:
>
> - As a facility is deactivated and decommissioned, the workers are subjected to more hazardous conditions than during operation. The workers will come into closer contact with radioactive materials, enter portions of facilities that were not intended to be occupied and will face other unexpected conditions.
> - The aging and degradation of equipment that is at the end of its design life will present increasing hazards as safety systems become unreliable and break down more frequently.[523]

He further observed in another hearing,

> Simply put, the process of "shutting down" many defense nuclear facilities compounds existing hazards involving handling and storing nuclear materials with additional hazards associated with cleaning up the facilities. If safety systems are not properly maintained, and other precautions are not taken, these facilities can pose an increasing risk to worker and public health and safety. . . . .
>
> Workers are more likely to come in contact, often unexpectedly, with radioactive and chemical materials that have been inaccessible for many years.
>
> Dismantling a defense nuclear facility can actually increase the risk of dispersal of radioactivity through material degradation, natural phenomena, fires, or accidental nuclear criticality. . . . .
>
> The potential for detonation, fire, and corrosion hazards may increase as chemical compounds become unstable through time. Some existing radiological hazards may become worse as daughter radionuclides emitting more penetrating radiation accumulate (for example, americium) . . . .
>
> Also, cleanup operations are rarely as routine or predictable as production operations.[524]

In underscoring the increased hazards posed by the termination of weapons production in the DOE complex, Conway and the other Board members also typically pointed to the aggravation of risks that stemmed from the continuing "erosion of technical capability"—the significant losses of technical personnel who had experience in operational safety-related issues.

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[523] U.S. Congress, House of Representatives, Committee on Appropriations, Subcommittee on Energy and Water Development, *Energy and Water Development Appropriations for 1996*, 104th Cong., 1st sess., January 31, 1995 (statement of John T. Conway, "Possible Restructuring of the U.S. Department of Energy"), 919–30.

[524] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 98–99.

SAFE MANAGEMENT OF A REDUCED NUCLEAR WEAPONS CAPABILITY

In surveying the heightened safety challenges associated with the cessation of weapons production in the DOE complex, the Board identified weapons-related activities newly under its jurisdiction—specifically large-scale dismantlement operations—as among the most potentially risky and thus among the most pressing priorities for Board oversight.[525] The sheer magnitude of the task of dismantling some 20,000 weapons at the rate of 2,000 per year contributed to the potential hazardousness of dismantling operations.

Recognizing the urgency of ensuring that dismantlement posed no "undue risk" to health and safety, the Board inaugurated a new practice—starting at the main dismantlement site, Pantex—of maintaining permanent on-site field representatives at certain high-priority sites. In initiating this practice, the Board built on the precedent of the Nuclear Regulatory Commission (NRC), which maintained on-site inspectors at licensed nuclear plants.[526] The Board provided for a field presence first at Pantex—with two full-time representatives—and later at Hanford, Savannah River, Los Alamos, and other sites. The Board's technical field representatives were charged with providing continuous feedback both to DOE site managers and to Board managers in Washington, DC. Weekly site representative reports and conference calls augmented the information from the field already regularly provided by technical staff trip reports.

The intensified scrutiny of Pantex operations that the on-site representatives allowed supplemented the Board's usual information-gathering practices for safety reviews. In conducting its technical reviews of weapons operations at DOE's assembly, disassembly, and testing sites, the Board and staff reviewed available Tiger Team reports on health and safety issues at the sites, hired additional expert consultants with nuclear weapons expertise, and made numerous site visits, with most effort focused on Pantex, and some visits to the Y–12 plant and the Los Alamos National Laboratory.[527] In the reviews for these sites, as well as the Nevada Test Site, the Board identified a need for improvement in numerous broad safety-related controls that it had addressed in previously issued recommendations. The Board found deficiencies in such

[525] For general background on the dismantlement mission, see Arjun Makhijani, Stephen I. Schwartz, and Robert S. Norris, "Dismantling the Bomb," in Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Washington, DC: Brookings Institution Press, 1998), 326–52.
[526] Glenn Russell George, "Negotiated Safety: Intragovernmental Risk Regulation in the U.S. Nuclear Weapons Complex" (Ph.D. diss., Harvard University, May 1995), 153 (accessed via Proquest).

multi-site safety issues as the utilization of standards, safety analysis, the operational readiness review process, and training and qualifications programs. As the Board had found elsewhere, it saw a strong need for improvement in these areas and pressed these sites to institute more formality in their conduct of operations. Particularly in view of ongoing losses of technical personnel at the sites, it urged DOE to move from a system that was relatively "expert-based" to a system more driven by formal conduct of operations.

Toward Improving Safety of Weapons Disassembly: Standards and Procedural Reviews

Some issues emerged as of particular concern at the dismantlement sites. At Pantex, the Board focused on the status of safety analyses and criticality analysis and requested the production of reports on criticality safety, as well as on radiation control practices. The Board also faulted DOE's guidelines on explosive safety, finding them insufficiently attentive to the potential for radioactive material releases in the event of accidents in the disassembly cells.[528] The Board recommended that criticality experts at Pantex participate in the Nuclear Explosive Safety Study Group (NESSG) that approved all weapons assembly/disassembly procedures.[529] At the Y–12 plant, the Board identified inadequate compliance with orders/standards, especially in radiological control practices, but also in the operational readiness review (ORR) process, training, and contamination control practices.[530] The Board requested a report from DOE evaluating the technical adequacy of radiological control practices at Y–12 compared with DOE and consensus standards, and a second report on plans to address long-standing problems of compliance with DOE orders.

Drawing upon the findings of its various reviews, the Board issued one formal recommendation specifically applicable to dismantlement facilities, Recommendation 93–1, *Standards Utilization in Defense Nuclear Facilities.*[531] This recommendation noted the discrepancy in nuclear safety requirements/standards between facilities that produced and processed fissionable materials, and those such as Pantex that assembled, disassembled, and

[527] Office of Technology Assessment, *Dismantling the Bomb*, 49–50.
[528] Office of Technology Assessment, *Dismantling the Bomb*, 49.
[529] Office of Technology Assessment, *Dismantling the Bomb*, 49.
[530] Office of Technology Assessment, *Dismantling the Bomb*, 51.
[531] Defense Nuclear Facilities Safety Board, *Recommendation 93–1, Standards Utilization in Defense Nuclear Facilities* (Washington, DC, January 21, 1993), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1993_01.txt.

tested nuclear weapons. The Board recommended that DOE review its nuclear safety orders and directives, develop a plan to make nuclear safety assurances comparable at both types of facilities, and give priority to a site-wide compliance review at Pantex.

Board activities at Pantex and other dismantling facilities involved the observation of, and intervention in, the processes of preparing to dismantle specific weapons systems. The Board sought a review process improvement that would entail, among other things, regularizing the practice of consulting with the laboratory weapons experts prior to the initiation of disassemby or dismantlement for a particular weapon type. As the designers of all U.S. nuclear weapons, DOE's three national weapons laboratories—Lawrence Livermore, Los Alamos, and Sandia—constituted "a unique source of information about the nuclear weapons slated for dismantlement."[532] The national laboratories, together with DOE management, had the responsibility for developing the standard operating procedures for nuclear weapons dismantlement at Pantex, with the laboratories having final approval authority.[533] However, the Board found that the optimal use was not being made of laboratory expertise either in the formulation of procedures or in the oversight of procedural compliance. As Conway said,

> We have made some suggestions to improve on the analyses needed to prepare for a particular weapon that has to be disassembled. We have a group of experts reviewing the entire method by which DOE and the contractor at Pantex prepare for a particular disassembly procedure.
>
> We found that initially they were not bringing in laboratory personnel who had helped design the weapons and who had intimate knowledge of the weapons. They were not bringing them in as the procedures were being drafted and written as to how the personnel were to take the weapons apart.
>
> We then recommended that they not move ahead with disassembly of any specific weapon until bringing in the specific laboratory personnel that designed that weapon, and have those personnel that helped design the weapon participate in writing the disassembly procedures, and in effect, saying the disassembly procedure is not a problem.[534]

The Board found fault with the overall safety attitude during dismantlement operations, noting excessive latitude for disassembly technicians to use their judgment when an operation was not proceeding as expected. Alarmingly, changes to the procedures were sometimes made without

[532] Office of Technology Assessment, *Dismantling the Bomb*, 43.
[533] Office of Technology Assessment, *Dismantling the Bom*b*,* 43.
[534] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1995*, 939.

the involvement of the cognizant weapons design laboratory.[535] The Board urged and eventually saw improvement in the attitude about preparing for unanticipated difficulties. As Conway said,

> Initially, we were told, well, if we run into a problem, we will bring in the laboratory personnel. They would not have known beforehand if they were going to have a problem. You have to have this knowledge ahead of time. We have got the laboratory people intimately involved now.[536]

Advocating the increased involvment of laboratory personnel in disassembly and dismantling operations, the Board was instrumental in persuading DOE to expand the "qualification evaluation" procedure, the third of three review procedures for approving dismantlement operations. The first review was the operational readiness review (ORR) conducted by a team of contractor engineers to ensure that the necessary equipment and procedures to begin dismantlement were in place.[537] The second review, an operational readiness evaluation (ORE), was a critique of the ORR conducted to confirm readiness. The third procedure, the Qualification Evaluation for Dismantlement Release (QED), was an additional review by national laboratory design engineers to verify the DOE critique, the correctness of disassembly procedures, and the proper handling of safety considerations. The Board sought the expansion of this procedure on finding persistent shortcomings in the safety aspects of DOE's ORR/ORE process for particular weapons systems at Pantex.[538]

Knowledge Preservation: Mitigating the Loss of Safety Expertise in Weapons Operations

After urging stepped-up involvement by national laboratory personnel to enhance the safety of specific disassembly operations, the Board made a broader recommendation concerning such personnel and other technical experts involved with weapons-related operations throughout the DOE complex. The Board called upon DOE to institute processes to retain access to and document the unique capabilities of individuals with experience in certain critical operations.

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[535] See John W. Crawford Jr., *An Assessment Concerning Safety at Defense Nuclear Facilities: The DOE Technical Personnel Problem*, DNFSB/TECH–10 (Washington, DC: Defense Nuclear Facilities Safety Board, March 1996), 4, http://www.dnfsb.gov/pub_docs/dnfsb/tr_199603.html. Crawford said of disassembly operations, "The procedures, while based on those provided by the weapons laboratory personnel, who are the technical experts for weapons operations, were being changed by personnel at Pantex *without having the changes reviewed and approved by the weapons laboratory*.

[536] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1995*, 939.

[537] Office of Technology Assessment, *Dismantling the Bomb*, 43.

[538] Office of Technology Assessment, *Dismantling the Bomb*, 43.

The Board was concerned about safety implications of the losses of technical personnel and skills from DOE and its contractors, because the safety of many critical processes depended too heavily on the informal knowledge of the individuals currently involved—technical knowledge that was often inadequately documented. With the downsizing of the DOE nuclear complex, the reduction of the nuclear stockpile, the hiatus in testing, and budget pressures, the problem of the loss of unique weapons and testing knowledge stood to grow worse.[539]

Speaking generally of the cadre of technical experts and the need to preserve their knowledge, Conway remarked, "It is a dwindling group. Unless we can tap that capability now, it will disappear on us." He elaborated on the consequences of the loss, stating, "As experienced operating personnel leave, the knowledge of facility designs and contents erodes, reducing the margin of safety."[540] He made the further points that the losses were worsening with the downsizing of the weapons complex, and that an eroding skill base had especially serious consequences for the safety of weapons-related activities, especially disassembly and testing. As he stated in a Senate Armed Services Committee hearing on April 25, 1995,

> The Board has been concerned with the loss of unique talents from DOE and its contractor organizations caused by the downsizing of the defense nuclear complex. This concern is particularly acute for the weapons laboratories and the facilities involved in the assembly, disassembly, and maintenance of weapons, where budget pressures and other constraints are leading to the severe erosion of the talent pools upon which much of the weapons program has depended.
>
> We have also been a strong supporter of maintaining technical competence within the laboratories. We were concerned that we were losing some of that technical competency, and particularly with the retirement of many of the weapons personnel that have intimate knowledge about design of weapons . . . .[541]

Conway mentioned Board action to ameliorate the erosion of technical expertise, including the issuance of Recommendation 93–6, *Maintaining Access to Nuclear Weapons Expertise in the Defense Nuclear Facilities Complex*,

> We made recommendations on how we can utilize the personnel that have this knowledge, even though they are retired, to bring them back and make sure we can get their knowledge down and documented for future laboratory personnel.

[539] Defense Nuclear Facilities Safety Board, *Recommendation 93–6, Maintaining Access to Nuclear Weapons Expertise in the Defense Nuclear Facilities Complex* (Washington, DC, December 10, 1993), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1993_06.txt.
[540] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 108.
[541] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 93–94.

> We are fearful that this technical competence may be evaporating. . . . I do not want to see those laboratories lose their capabilities.[542]

Recommendation 93–6 urged DOE to inaugurate a formal process to document and archive the collective knowledge that might otherwise be lost as facilities were closed and technical personnel retired. In particular, the Board called upon DOE to identify the critical skills and unique knowledge needed for particular operations, especially operations of two types, the dismantlement of weapons and nuclear explosives testing. In connection with disassembly, the recommendation emphasized the need to develop and document procedures for the safe disassembly or modification of all remaining types of weapons systems while personnel with the requisite expertise were still available and while scattered records could still be retrieved. The sites targeted with this advice included the weapons dismantling site at Pantex, the Oak Ridge Y–12 plant, and the national weapons laboratories. Accepting the Board's recommendation, DOE initiated programs at these sites to obtain and record from departing and retired personnel undocumented technical information that would enhance the technical knowledge of future personnel. The Board's advice also spurred DOE sites to step up their archiving of engineering records.[543] The Knowledge Preservation Program of Y–12, for example, completed in four years, established an electronic archive containing full-text-searchable transcripts of 239 one-to-two-hour-long interviews with current and retired employees. The interviews documented key safety knowledge of the employees, as well as historical process knowledge for diagnostic and upgrading purposes.[544]

In connection with weapons testing—specifically testing at the Nevada Test Site—the Board offered similar advice on retaining and documenting expertise in case testing were resumed. Although nuclear testing was under a moratorium, Conway noted in hearing testimony that the lifting of a moratorium on testing would not be unprecedented.[545] Recommendation 93–6 called for the identification of the skills needed to conduct nuclear testing operations safely, a review of personnel losses at the Nevada Test Site and the nuclear weapons laboratories, and the

[542] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 93.
[543] Kevin O'Neill, "Building the Bomb," in Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Washington, DC: Brookings Institution Press, 1998), 92.
[544] Best Manufacturing Practices Center of Excellence, *Department of Energy, Oak Ridge Operations (National Nuclear Security Administration–Y–12), Oak Ridge, TN* (Information: Knowledge Preservation Program, January 18, 2007), http://www.bmpcoe.org/bestpractices/internal/oakri/oakri_113.html.

establishment at each site of archiving and knowledge capture programs.[546] The Board considered the capture of this information from the test site and laboratories vital to DOE's capability to avoid safety problems in the event of future testing and, more generally, in the stewardship of the weapons stockpile, now the primary mission of the weapons laboratories.

Board Support for Criticality Studies at the National Defense Laboratories

In addressing the retention of technical expertise at DOE weapons-related sites, including the laboratories, one particular aspect of the issue singled out by the Board was the need to retain capabilities at the laboratories to conduct criticality experiments. The Board viewed basic scientific knowledge about criticality as crucial for the safe conduct of many activities in the weapons complex —any activities involving, or potentially resulting in, a sufficient concentration of radioactive materials to produce a self-sustaining nuclear chain reaction. In the performance of its oversight duties, the Board encountered frequent nuclear criticality safety risks and deficiencies.[547] For example, during routine site reviews at the Oak Ridge Y–12 plant in 1994, the Board observed violations of criticality safety limits in storage vaults that were sufficiently serious to prompt the issuance of a formal recommendation specifically addressing the problem at the site.[548]

Despite the concerns about the potential of accidental criticality events throughout the complex, however, the budget cutting that accompanied the downsizing of the weapons complex and President Clinton's deficit-reduction efforts threatened the resources and capabilities that the laboratories devoted to experimental criticality studies. In 1993 the Board was apprised of DOE's impending closure of the last nuclear criticality experimental facility, located at the Los Alamos National Laboratory.[549] In response, the Board issued Recommendation 93–2, *The Need*

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545 Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 103.
546 DNFSB, *Recommendation 93–6,* 2–4.
547 Defense Nuclear Facilities Safety Board, *Fifth Annual Report to Congress* (Washington, DC, February 1995), 20, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/ar_1995.html.
548 Defense Nuclear Facilities Safety Board, *Recommendation 94–4, Deficiencies in Criticality Safety at Oak Ridge Y–12 Plant* (Washington, DC, September 27, 1994), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1994_04.txt. See also Defense Nuclear Facilities Safety Board, *Status of Highly Enriched Uranium Processing Capability at Building 9212 Oak Ridge Y–12 Plant*, DNFSB/TECH–9 (Washington, DC, December 8, 1995), http://www.dnfsb.gov/pub_docs/dnfsb/tr_19951208_or.html.
549 Defense Nuclear Facilities Safety Board, *Eighth Annual Report to Congress* (Washington, DC, February 1998), 1–10, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/ar_1998.pdf.

for Critical Experiment Capability, which urged DOE to take actions to retain facilities and criticality engineering expertise to perform general-purpose criticality experiments. Such experimentation was needed to improve the scientific basis for calculating margins of safety against runaway nuclear reactions.[550] As Conway said, speaking of the laboratories and the threatened end of experimental criticality studies,

> Many of the recommendations we have made are to strengthen the laboratories. One, in particular, we found out that through lack of money they were going to have to close down their capability of doing criticality studies. We thought that was wrong. One of our major recommendations was to assure that adequate funding would go on for their continued work in criticality studies[551]

In response to Board Recommendation 93–2, DOE altered course, and formed a Nuclear Criticality Steering committee to reinvigorate the program of experimentation in nuclear criticality, identifying the Los Alamos Critical Experiments Facility (LACEF) as the research facility to be used for it. The Board advocated continuing support for the facility and, in furtherance of safety in the complex, proposed to monitor DOE's use of critical experiment capability.

The Board Weighs in on the Defense Laboratories and Stockpile Stewardship

Besides supporting retention of the capabilities for criticality research in the DOE defense laboratories, the Board made a broader push to strengthen the laboratories, both through its advocacy for their activities and continued funding and through safety oversight of the laboratories' research and development operations. The Board argued for the continuing crucial role of the defense laboratories, notwithstanding the change in their mission that accompanied the changed mission of the nuclear complex.[552] The laboratories were no longer engaged in the design and development of new nuclear weapons. However, they had augmented research responsibilities relevant to safety throughout the complex, including duties in relation to the maintenance of the nuclear stockpile, which still consisted of more than 5,000 warheads.[553] The

[550] Defense Nuclear Facilities Safety Board, *Recommendation 93–2, The Need for Critical Experiment Capability* (Washington, DC, March 23, 1993), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1993_02.txt.
[551] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 101.
[552] U.S. Department of State, Bureau of Arms Control, "The Stockpile Stewardship Program," http://www.state.gov/www/global/arms/factsheets/wmd/nuclear/ctbt/fs_991008_stockpile.html.
[553] U.S. Department of Energy, Los Alamos National Laboratory, "Weapons Stewardship Presents New Challenges for National Labs" (Los Alamos, NM, 1996).

laboratories had increased responsibilities vis-à-vis the stockpile, because, in the absence of underground nuclear testing, laboratory research offered an alternative means to assure the reliability and safety of the nation's remaining weapons. Prior to the testing suspension in 1992, testing was the chief means to evaluate and certify nuclear warheads.[554] Absent testing, Congress and the Clinton administration agreed to the Stockpile Stewardship Program, a science-based program administered by the national laboratories, to provide basic knowledge to support "life-extending" operations for weapons.[555] In such operations, the weapons and components retained in the now smaller and aging stockpile underwent surveillance and periodic disassembly, refurbishment, reassembly, and re-certification.[556] In assessing the reliability and safety of the weapons so handled, the Stockpile Stewardship Program drew upon past nuclear test data, computer modeling, experimentation, and simulations.[557]

The Board's exercise of safety oversight over the stewardship activities of the laboratories entailed a number of special challenges. Among them were the heightened risks the laboratories' activities posed. These activities involved special hazards associated with the nuclear explosive activities, and with experiments involving co-located high explosives and nuclear material.[558] This co-location created the potential for explosive dispersal of radioactive materials or inadvertent nuclear detonation. In addition, the highly educated workforce exhibited a special reluctance to submit to the discipline of standards-based operations. The Board acknowledged some legitimacy in the laboratories' sense of their uniqueness, and proposed to address it in reviews of standards, stating,

> [The] Board has recognized that there can be considerable differences between the conduct of R&D activities by skilled scientists and engineers in laboratories, and "production" activities of less skilled workers . . . . A review effort [is] presently underway by the Board to determine whether there may be a more appropriate subset of requirements for the management of safety of research and

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[554] See U.S. Government Accountability Office, *Nuclear Weapons: Annual Assessment of the Safety, Performance, and Reliability of the Nation's Stockpile*, GAO–07–243R (Washington, DC, February 2007), 1, http://www.gao.gov/new.items/d07243r.pdf. GAO explains that certification is the process by which the weapons laboratories establish that a particular nuclear warhead meets the military's required operational specifications.
[555] See GAO, *Nuclear Weapons*, 1. With the passage of the *National Defense Authorization Act for Fiscal Year 1994*, Pub. L. No. 103–160, Section 3135 (1993), "Congress directed DOE to establish the Stockpile Stewardship Program."
[556] U.S. Department of State, Bureau of Arms Control, "The Stockpile Stewardship Program."
[557] On the Stockpile Stewardship Management Program, see U.S. Congress, Senate, Committee on Governmental Affairs, Subcommittee on International Security, Proliferation, and Federal Services, *Safety and Reliability of the U.S. Nuclear Deterrent,* 105th Cong. 1st sess., October 27, 1997, 1–12.
[558] Defense Nuclear Facilities Safety Board, *Strategic Plan: FY 2003– 2009* (Washington, DC, November 17, 2003), http://www.dnfsb.gov/pub_docs/dnfsb/rcsp_2003.pdf.

> development activities other than those now in DOE Orders, which are slanted more toward production and utilization facilities. . . . [T]he Board recognized that requirements in Orders had to be fitted to the specific facilities and sites.[559]

However, the Board chided the laboratories for persisting in their resistance to cooperate in the Board's efforts to upgrade standards,

> While the weapons laboratories have had the opportunity to help define the safety related requirements that are applicable to their activities they have not expeditiously moved to do so . . .
>
> In general, the Board has found DOE nuclear safety requirements reasonably consistent with comparable requirements used to regulate the commercial nuclear industry.
>
> The Board would be pleased to see the laboratories operate to such standards. The problem is that they historically have viewed such requirements as undue restraints. The record is replete with examples where safety practices at the weapons laboratories do not meet commercial industry standards.[560]

Despite the difficulties of gaining full "buy-in" by the laboratories to standards-based operations, the Board remained a supporter of the laboratories' work as the source of "a better predictive understanding of the safety and reliability of weapons." Against the threat of budget cuts for the laboratories, the Board advocated bolstering their scientific and engineering resources and infrastructure, calling for "continuing support for specific national laboratory facilities that will be essential for support of the stockpile stewardship mission." The Board wanted more, not less, reliance on the laboratories and "the untapped potential resident in [their] scientists and engineers,"

> The Board . . . believes that the existing knowledge and skill base at the laboratories could be better used today to help solve problems that exist throughout the complex.[561]

The Board urged greater involvement of the laboratories not only in weapons-related activities, but also in "the monumental task of dealing with the radioactive and hazardous wastes at [DOE's] former nuclear weapons production sites and national laboratories."[562] The Board

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[559] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 105.
[560] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 106.
[561] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 105.
[562] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 104.

saw potential for more research in the laboratories not just on such topics as how to safely dismantle specific weapons, but also on how best to stabilize and package various fissionable materials for safe storage. As the Board noted in congressional testimony,

> For example, the Board has strongly encouraged DOE to bring to bear the considerable expertise at Los Alamos in stabilization of plutonium residues . . . The potential for the national laboratories to conduct such research and development is beyond argument.[563]

NUCLEAR MATERIALS STABILIZATION AND SAFE STORAGE: GROWING BOARD FOCUS FROM 1994

The hazards posed by the remnants of weapons production—surplus "special nuclear materials" stored in an interim fashion and residual wastes—became a top priority for the Board's attention with the end of the Cold War, a priority on a par with weapons-related hazards.[564] The post–Cold War end of weapons production brought to the forefront the urgent risks associated with the huge inventory of such remnants of production—principally unencapsulated plutonium left in various forms in processing lines, high-level radioactive and hazardous waste in storage drums and tanks, and corroding spent radioactive fuel elements in water-filled reactor basins and storage pools.[565] The Board, with its safety mission, was especially appreciative of the "serious near-term safety issues" associated with these unstable nuclear materials and asserted forcefully, "We have material that is in unstable form that should be stabilized," lest it lead to an "inevitable spread of radioactive contamination."[566] However, the Board labored to persuade DOE of the immediacy of the need to put the materials in a safe and stable condition. Davis Hurt, an expert on the Board's technical staff on the "materials problem" and safe storage, recalled some complacency on DOE's part, stating in 1995,

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563 Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 104.

564 The term "special nuclear material," as defined in the Atomic Energy Act of 1954 (as amended) means 91) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of section 51, determines to be special nuclear material, but does not include source material; or 92) any material artificially enriched by any of the foregoing, but does not include source material.

565 For background, see Arjun Makhijani, Stephen I. Schwartz, and William J. Weida, "Nuclear Waste Management and Environmental Remediation," in Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Washington, DC: Brookings Institution Press, 1998), 353–94.

566 U.S. Congress, House of Representatives, Committee on Appropriations, Subcommittee on Energy and Water Development, *Energy and Water Development Appropriations for 1996*, 104th Cong., 1st sess., January 31, 1995 (statement of John T. Conway, "Possible Restructuring of the U.S. Department of Energy"), 917, 919–30.

> At the time these issues were first raised . . . a year-and-a-half ago, it is fair to say that the Department did not agree that these problems were severe or urgent, some of them anyway . . . Agreement that the problem is bad is getting better, but actual action on it is still leaving a lot to be desired.
>
> I think there has been a tendency on some people's parts in DOE to think that storage is a simple thing, that you produced the plutonium, you separated it from the spent fuel, you have made components out of it. Those were difficult things and storage is a simple thing, maybe not even requiring much thought.[567]

Conway was also unimpressed with the urgency that DOE initially displayed in addressing the problems of stabilizing and storing radioactive waste. Speaking of tank sampling and waste characterization efforts at Hanford, he said,

> At the rate they were going, it would have been 100 years before they would have characterized what was in the tanks, and you have to do that before we can even get to the point of how we are going to treat the waste.[568]

The Board's alarm about the unstabilized legacy materials, particularly plutonium wastes, and its desire to convey its concern to DOE prompted the Board to order the first in its series of technical reports, a series consisting of three dozen reports by 2009. Board staff released the in-depth report, *Plutonium Storage Safety at Major Department of Energy Facilities*, in April 1994. The report, whose principal authors were Davis Hurt and the Board's technical director, Dr. George W. (Woody) Cunningham, described technical issues and safety vulnerabilities associated with the special nuclear material and the radioactive production residues and waste existing in drums, tanks, process lines, and storage facilities throughout DOE's nuclear complex.[569] The report also discussed standards for stabilizing and storing plutonium materials. On its release, the report elicited more than 500 requests for copies, suggesting the magnitude of public, if not DOE, concern with the radioactive remnants of weapons production.

The Board judged that the pace of DOE's planned actions for dealing with the materials problem did not reflect its urgency. Drawing on its staff report and other investigations, the Board formulated one of its most important formal recommendations, Recommendation 94–1, *Improved Schedule for Remediation in the Defense Nuclear Complex*. Issued on May 26, 1994,

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[567] *Public Meetings and Hearings, 1995, Before the Defense Nuclear Facilities Safety Board*, vol. I of II (Washington, DC: Defense Nuclear Facilities Safety Board, 1995), 17–19.
[568] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1995*, 937.
[569] Defense Nuclear Facilities Safety Board, *Plutonium Storage Safety at Major Department of Energy Facilities*, DNFSB/TECH–1 (Washington, DC, April 14, 1994), http://www.dnfsb.gov/pub_docs/dnfsb/tr_19940414.html.

94–1 was the Board's first set of recommendations concerning the overall problem of surplus nuclear materials and residual waste. The recommendation urged DOE to accelerate the remediation of surplus fissionable and other radioactive material, calling upon it to establish a program to characterize, stabilize, and provide for its safe longer-term interim storage—storage of some 50 years. At issue were thousands of kilograms of unstable residues—plutonium in troublesome forms, solid and liquid, and some 2,100 metric tons of corroding spent fuel stored in basins at various sites, especially the basins at Hanford, but also the Savannah River Site and the Idaho National Engineering Laboratory.

In Recommendation 94–1, the Board identified what it considered to be the highest-priority health and safety risks posed by the legacy of radioactive materials, listing the top stabilization and storage concerns for stepped-up action according to a prioritization scheme based on risk characteristics. As Conway said of 94–1 and its risk-based prioritization,

> We have in our Recommendation 94–1 identified what this Board believes to be the most hazardous from the point of present danger to the workers at the plants because much of the material is in an unstable form.[570]

In Recommendation 94–1, the Board specifically advised: "that an integrated program plan be formulated on a high priority basis, to convert within two to three years the materials," —especially plutonium metal that is in contact with, or in proximity to, plastic—"to forms or conditions suitable for safe interim storage." The Board also called upon DOE to expedite efforts to remove and properly store degrading spent fuel from their storage pools. The recommendation added that DOE's plan "will require attention to limiting worker exposure and minimizing generation of additional waste and emission of effluents to the environment." It stated further that the plan "should include a provision that, within a reasonable period of time (such as eight years), all storage of plutonium metal and oxide should be in conformance with the DOE standard on storage of plutonium." In addition, 94–1 recommended the establishment of a research program reliant on the national laboratories "to address alternate processes to be used in safe conversion of various types of special nuclear materials to optimal forms for safe interim storage and longer term disposition."[571] Finally, 94–1 stated that DOE's plan for stabilization of

[570] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 95.
[571] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 105.

special nuclear material should be founded on systems engineering, drawing on the integrated use of facilities and capabilities at all of DOE's sites.

In responding to 94–1, DOE committed to a schedule of actions to accomplish the stabilization and safe packaging of a broad spectrum of radioactive and chemically unstable residues and transuranic materials.[572] On receiving DOE's plan in 1995, the Board devoted considerable time that year to follow-up activities, including four public meetings. These meetings involved briefings to the Board at its headquarters conducted by its technical staff on plutonium storage issues and on spent nuclear fuel problems, a briefing at Rocky Flats on historical accidents involving plutonium and the storage of plutonium metals, oxides, and liquids, and a briefing at Savannah River on the safe handling of spent nuclear fuel. The briefings addressed the magnitude of the materials problem, the reason it had reached its acute level, and the prospect for further deterioration absent immediate corrective action. The briefings also addressed possible technical solutions to the preparation of materials, the preparation of storage containers, plans for the surveillance of stored materials, and, for the longer term, plans to upgrade or construct facilities to process materials for long-term interim or permanent storage, e.g., through vitrification.

In the briefings, a number of presenters explained that the materials problem became severe when the sudden cutoff of weapons production nearly at its peak had frozen a great deal of material in the manufacturing pipeline or, in the case of spent fuels, left it in basins longer than planned. When weapons production was intensive, the plutonium-rich materials in the production lines were, as Cunningham put it, "recovered on a short turn-around time so that the plutonium would be available for weapons production."[573] However, the production cutoff ended this recycling through the production facilities. At the same time, because the cutoff was expected to be short term, the in-process material was left in a state not suitable for storage of any duration. As Hurt said,

> They buttoned up the plutonium as best they could in a very hasty fashion not realizing of course . . . that over five years later these materials would still be in the same places. Plutonium was left in forms that were not stable, not intended for long-term storage. Packaging was ad hoc, not carefully recorded . . . and not suitable to multi-year storage.[574]

[572] The secretary of energy accepted Recommendation 94–1 in late-August 1994, and DOE submitted an acceptable Implementation Plan in February 1995.
[573] *Public Meetings, 1995,* vol. I of II, 12.
[574] *Public Meetings, 1995,* vol. I of II, 17–19.

For spent fuels, as the Board's staff report stated, a similar change in normal handling practices occurred when production abruptly stopped, with similarly negative consequences for safety,

> When weapons production was at its peak, in-basin residence time of irradiated fuel elements was relatively short—only long enough to permit the short-lived volatile and gaseous fission products to decay and radiation levels to drop to the point that the fuel elements could be handled with less danger to the workers and less radiation damage to processing chemicals . . . .
>
> When production was stopped in the late 1980s, the spent fuel elements remaining in the fuel storage basins were simply left in place. Longer in-basin residence times . . . promote greater penetration by basin water and resultant corrosion.[575]

Board technical staff members detailed the near-term safety consequences of these changes in materials handling for the Board in early 1995, with Hurt speaking on plutonium residues and J. Kent Fortenberry speaking on spent fuel vulnerabilities.

Hurt, the lead author on the Board's technical report, stated that the material of concern included "20,000 or so kilograms of separated unencapsulated plutonium, observing, "It surprises a lot of people that there is so much material in the pipeline—so much material that was removed from the irradiated fuel, but not yet fabricated into weapon components." He added that he was speaking mostly about Rocky Flats,

> We believe that Rocky Flats has the worst problems . . . by a large margin. Rocky Flats has the most plutonium. They have the most types of problems. They have the most serious problems, we believe, in terms of risk to life and limb of workers as a minimum. They also have we think the least capability for dealing with those problems in the near future.

In outlining the risks that these materials posed, he began with the worst-case scenario—the type of incident that had occurred as a result of major fires in the past—a scenario involving off-site releases of radioactive contamination,

> The thing we fear the most is a massive fire that breaches the containment of the building either by burning the thing down or completely knocking out the ventilation system.[576]

Short of large-scale off-site releases, the materials posed numerous other risks, as documented in DOE occurrence reports. Often the packaging—much of it involving

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[575] Defense Nuclear Facilities Safety Board, *Review of the Hanford Spent Nuclear Fuel Project*, DNFSB/TECH–17 (Washington, DC, October 1997), 2-1, http://www.dnfsb.gov/pub_docs/hanford/tr_199710_hd.pdf.

plastic—was "now decomposing and producing hydrogen," which built up pressure inside drums and other storage containers. Improperly stored plutonium was known for "catching on fire, setting other things on fire, off-gassing . . . even causing small chemical explosions, explosions of flammable gasses."[577] Hurt mentioned, "Containers that rupture, containers that have fires in them and are found burned out afterwards, even flashing and sparking as containers are opened." He added, "These kinds of incidents are becoming more common," and pointed to a recent incident "where a drum of plutonium-bearing waste exploded, scattered debris around, and contaminated the two workers standing nearby."[578] Other on-site risks included criticality accidents and worker exposure from leaks, as Hurt noted,

> A sizeable amount of this material is concentrations that could go critical . . . . Criticality safety is the most serious concern just because a criticality accident would probably be fatal in a plant like that. There was a near accident two or three months ago [that] illustrates Mr. Crawford's point about . . . poorly trained operators.
>
> [An operator] was draining solution. . . . Luckily there wasn't quite enough solution in the line . . . but he was filling bottles with solution that was in the criticality danger range and he was putting these bottles side by side in the glove box. That is what I would say is a near miss.
>
> The lines are mostly overhead [with] people walking back and forth under the lines . . . . Leaks and line ruptures are frequent events. Plutonium solution gets dripped and sprayed around. They haven't sampled most of this material since 1989.
>
> The tanks are in an area that is operated manually. People turn valves and read sight glasses with their faces right up against these tanks.[579]

Serious hazards of a somewhat different variety attended spent nuclear fuel storage, as described by Kent Fortenberry, the Board's technical staff lead on the K-East Basin at Hanford. Fortenberry listed,

> Chronic leakage, seepage, seismic vulnerability which can lead to more catastrophic leakage, and also lead to structural damage of the fuel and, possible criticality conditions as, for instance, superstructure falls into these basins.[580]

[576] *Public Meetings, 1995,* vol. I of II, 22.
[577] *Public Meetings, 1995,* vol. I of II, 20.
[578] *Public Meetings, 1995,* vol. I of II, 24.
[579] *Public Meetings, 1995,* vol. I of II, 51–52.
[580] *Public Meetings, 1995,* vol. I of II, 120.

He added, remarking on the remediation difficulties posed by these conditions, "As the fuel continues to degrade and deteriorate, it becomes more difficult to handle. In some cases, it becomes difficult to stabilize."[581] The failure to stabilize severely corroding fuel elements posed risks not only to workers involved in surveillance and cleanup, but also to the environment. In the case of Hanford's K-East and K-West basins, which received all the spent fuel from Hanford's N-reactor, leakage could threaten the Columbia River, only a few hundred yards away.[582] Such leakage, already detected for a time from K-East, could become catastrophic if the structural integrity of the basins were severely compromised, e.g., by an earthquake, not an implausible event at Hanford.

This litany of hazards stood to grow continually worse, as all associated with the Board emphasized. Cunningham summarized the situation,

> As a result of stopping production, DOE is now faced with handling material of unknown characteristics that is improperly packaged and that can only degrade and become a worse problem the longer there is inaction by DOE.[583]

Board member Dr. Herbert J. C. Kouts concurred, adding that the continuing loss of technical personnel compounded the urgency of corrective action on nuclear materials hazards,

> The longer this takes before it is done, the greater the problem that will occur, not only because of greater deterioration of facilities, but because of greater loss of information among the people who are going to have to do the work.
>
> We know of numerous cases of body burden from plutonium by people who have been affected by accidents . . . by containers that have ruptured, by gloves that have ruptured in glove box operations, by minor fires . . . . the longer the time passes before things are done, the greater the problem is going to be.[584]

Given the severity of the materials problem and deteriorating storage conditions, the Board saw delay as a safety issue of concern and gave high priority to pressing DOE to meet its obligations under its implementation plan for 94–1. The Board acknowledged improvement in DOE's commitment to corrective actions, but still deplored the slow pace with which DOE accomplished the remediation of various nuclear materials hazards. Kouts commented on this slow pace, mentioning how progress was hampered by sheer built-in difficulties of the tasks,

[581] *Public Meetings, 1995,* vol. I of II, 120–21. See also Gerber, 246.
[582] On the K-East and K-West basins, see Gerber 244, 246–47.
[583] *Public Meetings, 1995,* vol. I of II, 12–13.
[584] *Public Meetings, 1995,* vol. I of II, 300.

including the necessity for the workers always to take time-consuming radiation protection measures,

> We have noticed . . . when we have gone through the facilities . . . very extensive operations . . . on radiation protection that consume a lot of time and we have been told that the normal useful amount of time they get out of the shift worker in these facilities is something like three hours per shift.[585]

Another serious obstacle to rapid progress—one expected to hamper the removal of fuel elements from basins—was sludge at the bottom of the basins.[586] As Conway said, speaking of his encounter with the problem at Hanford in 1993,

> Once you start moving fuel, you stir up the bottom, and it gets very cloudy. The amount of sludge and dirt in the bottom of these basins was worse than I had ever seen any other place. In fact, the first time I went into that basin with another Board member, I had never been in a more dirty place . . . . I had never been in a place before where I had to take off every stitch of clothing I had on before I went in because I couldn't wear anything out that I wore in there.[587]

Notwithstanding such inherent hindrances to materials stabilization, the Board viewed the technical challenges involved as generally surmountable and pressed DOE for progress on its especially critical commitments. Notable among these commitments was the removal of the deteriorating spent fuel from Hanford's K-East Basin, in Conway's words, "one of the worst tanks at any site."[588] Board pressure was the catalyst that prompted DOE to develop the Spent Nuclear Fuel Project, a key element of the implementation plan for Recommendation 94–1. The project was a comprehensive plan for the expeditious removal of the deteriorating spent nuclear fuel stored in the K-reactor basins, the stabilization of the fuel by suitable processes, and its placement in dry interim storage on-site pending its ultimate disposition. The Spent Nuclear Fuel Project was predicated on an aggressive schedule, in keeping with the urgency it deserved—fuel retrieval between 1997 and 1999. As the Board later said of the project in a follow-on

[585] *Public Meetings, 1995,* vol. I of II, 55.
[586] On the challenge of sludge, see Gerber, 247–48.
[587] U.S. Congress, House of Representatives, Committee on Commerce, Subcommittee on Oversight and Investigations. *Department of Energy's Hanford Spent Nuclear Fuel Project*, 105th Congress, 2d sess., May 12, 1998, 111.
[588] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1995*, 937.

recommendation to 94–1—Recommendation 2000–1, *Prioritization for Stabilizing Nuclear Materials*—"Progress toward remediation seemed adequate for a time."[589]

In the same source, Recommendation 2000–1, the Board also gave a generally positive assessment of some stabilization initiatives apart from the Spent Nuclear Fuel Project. In the Board's judgment, "A great deal [was] accomplished in meeting the safety objectives set forth in Recommendation 94–1, particularly with regard to those materials that constituted the most imminent hazards." The Board listed numerous corrective actions that DOE had implemented successfully. In connection with storage, DOE had mitigated the most immediate and greatest hazards, such as the packaging of plutonium metals and oxides in contact with plastic that had the potential to generate hydrogen gas. DOE made progress in removing plutonium from potentially dispersible solutions and storing it as more stable metal or oxides. Relocated materials were repackaged in more robust and better researched storage containers, mitigating issues of leakage and easing surveillance risks. Additionally, DOE made progress on cleaning out highly contaminated buildings.[590]

The Board recognized DOE's work on the handling of conditions and situations the Board had identified as imminent risks. The Board acknowledged notable progress on near-term corrective actions for "high-risk items," and some easing of the immediate concerns that had prompted the issuance of Recommendation 94–1. As Dr. A.J. Eggenberger recalled when he was serving as the Board's acting chairman,

> We asked . . . that actions be taken to stabilize those materials which caused the most risk to the people and to the workers . . . .They did that up to a point. They did the high-risk items.[591]

Eggenberger added the proviso, however, that DOE showed weakness in its ability to prioritize corrective actions beyond the short-term. The Board anticipated this problem even as it issued 94–1, citing among other causes for the problem the sheer enormity of the remediation task facing DOE. At one point, the GAO mentioned 7,000 facilities, which included only those destined for decommissioning and decontamination upon the completion of shutdown activities

[589] Defense Nuclear Facilities Safety Board, *Recommendation 2000–1, Prioritization for Stabilizing Nuclear Materials* (Washington, DC, January 14, 2000), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_2000_01.pdf. See also Gerber, 241.
[590] DNFSB, *Recommendation 2000–1, Prioritization for Stabilizing Nuclear Materials*.
[591] U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Oversight and Investigations, *A Review of Ongoing Management Concerns at Los Alamos National Laboratory*, 109th Cong., 1st sess., May 5, 2005, 46.

over the next 30 years.[592] The monumental stabilization task confronting DOE put a premium on establishing priorities among the risks to address. The task also demanded—for sustained momentum—longer-term planning about the operational capabilities that needed to be preserved, upgraded, or newly provided in order to accomplish stabilization. Finally, the task required the integration of activities and resources within sites and across sites. In emphasizing the need in DOE for a longer and wider view, the Board often held up one particular example as a serious planning mistake—the decommissioning of the PUREX plant at Hanford in 1990. This closure had long-lasting and broad ripple effects, because it deprived Hanford of the capability of chemically processing its irradiated uranium fuel on-site. The spent fuel "was left stranded" in the seismically vulnerable and leak prone K-East and K-West storage basins.

The planning failure represented by the PUREX closure was the kind of mistake that the Board targeted in its inclusion in 94–1 of a particular subrecommendation, the advice on adopting a systems engineering approach. The Board anticipated that the major stumbling block and challenge for DOE in carrying through on the commitments made under 94–1 would lie in sustaining the effort and accomplishing actions that required longer-term planning. Expecting this challenge, the Board advocated a systems approach, a point that Conway highlighted in a 1996 Senate Armed Services Committee hearing,

> Recommendation 94–1 stated that DOE's plan for stabilization of special nuclear material should be founded on systems engineering, drawing on the integrated use of facilities and capabilities at all of DOE's sites.[593]

Elaborating, he said, "We have thousands of facilities out there,"

> Eventually, you have to decide, as for the systems approach, what we are going to do with that particular facility or material you get out. It is a major problem . . . . So, it is a matter of selecting on a priority basis. The Board can suggest you do it on a priority basis—what is the most hazardous right now?
>
> . . . We have to take a look at each and every one of the sites and set priorities. I start first with the priority of the current danger, and that is the stability of some of the material that is out there. This is something one of our recommendations addresses, 94–1, that the Department of Energy determine at each of its locations what is the most dangerous materials right now that we have to stabilize . . . Then we have to . . . set a priority at each site . . . through a systems approach of what

[592] U.S. General Accounting Office, *Department of Energy: Cleaning Up Inactive Facilities Will Be Difficult,* GAO/RCED–93–149 (Washington, DC, June 1993).
[593] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 105.

> we . . . clean up. Then each site having done that, there has to be some way that headquarters can look at each of the various sites and then set priorities among the sites. But that has to be done by people who are technically competent to do this. It has to be done in [that] way that no matter what the political flack may be.[594]

Conway was asked by a Senator on the committee, "Now, is that being done? . . . . Is the statute recommending that that is the direction we need to go in?" Conway replied,

> The answer is, no, it is not being done properly as of now. We are still in the stage of trying to set priorities from the point of individual sites and particularly with regard to priorities of their most dangerous materials and situations out there now.[595]

[594] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 108.
[595] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 95–96.

CHAPTER 6: INTEGRATION: THE BOARD'S WATCHWORD FOR THE LONGER TERM

After the fifth year of operations, the Defense Nuclear Facilities Safety Board (DNFSB or the Board) shifted gears in its oversight activities for the second time, albeit with a less clearly demarcated adjustment than the reorientation at the end of the Cold War. The Board's second shift of focus involved a greater emphasis on assisting the Department of Energy (DOE) to improve the *integration* and longer-term coherence of its safety-related efforts in the DOE nuclear complex. As the Board stated in 2003 in its *Thirteenth Annual Report to Congress*,

> A review . . . shows that in the early years, the Board focused on ensuring that safety standards and DOE's technical competence were adequate, while at the same time trying to ensure that operational safety issues were dealt with expeditiously. Once adequate safety standards were in place, the Board focused more explicitly on DOE's safety management activities, on continuing improvement in conduct of operations, and on ensuring the integration of safety principles into design, construction, and decommissioning activities.[596]

The Board's second shift of focus followed its fifth-year self-assessment of its accomplishments and shortfalls in improving nuclear safety, and reflected the Board's judgment about how to make further progress in its safety mission.

The Board conducted a fifth-year self-assessment in fulfillment of a statutory obligation laid out in the legislation that created the Board. Congress required the Board to include in its fifth annual report "an assessment of the degree to which the overall administration of the Board's activities are believed to meet the objectives of Congress in establishing the Board," as well as the Board's "recommendations for continuation, termination, or modification of the Board's functions and programs . . . ."[597] In responding to the requirement to weigh the Board's effectiveness, the Board mentioned considerable success in gaining DOE's cooperation and in furthering its resolution of safety issues, particularly narrower, site-specific issues. In the fifth year review and other self-assessments, the Board also affirmed its success in getting DOE to take corrective action on the many imminent risks exposed or aggravated throughout the

[596] Defense Nuclear Facilities Safety Board, *Thirteenth Annual Report to Congress* (Washington, DC, February 2003), 1–3, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.

[597] Defense Nuclear Facilities Safety Board, *Fifth Annual Report to Congress* (Washington, DC, February 1995), n.p., http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php. In 1994, in preparation for the fifth-year self-assessment, the Board held nine public hearings to solicit the views of interested persons on the Board's effectiveness and possible changes to the Board. Eight of the hearings were held near DOE defense nuclear facilities.

complex after the shutdown of weapons production. The main frustration that the Board identified around the time of the fifth-year review, however, was the slowness with which DOE implemented the commitments it made in response to Board recommendations, particularly the commitments concerning the Board's two most crucial complex-wide recommendations, the recommendations on standards and on the technical personnel problem—Recommendation 90–2, *Design, Construction, Operation and Decommissioning Standards at Certain Priority DOE Facilities*, and Recommendation 93–3, *Improving DOE Technical Capability in Defense Nuclear Facilities Programs*. Speaking of the problem of the timeliness of DOE's issue resolution, the Board said,

> The primary difficulty the Board has encountered in the first five years is not with obtaining requested safety information, identifying significant safety problems requiring DOE attention, developing recommendations, or having the Secretary of Energy accept them. Those functions of the Board have been successfully executed in accordance with Congressional objectives. The problem centers on subsequent inaction and failure to implement recommendations and corrective measures in a timely manner.[598]

In considering this problem of the inadequate pace of DOE's corrective actions, the Board's diagnosis was not that the Board lacked the requisite statutory powers to enforce action or was otherwise misconceived. When called upon, as in the fifth-year review, to address its powers, the Board remained a steadfast defender of existing oversight arrangements and of the adequacy of its "action-forcing" authority. Rather than through statutory changes, the Board saw promise for improved timeliness and completeness of DOE's corrective actions through the increased integration of DOE's safety-related activities, and the more consistent application of the principles of systems engineering and other tools by which the huge array of safety-related tasks facing DOE could be prioritized and more efficiently structured.

The Board's strategy to assist DOE further did not entail a retreat from the Board's ongoing efforts to urge the resolution of previously identified safety issues and the acceleration of earlier initiatives. The Board continued to press DOE for improvement on the disparate corrective actions thus far agreed upon, especially in the problematic areas of personnel and standards. However, the Board also sought to assist DOE in establishing frameworks—structured ways of proceeding—in which to recast piecemeal actions as part of more comprehensive efforts and longer-term strategies to ensure safety in the weapons complex. One key Board initiative along these lines was the Board's promotion of a concept and approach, Integrated Safety Management (ISM), for integrating actions to mitigate different kinds of hazards—nuclear, chemical, and physical—affecting different sectors—the public, workers, and the environment—in a more comprehensive picture.

INTEGRATED SAFETY MANAGEMENT (ISM): ESTABLISHMENT, FOLLOW-UP

Integration became the Board's watchword for how to achieve more timely safety issue resolutions and more thorough safety improvements complex-wide when the Board issued Recommendation 95–2, *Safety Management*, in 1995, "one of the most encompassing" of the Board's recommendations.[599] As the Board later described the recommendation, it "encouraged DOE to build on the successes gained" in implementing two key recommendations issued earlier, Recommendation 90–2, on standards, and Recommendation 93–3, on the technical personnel problem.[600] Building on these successes, DOE was urged to "develop safety management programs for its defense nuclear facilities that integrated public protection, worker safety, and environmental protection into the work process."[601] In the words of Board member Joseph J. DiNunno,

> The major thrust of this recommendation was to bring the many safety-related directives, implementation efforts, and related new initiatives into a more cohesive, integrated, and effective safety management program, with clearer lines of responsibility and authority defined for its execution.[602]

ISM evolved from Recommendation 95–2, from DOE's 1996 implementation plan for 95–2, and from a technical report authored by DiNunno, DNFSB/TECH–16, *Integrated Safety Management,* which amplified the recommendation with a detailed discussion of what could be accomplished through ISM. ISM was a safety management program that provided a structured

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[598] DNFSB, Fifth Annual Report to Congress, 69.
[599] Defense Nuclear Facilities Safety Board, *Recommendation 95–2, Safety Management* (Washington, DC, October 11, 1995), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1995_02.html. The recommendation superseded Recommendations 90–2 and 92–5.
[600] Defense Nuclear Facilities Safety Board, Report to Congress on the Role of the Defense Nuclear Facilities Safety Board Regarding Regulation of DOE's Defense Nuclear Facilities (Washington, DC, November 1998), 10, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc_199811.html.
[601] U.S. Congress, House of Representatives, Committee on Commerce, Subcommittee on Energy and Power, *Legislation to Improve Safety and Security in the Department of Energy*, 106th Congress, 2d sess., March 22, 2000, 17, http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=106_house_hearings&docid=f:64031.pdf. Also, http://www.dnfsb.gov/pub_docs/dnfsb/ts_20000322_multi.pdf.

way to make safety planning an integral part of the planning and execution of work activities at all levels. DiNunno, who authored the technical report and was instrumental in the development of ISM, also described it as a means to circumvent the "stovepipes" that had developed historically to handle various aspects of safety in the weapons complex.[603] Instead of multiple, unintegrated programs—e.g., separate protective programs for the public, for workers, and for the environment—ISM represented an attempt to provide a single safety management program. Through ISM, a structured, comprehensive approach to performing work safely, the Board encouraged DOE to identify good practices developed for each of the sectors to be protected—the public, workers, and the environment—as well as the major types of hazards—nuclear and non-nuclear—and to effect these practices as an integrated system in which safety controls were incorporated in advance in every activity.[604]

The basic tenets of ISM, as stated in DOE's 1996 Implementation Plan and captured in DOE Policy 450.4, *Safety Management System Policy*, included five core safety management functions.[605] Often cited by Board members, these commonsense but crucial functions were to:

- define the scope of work,
- analyze the hazards,
- develop and implement hazard controls,
- perform work within controls, and
- provide feedback and continuous improvement.

ISM also institutionalized guiding management principles that constituted the basis for a safety-conscious and efficient organization, including:

- line management responsibility for safety,
- competence commensurate with responsibility, and
- identification of safety standards and requirements appropriate to the task at hand.

In a March 2000 congressional hearing, during which Board Chairman John T. Conway described progress in the implementation of ISM by contractors, he characterized features that would mark the system's implementation:

[602] Joseph J. DiNunno, *Integrated Safety Management*, DNFSB/TECH–16 (Washington, DC: Defense Nuclear Facilities Safety Board, June 1997), iii, http://www.dnfsb.gov/pub_docs/dnfsb/tr_199706.pdf.
[603] DiNunno, Integrated Safety Management, 3/15.
[604] Defense Nuclear Facilities Safety Board, *Strategic Plan: FY 2003–2009* (Washington, DC, November 17, 2003), 8, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rcsp_2003.pdf.

- site-wide nuclear safety requirements, mutually agreed upon by DOE and contractor(s) as applicable to the work performed,
- establishment by the contractors of manuals of practices reflecting the requirements established,
- safety planning as an integral part of work planning,
- safety and hazards analysis with safety measures tailored to the hazards of the operations involved,
- qualification and training of personnel commensurate with safety responsibilities assigned, and
- assessments and feedback for improvements performed.[606]

During the tenure of Secretary of Energy Hazel O'Leary, DOE committed to establishing the ISM system for an initial group of 10 operational defense nuclear facilities.[607] Her successor, Secretary Federico Peña, made the implementation of the concept a requirement for all of DOE's highly hazardous activities, nuclear and non-nuclear, in the complex.[608] In 1998 Secretary Bill Richardson voiced strong support for ISM, calling in 1999 for its implementation at every DOE facility in the DOE nuclear complex by September 2000.[609] The commitment to ISM was to be met at each site through the implementation of an Integrated Safety Management System, which would include functional area safety management programs such as radiation control, hazard analysis, configuration management, electrical safety, training, and others. The programs were typically to be set forth in the contractors' manuals of practice.

The Board closely tracked the field implementation of ISM, holding some 10 public meetings between 1997 and 2001 to address DOE's progress and to solicit the feedback that was crucial to continuous improvement in both safety and efficiency. In the March 2000 hearing, Conway offered his view of the Board's accomplishments in assisting DOE in its safety practices, pointing in the main to achievements related to the implementation of ISM.

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605 Interview, John E. Mansfield, Board vice chairman (since 2007; Board member, 1997–present), Washington, DC, August 25, 2008. See also Defense Nuclear Facilities Safety Board, *Ninth Annual Report to Congress* (Washington, DC, February 1999), 2-3, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.

606 House, Commerce Subcommittee on Energy and Power, Legislation to Improve Safety and Security in the Department of Energy, 18.

607 On Integrated Safety Management, see the U.S. Department of Energy, Office of Health, Safety and Security (HSS) Integrated Safety Management (ISM) Web Site: http://www.hss.energy.gov/healthsafety/ism/. DOE's Office of Health, Safety and Security was created in the summer of 2006.

608 DNFSB, *Ninth Annual Report to Congress*, 2-3. Peña, the eighth secretary of energy, who served from March 12, 1997 to June 30, 1998, also issued DOE Policy 450.6, *Secretarial Policy Statement: Environment, Safety and Health*.

609 Defense Nuclear Facilities Safety Board, *Tenth Annual Report* (Washington, DC, February 2000), 2-2, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.

> In our Tenth Annual Report to Congress issued in February 2000, the Board noted significant progress by the DOE in upgrading its safety management program and practices at defense nuclear facilities . . . . Using its action forcing powers, the Board has been able to help reorient DOE's safety program and to set it on a course that:
> - Places more reliance on standards that define good practices and less reliance upon expert-based safety management;
> - Makes work planning and safety planning an integrated process;
> - Treats public, worker, and environmental protection as an integrated process;
> - Treats radioactive and nonradioactive hazards in an integrated fashion in establishing controls; and
> - Tailors safety measures to the hazards involved.[610]

One concrete indicator of the progress made in implementing ISM was the number of authorization agreements executed between DOE and its contractors specifying the contractor's proposed means for conducting work safely. The Board introduced the concept of authorization agreements—similar to Nuclear Regulatory Commission (NRC) licenses for commercial nuclear facilities—in a technical report authored by DiNunno in 1995, *Fundamentals for Understanding Standards-Based Management of Department of Energy Defense Nuclear Facilities.*[611] Such agreements, as viewed by Board member John E. Mansfield, were designed to counter an old problem, namely, "while DOE had good standards, they were not written into contracts as contractually binding requirements." [612] Authorization agreements included the contractor's commitments, which were contractually binding, to conduct specified work activities in accordance with specific terms and conditions. The Board's *Ninth Annual Report to Congress* described the benefits of such agreements or sets of control measures, stating,

> Authorization agreements (similar to the licenses of commercial nuclear facilities) greatly facilitate the identification, implementation, and maintenance of safety controls needed to prevent an accidental release of radioactive materials in or from the work place, or mitigate the consequences of an accident if one should occur.[613]

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[610] House, Commerce Subcommittee on Energy and Power, Legislation to Improve Safety and Security in the Department of Energy, 27.
[611] Joseph J. DiNunno, "Fundamentals for Understanding Standards-Based Safety Management of DOE Defense Nuclear Facilities," DNFSB/TECH–5 (paper prepared for the Defense Nuclear Facilities Safety Board Public Meeting On Standards-Based Safety Management, Washington, DC, May 31, 1995), http://www.hss.doe.gov/deprep/archive/techrpts/bm95u13b.htm.
[612] Interview, Mansfield.
[613] DNFSB, Ninth Annual Report, 2–10.

By late 1999, as an outcome of ISM activity, more than 100 Authorization Agreements were in place in the weapons complex, serving as a substantive measure of successful ISM implementation.[614]

ISM implementation remained an ongoing focus of monitoring by the Board, which exerted additional pressure when it observed flagging efforts by DOE. In a typical intervention, the Board, for example, formally notified the DOE acting assistant secretary for environmental management in September 2004 of its concern that the "Integrated Safety Management (ISM) System for the Hanford tank farms [was] failing to control work activities adequately." The Board attributed several recent safety-related events at Hanford to a decrease in the effectiveness of the existing Hanford tank farm ISM System, observing,

> This concern has been engendered by a series of occurrences, incidents, near misses, and other operational events indicating serious weaknesses in work planning, conduct of operations, and responses to abnormal events or unexpected conditions. A prime example is the recent event where controls on worker exposure failed and a worker received an excessive and unexpected extremity exposure. . . . It would be an oversimplification to assign a single cause (e.g., accelerated cleanup) to these occurrences in light of their variety. However, the number of serious events at the tank farms is not to be expected at a project with a mature and effective ISM System . . . lasting success in implementing an effective ISM System at the tank farms has not been apparent.[615]

In response to the perception that ISM implementation was lagging in some places, the Board issued Recommendation 2004–1, *Oversight of Complex, High-Hazard Nuclear Operations*, whose thrust in part was to reinvigorate DOE's ISM implementation efforts.[616] Board member R. Bruce Matthews, DiNunno's successor, also authored a follow-on report to DiNunno's technical report on ISM, entitling the new report *Integrated Safety Management: The Foundation of a Successful Safety Culture*, DNFSB/TECH–36.[617] The Board remained convinced of ISM's

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[614] DNFSB, Tenth Annual Report, 2–8.
[615] Letter to Paul M. Golan, Acting Assistant Secretary for Environmental Management, U.S. Department of Energy, September 8, 2004, from John T. Conway, Chairman, DNFSB, http://www.dnfsb.gov/pub_docs/correspondence/hanford/cor_20040908_hd.pdf.
[616] Defense Nuclear Facilities Safety Board, *Fifteenth Annual Report to Congress* (Washington, DC, February 2005), 5-2, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/ar_2005.pdf.
[617] Matthews, a Ph.D. materials scientist joined the Board in 2003. He had 30 years of experience in nuclear technologies, specializing in special nuclear materials, weapons plutonium, and nuclear reactor fuels. He also had experience managing nuclear facilities, notably, at Los Alamos National Laboratory. See U.S Department of Energy, Office of Health, Safety, and Security, "R. Bruce Matthews: Biography," http://www.hss.doe.gov/deprep/dnfsb/members/matthew.htm.

importance, as was reaffirmed in 2009 by Board Chairman Dr. A. J. Eggenberger. At a congressional hearing, Eggenberger stated,

> Shortcomings in safety and efficiency in the operation of . . . defense nuclear facilities can almost always be related to a failure to apply Integrated Safety Management.[618]

REVISITING CONGRESS'S REGULATORY COMPROMISE: 1995–2000

As the Board devoted major energies to the oversight of ISM implementation, the Board effectively demonstrated its confidence that such implementation would go a long way to alleviating the persistent complex-wide safety deficiencies that the Board identified when it took stock of its effectiveness in its fifth-year self-assessment. However, the pace of change and the emergence of additional problems in the complex, especially with the cost and continual slippages in the cleanup program frustrated many executive-branch and legislative staff, prompting renewed calls for stronger external oversight of these programs. By the mid-1990s, the Board was compelled to address a variety of proposals that envisioned a very different means to remedy DOE's safety and environmental deficiencies, namely, external regulation of the DOE defense nuclear complex.

DOE's continuing problems—including its slow responses to Board recommendations—revived discussion in both the legislative and executive branches about the best approach to regulating the DOE nuclear weapons complex. Congress had anticipated that this question would be revisited when it formulated the regulatory compromise embodied in the Board's authorizing statute. As mentioned, this statute required the Board to provide its views on, among other things, whether its statutory powers were sufficiently robust, as part of its fifth annual report to Congress. Although the Board consistently affirmed its preference for the current recommendation process over more formal regulatory mechanisms, others took DOE's difficulties and dilatory responses to the Board as evidence supporting the need for legal and/or organizational changes to the oversight regime in the weapons complex. Specifically, a number of proposals were floated and studies conducted that were predicated on the idea that DOE

[618] U.S. Congress, House of Representatives, Committee on Appropriations, Subcommittee on Energy and Water Development, 111th Cong., 1st *sess, Nuclear Weapons Complex*, March 17, 2009, 3 (statement of Dr. A.J. Eggenberger, "Weapons Complex Nuclear Safety Issues"). http://appropriations.house.gov/Witness_testimony/EW/A_J_Eggenberger_03_17_09.pdf.

needed to be subject to stronger external regulation, whether by the Board with enhanced powers or some other federal entity.

Proposed Regulatory Alternatives

The first among various initiatives to put DOE under additional or stronger external regulation and even to abolish DOE was a legislative proposal floated during the 103rd Congress (1993–94), H.R. 3920, Federal Nuclear Facilities Licensing and Regulation Act.[619] The bill was introduced in February 1994 by Representative George Miller (D–CA), chairman of the House Committee on Natural Resources, and three co-sponsors. The bill called for NRC licensing for all *new* DOE nuclear weapons and research facilities.[620] In addition, the bill proposed a federal study commission of 13 members, including the chairs of both the Board and the NRC to determine the need on a case-by-case basis for independent, external regulation and licensing of existing DOE facilities.[621] In several hearings on the bill held in March 1994 by the House Natural Resources Subcommittee on Energy and Mineral Resources, Dr. John Ahearne, a former NRC chair, then at Duke University, argued that the NRC should regulate DOE defense nuclear facilities.[622] However, neither the NRC nor the Board voiced support for H.R. 3920. In the 1994 hearings, Conway, speaking for the Board, expressed skepticism about the potential effectiveness of a federal study commission, contributing to the bill's failure.[623] The Board was more harshly dismissive of the entire bill in retrospect.

> No companion bill was introduced in the Senate and no other Committee of the Congress including those that had substantive responsibility for DOE defense activities, e.g., Committees on Armed Services and Energy and Natural Resources, considered the bill sufficiently important for consideration. Similar to

[619] Glenn Russell George, Negotiated Safety: "Intragovernmental Risk Regulation in the U.S. Nuclear Weapons Complex" (Ph.D. diss., Harvard University, May 1995), 171 (accessed via Proquest). Overlapping with the first two years of the Clinton administration, the 103rd Congress ran from January 5, 1993, to January 3, 1995.
[620] Federal Nuclear Facilities Licensing and Resolution Act, H.R. 3920, 103d Cong. (1994), http://bulk.resource.org/gpo.gov/bills/103/h3920ih.txt.
[621] U.S. General Accounting Office, *Department of Energy: Clear Strategy on Externa1 Regulation Needed for Worker and Nuclear Facility Safety*, GAO/RCED–98–163 (Washington, DC, May 21, 1998), 5, http://www.gao.gov/archive/1998/rc98163.pdf.
[622] DNFSB, *Report to Congress on the Role of the Defense Nuclear Facilities Safety Board*, 3. See also U.S. Congress, House of Representatives, Committee on Natural Resources, Subcommittee on Energy and Mineral Resources, *Federal Nuclear Facilities Licensing and Regulation Act,* 103rd Cong., 2d sess., March 1 and 8, 1994, 226–51. See also Bert Chapman, "The Defense Nuclear Facilities Safety Board's First Decade," *Journal of Government Information* 27 (2000), 363–64, http://docs.lib.purdue.edu/lib research/70.
[623] House, Natural Resources Subcommittee on Energy and Mineral Resources, *Federal Nuclear Facilities Licensing and Regulation Act*, 237–39.

> thousands of other bills introduced in the Congress that are not acted upon, this bill was never voted on or even reported out of Committee or Subcommittee.[624]

The Board was later similarly critical of another draft bill, H.R. 3907, External Regulation of the Department of Energy Act, introduced in the 106th Congress on March 14, 2000, by Representative Thomas Bliley (R–VA) and several co-sponsors.[625] The bill would establish external regulation of DOE defense nuclear facilities by the NRC, abolishing the Board and making its staff available to the NRC, effective October 1, 2001.[626]

After the 1994 failure of H.R. 3920, considerations of changes to the regulatory arrangements for defense nuclear facilities moved for a time to the executive branch of government. In January 1995, Secretary of Energy O'Leary convened a committee to examine the pros and cons of subjecting DOE nuclear facilities to further federal regulation.[627] Called the Ahearne Committee after its chairman, John Ahearne, this committee issued a final report in December 1995 that advanced three major positions:

- Essentially all aspects of safety at DOE's nuclear facilities and sites should be externally regulated.
- Existing agencies rather than a new one should have this responsibility.
- Under any regulatory regime, DOE must maintain a strong internal safety management system.[628]

In stating the rationale for these positions, the Ahearne report put great emphasis on the potential for additional external regulation "to improve the public's confidence in the safety of DOE's operations" by enhancing "opportunities for effective involvement in the regulation of safety—as . . . with similar facilities in the private sector."[629] The report restated the arguments often heard at the time the Board was created about the incompatibility of DOE's continuing self-regulation and public confidence,

> The inherent conflict of interest between mission and self-regulation of safety at DOE, aggravated by a long legacy of secrecy, is at the root of many of the safety problems in the nuclear complex. External regulation would end that conflict . . . . Only independent, external regulation can ensure the stable regulatory framework

[624] DNFSB, *Report to Congress on the Role of the Defense Nuclear Facilities Safety Board*, 3.
[625] External Regulation of the Department of Energy Act, H.R. 3907, 106th Cong. (2000).
[626] House, Commerce Subcommittee on Energy and Power, Legislation to Improve Safety and Security in the Department of Energy, 1–2.
[627] DNFSB, *Report to Congress on the Role of the Defense Nuclear Facilities Safety Board*, 3.
[628] Advisory Committee on External Regulation of Department of Energy Nuclear Safety, *Improving Regulation of Safety at DOE Nuclear Facilities. Final Report* (Washington, DC, December 1, 1995), 1–2, http://www.osti.gov/bridge/servlets/purl/181136-25nT51/webviewable/181136.PDF.
[629] Advisory Committee on External Regulation, Improving Regulation of Safety at DOE Nuclear Facilities, 2–3.

> . . . that is required to ensure credibility. The Department has been unsuccessful in its attempts to achieve credibility under self-regulation . . . and . . . the credibility of its safety efforts remains low . . . . We believe that external regulation is essential to earning the public confidence the Department seeks and needs to free itself to carry out its important national missions.[630]

In stressing the need for external regulation to enhance public confidence, the report effectively found the Board wanting in its accomplishment of one of the major goals for its creation, namely, the goal of promoting sufficient openness about safety issues in the nuclear complex to restore public confidence. The report also disparaged the Board's lack of formal enforcement authority and limited size and budget. At the same time, the report recognized that the Board's strengths in scientific and technical personnel and in operational flexibility made it a candidate agency, along with NRC, to serve as an external regulator of DOE. The report was non-committal as to which agency, the Board or NRC, should become the regulator, noting that both as currently constituted had shortcomings for the role.

> Neither NRC nor the DNFSB was designed to carry out the kinds of responsibilities required of a regulator of facility safety at the DOE nuclear complex. Both would have to undergo significant changes . . . . We present two options for facility operator—NRC with a more flexible approach and incorporating the resources of the DNFSB, or a restructured and enlarged DNFSB.[631]

In addition to an expanded mission for the NRC or the Board, the report envisaged the Occupational Safety and Health Administration (OSHA) as also regulating DOE nuclear facilities, specifically in the area of worker safety.[632] The Environmental Protection Agency (EPA) would retain its role as the regulator of "environmental protection matters for all DOE nuclear facilities and sites under the environmental statutes," operating along lines comparable to those prevailing in commercial nuclear facilities.[633]

DOE under Secretary of Energy O'Leary initially endorsed the recommendations of the Ahearne Committee report, deciding in December 1996 that NRC should become the principal external regulator of nuclear safety at DOE facilities, with a phase-in period of 10 years.[634] During that period, the Board would continue oversight activities, gradually reducing the pace and scope of its oversight as the NRC became the external regulator. In 1997, after DOE

[630] Advisory Committee on External Regulation, Improving Regulation of Safety at DOE Nuclear Facilities, 2–3.
[631] Advisory Committee on External Regulation, Improving Regulation of Safety at DOE Nuclear Facilities, 77.
[632] GAO, Department of Energy: Clear Strategy on Externa1 Regulation Needed, 6. See also Chapman, 366.
[633] Advisory Committee on External Regulation, Improving Regulation of Safety at DOE Nuclear Facilities, 3.
[634] GAO, Department of Energy: Clear Strategy on Externa1 Regulation Needed, 2.

committed to seeking the necessary legislation for this regulation plan, NRC Chair Shirley Jackson endorsed the plan.[635] O'Leary's successor, Secretary Peña, chose to evaluate the feasibility of the plan through the creation of a joint, two-year DOE–NRC pilot project for simulated regulation, with the Lawrence Berkeley National Laboratory in California as the project's initial site and selected facilities at Savannah River and Oak Ridge as follow-on sites.[636]

These moves toward external regulation by the NRC met with a mixed response. The chair of the House Commerce Subcommittee on Energy and Power, Representative Daniel Schaefer (R–CO), gave the idea full-throated support in a May 20, 1998 hearing.

> If the Department knew that a regulator with full enforcement authority was watching over its shoulders, many DOE sites would be managed more efficiently and safely. Had such a watchdog been required for DOE sites from the beginning I think we could have avoided many of the massive environmental problems that the DOE complex faces today.[637]

In the same month, the General Accounting Office (GAO) weighed in on the external regulation initiative, criticizing the choice of pilot project sites on the grounds that they were not representative of the full spectrum of safety problems to be encountered in the DOE nuclear complex. The sites contained "no nuclear reactors, weapons plants, or heavily contaminated facilities"—the very kinds of facilities that best exemplified the troubling safety issues that triggered the renewed exploration of external regulation in the first place.[638] GAO's unenthusiastic assessment contributed to already waning momentum of executive branch proposals for additional external regulation of DOE.

In addition to proposals and protracted debates about an altered regulatory regime for DOE, the late 1990s saw the revival of Reagan-era debates about the very existence of DOE, which resulted in several legislative proposals to eliminate DOE altogether.[639] Such proposals, which would also have precipitated sharp change for the Board, emerged in Congress in 1995, after the congressional majority passed into Republican hands. These proposals called for

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[635] Interview, Kenneth M. Pusateri, Board, general manager (1989–2006), Washington, DC, January 3, 2008. Jackson's successor at the NRC was less enthusiastic.
[636] GAO, *Department of Energy: Clear Strategy on Externa1 Regulation Needed*, 8.
[637] U.S. Congress, House of Representatives, Committee on Commerce, Subcommittee on Energy and Power, *External Regulation of Department of Energy Nuclear Facilities,* 105th Cong., 2d sess., May 20, 1998, 1.
[638] GAO, Department of Energy: Clear Strategy on Externa1 Regulation Needed, 2.

transferring some programs of the dismantled DOE to other federal agencies, while privatizing other programs and putting them under the NRC.[640] One bill, the Department of Energy Abolition Act, S. 1678, was floated in 1996 by Senator Rod Grams (R–MN), and another with a similar thrust and title, H.R. 1577, was introduced in 1997 in the House of Representatives.[641] Under the unsuccessful bills, the functions of the Board were slated for transferal to the Department of Defense.

Defenses of the Regulatory Compromise that Created the Board

The various proposals for changes to the oversight and management arrangements in the DOE weapons complex were not supported by the Board, as Conway pointed out with a touch of wryness in a congressional hearing. In testimony about the latest, March 2000 legislative proposal to eliminate the Board in favor of NRC regulation (H.R. 3907), he likened the Board's situation as a small organization to that of the Marines, which was also often on the verge of being folded into a larger entity.

> My pleasure in being with you here this morning is somewhat tempered with the fact that one of the bills you propose to make into law would do away with the organization I represent. . . . .We, the members of the Board, have put together an elite group of technical experts. . . . I and our staff—I feel that we are somewhat like the Marine Corps. We have an elite group. Periodically there are discussions or recommendations to put the Marines into the Department of the Army, and for the last 4 or 5 years we have heard various suggestions of taking our staff and putting them into the NRC.[642]

At the same time that Conway critically assessed the various proposed regulatory and bureaucratic changes, he offered the view that there was no more legitimate or credible voice than the Board to speak to such changes.

> While many reports have been written about external regulation, pilots conducted at non-defense facilities, and opinions offered on this subject, I must emphasize that the Board is the only external, independent organization that has actually conducted full-time technical oversight of public and worker health and safety at

[639] Terrence R. Fehner and Jack M. Holl, *Department of Energy, 1977–1994: A Summary History* (Washington, DC: U.S. Department of Energy, November 1994), 31, 35–36, 51, http://www.osti.gov/bridge/servlets/purl/10106088-mgIkuD/webviewable/10106088.PDF.
[640] Interview, Pusateri.
[641] *Department of Energy Abolishment Act*, S. 1678, 104th Cong., (1996); and Department of Energy Abolishment Act, H.R. 1577, 105th Cong. (1997).
[642] House, Commerce Subcommittee on Energy and Power, Legislation to Improve Safety and Security in the Department of Energy, 25–26.

> DOE defense nuclear facilities. Consequently, the Board frequently has been called upon by both the legislative and executive branches to share its collective knowledge gained from 10 years of oversight experience in DOE's defense nuclear facilities.[643]

On one of the many occasions when the Board was asked to give its views on regulatory and oversight options, the Board provided them in the form of an extensive written report, as mandated by Congress in the National Defense Authorization Act for Fiscal Year 1998. Per the mandate, the Board provided to Congress in November 1998 its *Report to Congress on the Role of the Defense Nuclear Facilities Safety Board Regarding Regulation of DOE's Defense Nuclear Facilities*. As Conway summarized the report's findings, the Board "found no creditable arguments, either on the grounds of improved safety or cost effectiveness, to subject the defense nuclear facilities to additional external regulation." [644]

Whenever responding to queries about proposed regulatory changes, the Board always restated its fundamental support for the regulatory compromise that was struck in 1989 in the Board's enabling legislation. From the Board's point of view, much of the agitation for changes rested on fundamental misperceptions of the Board's actual powers, as well as of the actual state of regulation in DOE facilities. In the Board's view, the proposed legislative changes also misdiagnosed the sources of DOE's problems, and thus were likely to do more harm than good.

With respect to the state of regulation, Board members often pointed out that proposals for regulatory change, such as those in the Ahearne Committee report, were predicated on a dated view of the actual level or pervasiveness of regulation to which DOE facilities were subject. In the Board's view, the proponents of additional external regulation exaggerated the degree to which DOE still "self-regulated" the safety of its facilities. DiNunno, for example, who had represented the Board on the Ahearne committee but dissented from its conclusions, noted that DOE remained "self-regulating" only to a limited degree.[645] Historically, DOE had been granted autonomy to decide the trade-offs that had to be made between its paramount national security mission and its secondary mission, the mitigation of radiological risk to the public.[646]

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[643] House, Commerce Subcommittee on Energy and Power, Legislation to Improve Safety and Security in the Department of Energy, 28.
[644] House, Commerce Subcommittee on Energy and Power, Legislation to Improve Safety and Security in the Department of Energy, 28.
[645] Interview, Pusateri. See also, "Appendix 2: Statement by Joseph J. DiNunno Relative to the Report of the Advisory Committee on External Regulation," A2/1-2, in DNFSB, *Report to Congress on the Role of the Defense Nuclear Facilities Safety Board*.
[646] GAO, Department of Energy: Clear Strategy on Externa1 Regulation Needed, 3.

However, since the 1980s, the areas in which DOE retained the freedom to regulate itself had shrunk significantly. For risks less central to the national security mission than radiological risks—e.g., occupational safety hazards and the risk of environmental contamination, particularly from non-radioactive hazardous waste—DOE had come under increasing formal external regulation.[647] As DiNunno said,

> It is important to understand that the often expressed statement that DOE regulates itself is misleading. DOE self-regulates today only in a limited area of nuclear materials. Regulation of the hazardous and toxic materials, control of some releases of radioactivity to the environment and disposal of mixed and radioactive wastes are externally regulated . . . . DOE today is not free to operate in the way that historically caused the contamination of sites now requiring major cleanup and environmental restoration.[648]

Expanding on the same idea, Conway frequently pointed out that DOE nuclear facilities were subject to an array of safety-related laws and regulatory agencies. In the 1994 hearings on H.R. 3920, for example, he mentioned that DOE nuclear facilities were subject "to federal environmental laws administered by EPA, . . . to State environmental requirements . . . to Department of Transportation regulations on the transport of nuclear materials, to the Mine Safety and Health Administration for the Waste Isolation Pilot Plant (WIPP) facility, and to NRC licensing for certain nuclear waste facilities."[649] Moreover, as Conway said, in a certain sense DOE itself already functioned as an outside regulator vis à vis its contractors.

> One must keep in mind that the actual work carried out by the Government in its nuclear weapons activities is done by contractor employees, not by federal employees of the DOE. It is DOE's responsibility to assure that the work is done safely, efficiently and with full compliance with the environmental laws . . . . [F]or all intents and purposes . . . DOE "regulates" the individual contractors doing the work. DOE has the authority and power to force a site, a facility or particular job to be curtailed or be shut down. Do we need to add additional government employees of another government agency such as the NRC to assure that DOE government employees are properly enforcing government laws, safety rules and regulations on contractor management and workers? If so, at what additional cost?[650]

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[647] George, 56–57, 229.
[648] Joseph J. DiNunno, "External Regulation of DOE Nuclear Safety: A Different Point of View" (paper prepared for presentation to local section, American Nuclear Society, Washington, DC, February 27, 1996), http://www.dnfsb.gov/pub_docs/dnfsb/com_19960227.html.
[649] House, Natural Resources Subcommittee on Energy and Mineral Resources, *Federal Nuclear Facilities Licensing and Regulation Act*, 237–38.
[650] House, Commerce Subcommittee on Energy and Power, Legislation to Improve Safety and Security in the Department of Energy, 28.

Arguing that the pervasiveness of regulation in DOE nuclear facilities should not be underestimated, the Board also regularly argued that the Board's powers in conducting oversight likewise should not be underestimated. Advocates of external regulation typically understated the powers of the Board, repeating the notion that they were "merely advisory." However, the Board held that the authority inhering in the recommendation process and other Board powers was substantial.[651] The Board members asserted that the Board's authority, first described as "decision-forcing" by the U.S. Court of Appeals of the D.C. Circuit, was not only adequate to its oversight role, but better suited than more coercive or intrusive mechanisms would be. Eggenberger restated this position in the third year of Board operations, when he emphasized the value and appropriateness of the cooperative interaction with DOE that had developed for resolving complex technical problems.

> In many ways, I believe the recommendations that we make are stronger—stronger—than what one could do in a regulatory mode. This is because, number one, we are working directly with the Secretary of Energy [Watkins] and he is serious about safety. . . . He has cooperated with us completely in all endeavors. He has instructed his personnel to do so . . . .We have briefings with them. They brief us. They discuss issues that we ask them to discuss. We sometimes have a heated scientific discussion. But they have cooperated, and in my opinion, it is working well.[652]

Finding that the Board's manner of proceeding had demonstrated its efficacy, the Board members also retained their long-standing wariness of full formal regulation, fearing, as Conway put it, "the potentially litigious and confrontational processes that frequently characterize adjudicatory proceedings under regulatory regimes.[653] DiNunno seconded the point in arguing that the proposals of the Ahearne Committee "Taken as a whole . . . represent a regulatory model that will exacerbate DOE's problems, not solve them."[654] He added,

> The safety problems of DOE require technical solutions—stabilization of residual wastes, clean up of contaminated buildings and sites, safe dismantlement of nuclear weapons, and safe stewardship of strategic materials. The solution offered is a cumbersome, complex, legal structure with dramatically increased potential

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[651] House, Natural Resources Subcommittee on Energy and Mineral Resources, *Federal Nuclear Facilities Licensing and Regulation Act*, 240.

[652] Senate, Committee on Armed Services, Department of Defense Authorization for Appropriations for Fiscal Year 1993, 244.

[653] House, Commerce Subcommittee on Energy and Power, Legislation to Improve Safety and Security in the Department of Energy, 28.

[654] U.S. Congress, Senate, Committee on Armed Services, Department of Defense Authorization for Appropriations for Fiscal Year 1997 and the Future Years Defense Program, 104th Cong., 2d sess., March 6, 13, 20, 25, 29, 1996. 33.

> for litigious proceedings that could impede DOE's mission and add unneeded cost to the taxpayer.[655]

Apart from the potential drawbacks of a legalistic framework, the Board members failed to see how additional regulation would get to the root of DOE's problems, foremost among which, in their view, remained the technical personnel problem. The Board members continued to identify this problem as the most fundamental obstacle to expeditious safety improvement in the complex. They often reiterated the point that enhanced safety in DOE nuclear facilities depended far less on the powers of the Board or specific regulatory arrangements than on the cadre of technical personnel in DOE. They repeatedly underscored the need for a level of technical competence in DOE that would allow it to be "a demanding customer" of its contractors.[656] Such competence was necessary for both enhanced safety and public confidence.

Finding no certain benefits in reformed regulatory structures and some probable drawbacks, the Board members regularly played their trump card in the external regulation debate—the issue of comparative cost.[657] The Board argued that its oversight approach was demonstrably effective—producing safety improvements—at much lower cost than various proposed regulatory alternatives. Speaking about the Board's comparative cost effectiveness in a March 1997 hearing, Conway cited estimates that the NRC would require 1,100–1,600 additional staff and $150–$200 million annually to regulate DOE's facilities.[658] By contrast, the Board operated in the late 1990s at a cost of about $17 million per year.[659] Testifying in 2000, Conway said,

> We believe that in an era of shrinking dollars to perform DOE's major missions—weapons maintenance/ stewardship and cleanup—it would not be prudent to transfer safety-related responsibilities into a more costly regulatory structure for questionable fringe benefits.[660]

In arguing in these cost/benefit terms, the Board had the support of a crucial and steady ally in Congress, the Senate Armed Services Committee. Although some of the original

[655] Joseph J. DiNunno, "External Regulation of DOE Nuclear Safety: A Different Point of View."
[656] Interview, Pusateri.
[657] DNFSB, Report to Congress on the Role of the Defense Nuclear Facilities Safety Board, 9–14.
[658] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1997*, 31.
[659] The Board's initial start-up appropriation—for FY 1989—had been $7 million. Two decades later, with the growth of the Board and added oversight responsibilities, the Board's budgetary authorizations were in the range of $25 million annually.

membership on this committee responsible for creating the Board had changed since the late 1980s, the committee remained favorably disposed to the Board—the most favorably disposed among the committees with oversight responsibility for the Board.[661] Supporting the Board's cost/benefit arguments, the Senate Armed Services Committee always mentioned cost efficiency as one reason to continue current oversight arrangements. The committee also expressed wariness about the potential for external regulation to lead to undue interference with the defense mission of the nuclear weapons complex. In the committee's FY 1997 budget authorization report, for example, the committee criticized the Ahearne committee report, stating,

> [It] ignores the priorities and paramount objective of the Atomic Energy Act and . . . does not grasp the danger inherent in a weakened strategic deterrent. The committee has seen no compelling data or argument to . . . subject national security programs to a new, independent, external regulatory system. In addition, there appear to be two distinct disadvantages to external regulation . . .: (1) it could increase the potential effect of intervenors, lawyers, and the members of the judiciary, associated with the regulatory process, in imposing burdens that would have an adverse effect on the Department's defense and national security missions; and (2) it could dramatically increase operating costs. Since the creation of the Defense Nuclear Facilities Safety Board (DNFSB) in 1988, the board has gained the bipartisan support and confidence of the committee. The committee is satisfied with the current relationship between the board and the Secretary of Energy.[662]

The same committee's budget authorization report for FY 1999 was similarly negative about external regulation and positive about the Board.

> The committee is not convinced that external regulation of new or existing DOE defense nuclear facilities will increase safety, decrease cost, or improve operational efficiency at such facilities . . . . The committee is concerned that the implementation of an additional external regulation approach could draw scarce resources away from high priority, compliance driven clean-up actions and critical national security activities, with little added benefit.[663]

The report added the Board "continues to provide exceptional and effective external oversight with a budget that equals about one-tenth of one percent of total Atomic Energy Defense funding." [664]

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[660] House, Commerce Subcommittee on Energy and Power, Legislation to Improve Safety and Security in the Department of Energy, 29.
[661] Interview, Pusateri.
[662] S. Rep. No. 104–267 [to accompany S. 1745], at n.p. (1996), http://www.congress.gov/cgi-bin/cpquery/?&sid=cp104xbGcm&refer=&r_n=sr267.104&db_id=104&item=&sel=TOC_797070&.
[663] S. Rep. No. 105–189, at 431 (1998).
[664] S. Rep. No. 105–189, at 431 (1998).

By 2000, in view of the strong votes of confidence for the Board from the Senate Armed Services Committee and steadfast support from other key players, the advocates of external regulation and privatization backed off from efforts to advance additional external regulation regimes upon DOE. In turn, assured of the indefinite extension of its statutory mandate, the Board was able to devote its full attention to its oversight of the DOE nuclear weapons complex.[665]

THE BOARD'S OPERATIONS: GROWTH, REFINEMENT, FORMALIZATION

During and after the period in which regulatory alternatives were under discussion, the Board itself saw some changes, some having to do with its methods of operation and some with its personnel.

Personnel: Stability at the Top, Expertise Throughout

In the realm of personnel, the Board was and remained a rather stable operation, characterized by low turnover in both Board membership and the three categories of staff—technical, legal, and administrative. Three of the Board's five inaugural members, Conway, Eggenberger, and Kouts, were reconfirmed and remained with the Board a decade after its establishment. The first new member of the Board, Joseph J. DiNunno, served for a decade prior to his retirement in June 2002.[666] John Mansfield, the second new member, appointed in 1997, remained on the Board in 2009. Only two of the later appointees were no longer on the Board in 2009, Jessie Hill Roberson and R. Bruce Matthews. Roberson, who was appointed on

[665] Interview, Pusateri. As Congress backed off from proposals to change arrangements for external oversight in the weapons complex, an organizational change in DOE did go forward, reflecting the perception of continuing management and security weaknesses in DOE. In 1999 Congress altered the organization of DOE by establishing the National Nuclear Security Administration (NNSA) as a separately organized, semi-autonomous agency within DOE. See U.S. Department of Energy, National Nuclear Safety Administration Web site, http://www.nnsa.energy.gov/about/index.htm. NNSA was charged with the management and operation of the nation's nuclear weapons, nonproliferation, and naval reactors programs. In relation to nuclear weapons, DOE's NNSA was charged with managing the facilities and activities that implemented the Stockpile Stewardship Program, including surveillance, maintenance, refurbishment, production, and dismantlement of nuclear weapons, as well as research and development and certification efforts. The facilities for which the NNSA was responsible included the three nuclear weapons laboratories, the Nevada Test Site, and four weapons handling plants—the Pantex Plant in Texas, the Y–12 National Security Complex in Tennessee, the Kansas City Plant in Missouri, and elements of the Savannah River Site in South Carolina.

[666] See U.S Department of Energy, Office of Health, Safety, and Security, "Biography: Mr. Joseph John DiNunno," http://www.hss.doe.gov/deprep/dnfsb/members/jjdinn.htm.

January 16, 2000, was subsequently appointed to be the DOE assistant secretary for environmental management.[667] The Board members serving in the Board's twentieth year had seen tenures ranging from two decades for Eggenberger, more than one decade for Mansfield, roughly a half-decade for Joseph F. Bader, and three years for Larry W. Brown and Peter S. Winokur, as noted in Table 1.

Table 1. Defense Nuclear Facilities Safety Board Membership, 1989–2009

John T. Conway (Former Chairman) 10/18/89–04/02/05	**A.J. Eggenberger** (Former Chairman) 10/18/89–07/31/09 Vice Chairman until July 2005.	**Herbert J.C. Kouts** 10/18/89– 01/14/00	**John W. Crawford Jr.** 10/18/89–11/22/96	**Edson G. Case** 10/18/89–09/16/91
Peter S. Winokur 10/23/06–present		**Jessie Hill Roberson** 01/16/00– 07/18/01	**John E. Mansfield** 10/31/97–present Vice Chairman since 2007.	**Joseph J. DiNunno** 08/13/92–06/01/02
		Joseph F. Bader 11/30/04–present	--	**R. Bruce Matthews** 04/22/03–12/31/05
			--	**Larry W. Brown** 09/29/06–present

The new Board members were all "respected experts in the field of nuclear safety," like the original members and as required by the Board's enabling statute. DiNunno had served for nearly two decades in the Navy Department, including under Rickover in the Naval Reactors Program, after which he spent 13 years with the Atomic Energy Commission (AEC), eventually heading the agency's first Office of Environmental Affairs. He also had extensive experience in private industry in a variety of nuclear safety and environmental roles.[668] Mansfield, a Ph.D. physicist and the Board's vice chairman since 2007, had a broad background of federal service in both the executive and legislative branches, as well private-sector experience.[669] He served on the staffs of the House and Senate Armed Services Committees and held senior positions at the Defense Intelligence Agency, the Defense Nuclear Agency, and the Defense Advanced Research Projects Agency (DARPA). He had expertise in risk assessement, operations analysis, nuclear

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[667] See U.S Department of Energy, Office of Health, Safety, and Security, "Biography: Jessie Hill Roberson," http://www.hss.doe.gov/deprep/dnfsb/members/roberson.htm.
[668] See U.S Department of Energy, Office of Health, Safety, and Security, "Biography: Mr. Joseph John DiNunno," http://www.hss.doe.gov/deprep/dnfsb/members/jjdinn.htm.
[669] Defense Nuclear Facilities Safety Board, *Eighth Annual Report* (Washington, DC, February 1998), 1–11, and Appendix B, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.

weapons technology, defense policy analysis, and the management of technology support to national defense programs. Roberson, a specialist in systems engineering, had extensive private-sector experience in reactor operations.[670] She served for a decade with DOE in technical and managerial positions at the Rocky Flats Environmental Technology Site and Savannah River, where her focus included environmental cleanup, waste management, safeguards, and security, as well as nuclear reactors and weapons. Matthews, a Ph.D. in materials science, had 30 years of scientific and engineering experience in nuclear technologies with a primary focus on nuclear materials for nuclear weapons and reactors.[671] As Division Director at Los Alamos National Laboratory, Matthews managed nuclear facilities with responsibility for DOE programs, operations, construction, safety and security. Bader, an expert in mechanical and nuclear engineering, had extensive knowledge of design, construction management, and operations of R&D facilities, materials production, and power plants. He held executive and senior management positions in the nuclear weapons complex and nuclear power sectors, and conducted numerous program/project reviews. Larry W. Brown served in the U.S. Navy for more than 30 years, including as commander of two non-nuclear navy destroyers.[672] After practicing law on leaving the navy, he served at DOE as a senior policy adviser on nuclear, spent fuel, and nonproliferation/security issues. Peter S. Winokur, a Ph.D. physicist, with 37 years of scientific and engineering experience, specialized in radiation effects science, technology, and hardiness assurance in support of military and space systems.[673] One of the most highy cited researchers in engineering, he served as a senior policy analyst for the National Nuclear Security Administration, a unit of DOE established in 2000, served as a senior staffer in Congress on energy issues, and held senior postions at Sandia National Laboratory.

The consistently exceptional technical and management qualifications that the Board members brought, combined with their low turnover, contributed to strong and continuous management at the Board. The continuity of management was reinforced by the nature of the Board members' appointments. Appointed for fixed five-year terms, the Board members were

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[670] See U.S Department of Energy, Office of Health, Safety, and Security, "Jessie Hill Roberson: Biography," http://www.hss.doe.gov/deprep/dnfsb/members/roberson.htm.
[671] See U.S Department of Energy, Office of Health, Safety, and Security, "R. Bruce Matthews: Biography," http://www.hss.doe.gov/deprep/dnfsb/members/matthew.htm.
[672] See U.S Department of Energy, Office of Health, Safety, and Security, "Larry Warren Brown, Captain, United States Navy (ret.): Biography," http://www.hss.doe.gov/deprep/dnfsb/members/brown.htm.
[673] See U.S Department of Energy, Office of Health, Safety, and Security, "Peter S. Winokur, Ph.D.: Biography," http://www.hss.doe.gov/deprep/dnfsb/members/winokur.htm.

statutorily able to "serve after the expiration of that member's term until a successor has taken office."[674] The Board's continuity of management contributed to its ability to conduct oversight with a consistent but flexible plan of action.

Among the Board's management achievements was the creation of an exceptionally qualified staff through the pursuit of a focused human capital development program. The total number of employees, for budgetary reasons, fell short of the Board's full statutory authorization of 150 full-time employees, hovering instead at a strength of about 100 staff members. Thanks to the Board's excepted service hiring and compensation authorities, and "years of careful recruiting and selection," these staff members included about 60 technical experts of "the highest caliber."[675] This cadre of scientists and engineers served both in the field at various DOE sites and in the Washington, DC, office.[676] As Board reports to Congress noted, "Essentially all of the technical staff have technical masters degrees, and approximately 28 percent have doctoral degrees," and they commonly had practical experience in the U.S. Navy's Naval Nuclear Propulsion Program, the nuclear weapons field, and/or the commercial nuclear power industry.[677] The technical staffers brought, as the Board stated,

> [E]xtensive backgrounds in technical disciplines such as nuclear-chemical processing, conduct of operations, general nuclear safety analysis, conventional and nuclear explosive technology and safety, nuclear weapons safety, storage of nuclear materials and nuclear criticality safety, and waste management.[678]

They augmented their qualifications, at Board urging, through the serious pursuit of professional development activities. To attract younger staff members, the Board also had a three-year Professional Development Program designed to bring "entry-level technical and scientific talent into professional positions within the Board." The Board said of the program,

> Through a technical mentor, individuals are provided a series of individually tailored developmental assignments, formal academic schooling, and a 1-year hands-on field assignment.[679]

A.J. Eggenberger, Board chairman as of 2005, described the intern program's intent,

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[674] *Atomic Energy Act of 1954* (42 USC 2011 et seq.), Section 311(d)(3).
[675] DNFSB, *Strategic Plan: FY 2003–2009*, 12–13.
[676] The Board has established site offices at the Hanford Site, Lawrence Livermore National Laboratory, the Pantex Plant, the Y–12 National Security Complex, the Savannah River Site, and the Los Alamos National Laboratory.
[677] DNFSB, *Strategic Plan: FY 2003–2009*, 12–13; DNFSB, *Ninth Annual Report to Congress*, February 1999, 5-1.
[678] DNFSB, *Strategic Plan: FY 2003–2009*, 12–13.
[679] DNFSB, *Strategic Plan: FY 2003–2009*, 13.

> [T]his is the investment the Board makes in developing our young engineers. It acts as an incentive for attracting young technical talent and it sustains the technical excellence of our staff.[680]

To maximize the effectiveness of its carefully selected staff members, the Board used a matrix form of organization to group them, which allowed the Board "to quickly reassign technical resources as needed to review emerging health and safety issues."[681] The Board organized its technical staff by strategic oversight areas of concentration, creating interdependent technical groups, "staffed with technical specialists having both the education and work experience commensurate with the designated oversight assignments." This organization fostered constant information sharing across areas of concentration, giving the Board the needed flexibility to respond to changes in DOE's priority concerns, plans, and schedules by redeploying staff resources within and among focus areas. The Board explained the premium it placed on flexibility, stating,

> The pace and focus of the Board's health and safety oversight work are controlled, in large part, by DOE's schedule for major actions in the defense nuclear complex. Thus, changes in DOE's schedules and priorities based on circumstances within and beyond DOE's control may require a corresponding change in the Board's oversight plans.[682]

Formalization of Board Activities

The explicit definition of the Board's primary areas of concentration and the corresponding organizational alignment of its staff were a formalization of the Board's division of work driven by the Government Performance and Results (GPRA) Act of 1993. The act required each federal agency to develop a five-year strategic plan that articulated its mission and goals, as well as proposed methods for achieving its goals. As required by the act, the Board issued its first Strategic Plan in 1997, along with its first annual performance plan, also required.[683] The Strategic Plan outlined general goals and objectives that addressed multi-year

[680] A. J. Eggenberger, "Technical Excellence," Presentation, at the DOE Nuclear Executive Leadership Training, September 22, 2005, https://www.hss.energy.gov/deprep/2005/FB05S22A.HTM.
[681] DNFSB, *Strategic Plan: FY 2003–2009*, 12.
[682] DNFSB, *Strategic Plan: FY 2003–2009*, 19. Because the work of the Board depended on the priorities of DOE and, more broadly, on U.S. policy on the nuclear deterrent, the Board, in formulating its strategic plans, stated several assumptions on which the plans were predicated, namely, that the United States would maintain its 1991 halt of new nuclear weapons production, and the 1992 halt of nuclear testing.
[683] Defense Nuclear Facilities Safety Board, *Strategic Plan: FY 1997–2002* (Washington, DC, 1997), http://www.hss.doe.gov/deprep/1997/bm97s30b.htm.

efforts and encompassed "a broad spectrum of technical areas relevant to the safety of DOE's defense nuclear mission."[684] The Board used its Strategic Plan to establish a framework for facilitating management decisions. In the plan, the Board recast and grouped the wide array of technical areas in which it was already performing safety oversight into strategic areas of concentration. For each strategic area, the Board's planning efforts yielded an associated set of annual performance objectives, action plans, and measurements that could "demonstrate progress toward achieving the Board's strategic goals."[685]

The first of the Board's Strategic Plans, issued "after consultation with the Office of Management and Budget, Congressional staff members, and the public," described the nature of the Board's work within three strategic areas of concentration.[686] These three focus areas, as stated in the Board's *Strategic Plan for FY 1997–2002*, were:

I. Complex-Wide Health and Safety Issues

II. Management and Stewardship of the Nation's Stockpile and Nuclear Weapons Components

III. Hazardous Remnants of Weapons Production.[687]

In the first strategic area, the Board planned for continuing oversight on, among other things, DOE's implementation of Integrated Safety Management, the development and implementation of standards, requirements, and safety programs, the competence of technical personnel, and the review of DOE design and construction projects. In the second strategic area, the Board planned for continuing efforts to support the safe execution of DOE's work in the nuclear weapons stockpile, as well as associated research and development activities. In the third area, the Board planned to continue its intensive involvement in monitoring waste characterization, stabilization, and storage operations, and in urging DOE to accelerate the disposition of inventories of hazardous nuclear materials and the decommissioning of surplus facilities. As the Board pursued its safety activities, closely tying them to the goals and objectives embodied in its plans, it reported its accomplishments and associated problems extensively in its annual reports and other communications with Congress. At the same time, based on the lessons learned in its planning initiatives, the Board refined its planning efforts, seeking "a streamlined approach that allows the

[684] DNFSB, *Strategic Plan: FY 2003–2009*, 18.
[685] Transmittal letter to Jacob J. Lew, Director, Office of Management and Budget, from John T. Conway, October 30, 2000, for *Fiscal Year 2002 Performance Plan, October 2000.*
[686] Transmittal letter to Lew, from Conway, October 30, 2000.

Board to use its resources effectively," and to adapt and move resources to meet new oversight demands.[688]

As of 2003, in the *Strategic Plan for Fiscal Year 2003–2008*, the Board focused its technical nuclear safety oversight on four interdependent, strategic areas of concentration, adding one area, "Nuclear Facilities Design and Infrastructure," to the three originally set forth in the Board's 1997 strategic plan. As reformulated in the plan, the areas were:

- Nuclear Weapons Operations;
- Nuclear Material Processing and Stabilization;
- Nuclear Facilities Design and Infrastructure;
- Nuclear Safety Programs and Analysis.[689]

In effect, the Board elevated one of the objectives previously encompassed under the strategic area of "Complex-Wide Issues" to a new, fourth strategic area, "Nuclear Facilities Design and Infrastructure."[690] This creation of a new strategic area raised the profile of the Board's review of DOE's design and construction of new defense nuclear facilities and major modifications to existing facilities. The Board's legislative mandate had always included the review of DOE's design and construction projects. Although the Board was not empowered to stop facility construction, it was charged with determining that nuclear safety aspects of the design were adequate to protect health and safety. From the beginning of operations in 1989, the Board had worked with DOE to carry out this mandate, reviewing numerous DOE design and construction projects. However, the elevation of these oversight activities to a strategic focus reflected a major increase in work for the Board in the area of design/construction reviews, beginning in the early 2000s.[691]

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[687] DNFSB, *Strategic Plan: FY 1997–2002*, 8.
[688] Interview, Pusateri. See also Transmittal letter to Lew, from Conway, October 30, 2000.
[689] DNFSB, *Strategic Plan: FY 2003–2009*.
[690] Beginning with the *Fourteenth Annual Report*, February 2004, the Board used the fourth category in its organization of its annual reports to Congress.
[691] DNFSB, *Strategic Plan: FY 1997–2002*, 7. Decisions about future weapons and the construction or upgrade of facilities to produce them were pertinent to the safety-related activities of the Board. For a time during the administration of George W. Bush, significant contingents in both the legislative and executive branches backed proposals to build a new generation of nuclear weapons, most notably the Reliable Replacement Warhead (RRW), and to revamp a consolidated nuclear weapons infrastructure to produce them. For proponents, this renovation was a better approach to ensuring the reliability of the smaller U.S. nuclear deterrent than investing in high-cost life extensions for aging weapons. In 2006 NNSA produced a multi-year plan to build new or upgraded facilities at each of its eight nuclear weapons-related sites—*Complex 2030: A Preferred Infrastructure Planning Scenario for the Nuclear Weapons Complex*. After 2007, Congress deleted all funds for the Reliable Replacement Warhead. See Michael Coleman, "Wilson: Pearce Was 'Stupid' To Introduce Bill," *Albuquerque Journal*, May 25, 2008 (accessed via Proquest).

BOARD OVERSIGHT IN THE AREA OF DESIGN AND CONSTRUCTION

The Board's inclusion of the category "Nuclear Facilities Design and Infrastructure "in its list of strategic areas of concentration was associated with a substantial increase in Board resources devoted to the area. Although the Board's oversight work in the other strategic areas continued undiminished, design and construction reviews in the early 2000s constituted an area of marked growth for the Board.[692] The increased workload associated with design/construction oversight reflected in part the fact that detailed design and construction reviews were extremely resource- and labor-intensive and time-consuming. At the same time, such reviews were considered vital to ensuring that safety was built into facility design, given the extreme expense of construction-stage retrofits in building projects. Another reason for the growth in this category of work for the Board was the growth in the number and scale of DOE's design and construction projects. Numerous projects to support the ongoing mission of the DOE nuclear complex and cleanup of sites were in various stages of development in 2001, reflecting the need for new capability to process legacy special nuclear materials, and the need to replace aging facilities required to maintain the nuclear weapons stockpile.

Writing in 2002, the Board said of this expanding DOE design and construction, "In recent years, there has been an increase in the number of new DOE projects, with 20 to 30 projects in the design and construction phase," requiring Board reviews.[693] Some examples of the projects involving Board oversight at the time included,

- the Tritium Extraction Facility, then under construction at the Savannah River Site, to process irradiated targets;
- the Hanford Waste Treatment Plant, four major nuclear facilities in the design and construction phase, to pre-treat and vitrify the high-level waste from the Hanford waste storage tanks;
- the Highly Enriched Uranium Materials Facility, in the design phase at the Y–12 National Security Complex, to provide long term consolidated storage for all highly enriched uranium materials at the site;

[692] A. J. Eggenberger, "Regulatory Challenges and Plans for the Year Ahead" (presentation to Energy Facility Contractors Group, Washington, DC, March 19–20, 2008), http://www.dnfsb.gov/pub_docs/testimonies/all/sp_20080320.pdf.
[693] DNFSB, *Strategic Plan: FY 2003–2009*, 8.

- the Pit Disassembly and Conversion Facility, in the design stage at the Savannah River Site, to convert surplus weapons grade plutonium metal into oxide for subsequent feed to the Mixed Oxide (MOX) Fuel Fabrication Facility.[694]

Other significant projects involving substantial Board oversight in the course of the 2000s included,

- the Salt Waste Processing Facility, in the design phase at Savannah River Site, to remove cesium, strontium, and actinides from high-level waste for vitrification in glass logs;
- the Chemistry and Metallurgy Research Replacement Project, in the design phase at the Los Alamos National Laboratory, to replace the current aging and deteriorating facility with a modern facility;
- the Uranium Processing Facility, in the design phase at Y–12 National Security Complex, to replace aging facilities and consolidate current capability to process uranium materials at the site;
- the New Solid Transuranic Waste Facility, in the design stage at Los Alamos, to store, characterize, repackage, and ship solid transuranic waste.[695]

Estimates of the total cost of the projects in which the Board became involved in the 2000s were more than $20 billion.[696] This involvement in design/construction reviews placed heavy demands on the technical oversight resources of the Board, in particular, as the Board stated in a budget request, "resources in specialty skill areas such as seismic engineering of structures, geotechnical reviews, concrete chemistry, systems engineering, and hazard analysis."[697]

As the Board stepped up its design/construction oversight, it stated a number of the operative assumptions with which it approached the activity, including the premise that "These facilities must be designed and constructed in a manner that will support safe and efficient operations for 20 to 50 years." Such a facility life span, as the Board noted,

> in turn requires a robust design process to ensure that appropriate health and safety controls are identified and properly implemented early in the process. ISM provides the framework for this process.[698]

[694] DNFSB, *Strategic Plan: FY 2003–2009*, 8.
[695] House, Appropriations Subcommittee on Energy and Water Development, *Nuclear Weapons Complex*, statement by Eggenberger, March 17, 2009, 4.
[696] Defense Nuclear Facilities Safety Board, *FY 2009 Budget Request to the Congress* (Washington, DC, February 2008), http://www.dnfsb.gov/about/budget.php.
[697] Defense Nuclear Facilities Safety Board, *FY 2008 Budget Request to the Congress* (Washington, DC, February 5, 2007), 1, http://www.dnfsb.gov/about/budget.php.
[698] DNFSB, *Thirteenth Annual Report to Congress*, February 2003.

> The Board's expectation is that the design and construction phases will identify the set of risks for each project and demonstrate clear and deliberate implementation of ISM principles and core functions.[699]

Major Board Efforts in the Design Review Area

In the Board's increased oversight of design/construction activities, the most prominent example involved the four-facility Waste Treatment and Immobilization Plant (WTP) at the Hanford Site, the largest ongoing environmental cleanup project in the world, projected to cost in excess of $12 billion.[700] The WTP, managed by the DOE unit, the Office of River Protection, is a huge vitrification complex that would receive and process the 53 million gallons of high-level nuclear waste from the Hanford tank farm.[701] Construction of the complex began in July 2002 and was slated to take some 15 years.[702]

The Board began to dedicate substantial technical resources to the project in late 2001, with oversight of the plant's design, including reviews of earthquake design documentation for the structure.[703] Beginning in mid-2002 and for the next two years, the Board repeatedly raised concerns to DOE regarding the seismic safety of the plant's design. The Board questioned the site data and seismic ground motion criteria used to design the WTP facility foundations,

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[699] Defense Nuclear Facilities Safety Board, *FY 2010 Budget Request to the Congress* (Washington, DC, May 2009), http://www.dnfsb.gov/aboaut/budget.php.
[700] Interview, Dr. A. J. Eggenberger, July 9, 2008. For non-DOE, non-DNFSB background on Hanford's Waste Treatment Plant, see Michele Stenehjem Gerber, *On the Home Front: The Cold War Legacy of the Hanford Nuclear Site* (Lincoln: University of Nebraska Press, 1992), 253–58.
[701] Oregon, Department of Energy, Nuclear Safety Division, *Hanford Cleanup: The First 15 Years* (Salem, OR, October 2004), http://www.oregon.gov/ENERGY/NUCSAF/docs/15year.pdf. As this report stated on page 120, in July 2002, "Construction of Hanford's high-level waste vitrification facilities began, as structural concrete [was] poured as part of the 5-foot thick, steel-reinforced foundations and basement walls for one of two waste processing buildings. The project will require 58,000 tons of steel, 160 miles of piping and 1,260 miles of electrical cable. Two cement processing plants have been installed to produce the concrete that will be needed over the next five years."
[702] Interview, Eggenberger. Between 2003 and 2006 the project made progress in the cleanup of the Hanford tank wastes. The transfer of the radioactive wastes from the single-shelled tanks to the double-shelled storage tanks was finally completed. This waste awaited processing into glass in the Hanford Waste Treatment Plant.
[703] U.S. Congress, House of Representatives, Committee on Appropriations, Subcommittee on Energy and Water Development, *Energy and Water Development Appropriations for 2007*, 109th Cong., 2d sess., April 6, 2006 (testimony of Dr. A. J. Eggenberger), http://www.dnfsb.gov/pub_docs/hanford/ts_20060406_hd.pdf. Planning for vitrification facilities for the Hanford wastes began in the early 1990s, and went through several major shifts of direction. In 1995 DOE began a program to privatize the processing of high-level radioactive waste at Hanford, forming a unit to establish design requirements for the plant. Then called the Tank Waste Remediation System (TWRS), the plant was to be DOE contractor-owned and contractor-operated with licensing by the NRC. In 2000 the contractor declined to continue the TWRS program due to financial issues. DOE took over the project and abandoned the privatization approach for TWRS in favor of a more traditional government-owned, contractor-operated approach.

pointing out that they were insufficiently conservative and produced underestimates of seismic loads. As Eggenberger testified about the Board's review of seismic issues,

> The review was based on our technical people looking at the assumptions and calculations that had been previously made and the geology and seismology that we know now about the Pacific northwest area and . . . the faulting in that particular area. Based on that a set of questions were asked that could and can influence the seismic design basis. Those were asked, and these meetings were not sessions between our staff and DOE staff that lasted for an hour or so. They would last for days, and they would talk about these in extreme detail.[704]

In addition, the Board cautioned DOE that the aggressive, "fast-track" construction schedule, in which construction proceeded before the design was finalized, posed a serious risk that safety deficiencies in the design could require costly reengineering later. To avert this potential need for retrofits to ensure seismic safety, the Board advised DOE to adopt conservative design margins. By 2005, after considerable discussion between DOE and the Board, they continued to differ on seismic risk analyses and design criteria. With questions about seismic safety unresolved, DOE was compelled to suspend construction work on portions of the waste-processing facilities in March 2005, in order to double the seismic design standard.[705] Eventually, DOE developed revised estimates of ground motion, which the Board judged to be an adequately conservative basis to validate the existing design and construction of the plant. After further delay caused by congressional funding reductions through 2006, the construction stoppage affecting the pretreatment and the high-level waste facilities ended.

As the Board sought resolution of ground motion and seismic design issues in the structures of the WTP project, it also reviewed numerous other safety-related aspects of WTP's design and construction: electrical system design, instrumentation and control, ventilation systems, process safety, fire protection, hydrogen control, concrete quality, and standards issues. In connection with the hydrogen hazards and their possible impact on pipes, for example, the Board questioned the hydrogen generation rate estimates used to design hydrogen mitigation systems to prevent hydrogen-related accidents.[706] The Board's concerns prompted the contractor, Bechtel National, Inc. (BNI), to conduct studies and to revise its design basis generation rate

[704] House Appropriations Subcommittee on Energy and Water Development, *Energy and Water Development Appropriations for 2007*.
[705] Gerber, 255.
[706] Letter to Dr. Ines R. Triay, Acting Assistant Secretary for Environmental Management, U.S. Department of Energy, from A. J. Eggenberger, Chairman, January 8, 2009, http://www.hss.energy.gov/deprep/2009/FB09J08A.DOC

equation and its final estimate of the quantity of hydrogen that would be generated during WTP operations. The Board, always vigilant about the imperative to protect against fire, also challenged some of DOE's decisions regarding the application of fire-resistant coatings to structural steel, in response to which DOE also eventually modified aspects of its fireproofing project.[707] After the resolution of these and other concerns, the Board continued its monitoring of technical design/construction issues at the site, through the Board's resident site representatives, through regular discussions with DOE, and through site visits, e.g., a visit in January 2007 during which BNI and DOE's Office of River Protection briefed the three visiting Board members and Board staff.

Besides oversight activities at Hanford's WTP, another major Board effort in the review of facility design concerned the Chemistry and Metallurgy Research Replacement (CMRR) Project, Los Alamos National Laboratory (LANL).[708] This new facility, still in the design stage, was slated to replace the capability for operations then carried out in the five-decade-old Chemistry and Metallurgy Research facility to be closed in 2010. The Board viewed this replacement plan as a much-needed step—a prime case of the need to end reliance on unsound facilities. In the Board's view, the old "building's seismic fragility posed a continuing risk to the public and workers."[709] With respect to the planned replacement facility, the Board underscored the need to establish conservative design criteria for several of the project's safety-related systems, most notably, the ventilation and fire protection/suppression systems, as well as nuclear material container design. Under the Board's Recommendation 2004–2, *Active Confinement Systems*, the Board directed DOE's National Nuclear Security Administration to evaluate the ventilation system's design for the replacement facility to determine the adequacy of the project's strategy for confining hazardous materials.[710] However, the evaluation was delayed,

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[707] On January 29, 2008, the Board issued Recommendation 2008–1, *Safety Classification of Fire Protection Systems* (Washington, DC, January 2008), http://www.dnfsb.gov/pub_docs/recommendatoins/all/rec_2008_01.pdf. This Recommendation called for standards for the design and operation of fire protection systems, a primary means of protection from radiological hazards at DOE's defense nuclear facilities.

[708] Defense Nuclear Facilities Safety Board, *FY 2008 Performance and Accountability Report* (Washington, DC, November 15, 2008), http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rcpr_2008.pdf.

[709] House Appropriations Subcommittee on Energy and Water Development, *Nuclear Weapons Complex,* statement by Eggenberger, March 17, 2009.

[710] Defense Nuclear Facilities Safety Board, *Recommendation 2004–2, Active Confinement Systems* (Washington, DC, December 7, 2004), http://www.dnfsb/pub_docs/recommendations/all/rec_2004_02.pdf. See also Defense Nuclear Facilities Safety Board, *Confinement of Radioactive Materials at Defense Nuclear Facilities,* DNFSB/TECH–34 (Washington, DC, October 2004), http://www.dnfsb.gov/pub_docs/technical_reports/all/tr_200410.pdf.

putting the project at risk for the late discovery of safety design deficiencies. In 2005, the Board identified weaknesses with the project's confinement strategy and deficiencies in the identification of safety-related controls. The Board expressed general concern in a February 2007 report on the project's safety basis documents. In late 2008, Congress intervened in the situation, enacting a limitation on funding for the project pending actions by the Board and NNSA. The Board and NNSA were each required to submit certifications to the congressional defense committees that the design concerns raised by the Board had been resolved. The issues whose resolution required certification included the design of the facility's safety class systems, including confinement system design, and seismic safety.[711]

The Push for Earlier Incorporation of Nuclear Safety in Design

In the course of performing its safety design reviews, the Board became a driver of improvements in DOE's processes for incorporating safety into the design of facilities. The Board's experiences with two major projects in particular—Hanford's Waste Treatment Plant and Los Alamos's Chemistry and Metallurgy Research Replacement project—brought forcefully home that the late identification of safety-related design flaws was a recurring DOE problem.[712] As the Board stated in its FY 2008 budget request,

> The Board has recognized during the past several years that DOE has not been conservatively designing safety into new defense nuclear facilities early in project life.[713]

Lessons learned from these two high-priority projects and others highlighted the negative consequences of delays in the resolution of safety concerns. Such delays produced overruns in total project costs and schedule slippages while corrections were made. Recognizing the cost and schedule risks of delayed issue resolution, the Board emphasized the need for early attention to identifying safety issues on both its part and that of DOE. As Eggenberger said in 2009,

> For the past several years, the Board has driven an initiative to ensure that DOE and NNSA design project teams focus on early recognition and rapid resolution of safety issues . . . .

[711] House Appropriations Subcommittee on Energy and Water Development, *Nuclear Weapons Complex,* statement by Eggenberger, March 17, 2009, 4. The limit on funding was stipulated in Section 3112 of the National Defense Authorization Act for Fiscal Year 2009, Pub. L. No. 110–417.
[712] Defense Nuclear Facilities Safety Board, *Eighteenth Annual Report to Congress* (Washington, DC, February 2008), 4-2, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.
[713]DNFSB, *FY 2008 Budget Request to the Congress*, 53.

> Performing thorough reviews of safety issues earlier in the design process allows issues to be resolved efficiently and in a timely manner, and minimizes adverse impacts to project cost and schedule. This approach is essential to the success of major design and construction projects. . . .
>
> The importance of this initiative . . . cannot be overstated. This approach is the best way to avoid costly late resolution of major design issues or surprises late in the development of a new facility.[714]

Aiming to shift the identification of major hazards and safety-related design requirements to earlier in the design process, the Board and DOE began evaluating elements of DOE's design and construction process to identify actions that could ensure the expeditious resolution of safety concerns and the early incorporation of appropriate safety features into design.

Public Meetings and New Guidance on Integrating Safety into Design

The joint improvement efforts of the Board and DOE began in late 2005, when the Board held the first of a series of public meeting to explore DOE's policy direction on safety-in-design, and to delve into the DOE design process. At the initial public meeting, held on December 7, 2005, the deputy secretary of energy "acknowledged that safety was not being integrated consistently into the early stages of the design of new defense nuclear facilities," and committed to addressing the Board's fundamental concerns with that earlier integration.[715] Public hearings held in July 2006 and March 2007 on incorporating safety-in-design addressed early identification of issues, communication of Board issues to DOE, issue management, and early resolution and closure of design-related safety issues. Assessing the hearings' usefulness, the Board said,

> These public hearings have aided the Board in measuring the success of DOE's actions regarding their safety-in-design initiative and allowed examination of how DOE develops safety-related design requirements for its new projects. The Board plans to observe DOE's implementation of its safety-in-design initiative and revised directives.[716]

Through the public meetings, the Board provided impetus for DOE's new Integration Safety-in-Design initiative. This new guidance included the revision of the existing DOE Order

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[714] House Appropriations Subcommittee on Energy and Water Development, *Nuclear Weapons Complex*, statement by Eggenberger, March 17, 2009, 4–5.
[715] Eggenberger, "Regulatory Challenges and Plans for the Year Ahead," 5. See also DNFSB, *FY 2008 Budget Request to the Congress*, 6–8.

for project management requirements for new design and construction, and commitments to revise the associated DOE Manual.[717] These revisions mandated the integration of safety into the design of new defense nuclear facilities at the earliest stages of project management.[718] The Board was also actively involved in the development of a new DOE standard, issued in March 2008, DOE–STD–1189, *Integration of Safety into the Design Process*. To demonstrate the application of the concepts in the revised Order 413.3A and the new standard, the Board and DOE selected two ongoing design and construction projects—the Uranium Processing Facility project and the Integrated Waste Treatment Unit project at the Idaho National Laboratory. The Board also collected information in a public hearing regarding the implementation of the revised order and the new standard.[719]

Congressional Action on Safety in Design

In addition to Board actions to drive DOE initiatives on the earlier integration of safety in design, Congress took action in late 2006, giving further impetus to these ongoing improvement efforts. As Eggenberger stated in 2008, the cost overruns and chronic schedule slippages in WTP led some in Congress to perceive "that slow resolution of safety-related issues was the primary cause," and that the Board's influence was not being heeded in DOE.[720] Troubled by the failure of DOE to act in a timely manner on technical issues raised by the Board, Congress proposed "that the Board and the Department would benefit from a more structured process for issue resolution that would allow issues to be raised, evaluated, and adjudicated at logical points in the design and construction process."[721] Lawmakers also required the Board to provide several kinds

[716] DNFSB, *Eighteenth Annual Report to Congress*, 4-2.
[717] DOE Order 413.3, *Program and Project Management for the Acquisition of Capital Assets*. That order, now DOE Order 413.3A, was the DOE directive on project management requirements for new design and construction projects. The revision of DOE Order 413.3 was augmented by the related revisions of the associated DOE Manual 413.3-1, *Project Management for the Acquisition of Capital Assets*.
[718] Defense Nuclear Facilities Safety Board, *Quarterly Report to Congress*, February 15, 2007, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc_20070215_qr.pdf.
[719] DNFSB, *Eighteenth Annual Report to Congress*, 4-2.
[720] Eggenberger, personal communication. See also Eggenberger, "Regulatory Challenges and Plans for the Year Ahead," 5.
[721] H.R. Rep. No. 109–702, at 976 (2006) (Conf.Rep.). See also Defense Nuclear Facilities Safety Board, *Seventeenth Annual Report to Congress* (Washington, DC, February 2007), 45, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php. Issued on September 29, 2006 and approved by both houses of Congress, House Conference Report 109–702 on the National Defense Authorization Act for Fiscal Year 2007 (H.R. 5122), Section 3201, indicated the concern of lawmakers regarding the resolution of technical issues raised by the Board, and called for reports to Congress.

of reports to Congress. Congress instructed DOE and the Board to report jointly to the congressional defense committees "on their efforts to improve the timeliness of issue resolution, including recommendations, if any, for legislation that would strengthen and improve technical oversight of DOE's nuclear design and operational activities."[722] Pending the submission of this jointly prepared DOE–Board report, Congress directed the Board to submit quarterly reports on the "status of significant unresolved technical differences between the Board and the Department of Energy (DOE) on issues concerning the design and construction of defense nuclear facilities," and whether or not they were getting resolved.[723] On July 19, 2007, the Board and DOE issued their joint report detailing many of the actions undertaken to accelerate identification and resolution of safety issues. This report also described "more effective processes or protocols for the communication to DOE of issues identified by the Board and for the tracking and management of these issues," and stated "The Board and DOE are working together to accomplish these objectives."[724]

After the Board had discharged this reporting obligation to Congress with the issuance of seven reports, the Board indicated that it would continue the practice in the interest of continued improvement in design/construction oversight, as Eggenberger noted in 2009.

> While the direction no longer requires the Board to continue providing quarterly reports, we believe these reports serve as an appropriate mechanism to keep all parties informed of the Board's concerns with new designs for DOE defense nuclear facilities. The Board has also been encouraged by the feedback received from the Congressional committees and intends to continue providing these reports to Congress and DOE.[725]

The energy with which the Board sought continued improvement in the design/construction process reflected an overarching concern on the part of the Board about a basic threat to safety. Articulated in 2009 by Eggenberger, this was the threat of continuing reliance in the DOE nuclear weapons complex on aging and unsound facilities, many from the Manhattan Project era. Schedule slippages in replacement projects were a concern for the Board, not just because they increased costs, but also because they necessitated further use of "facilities

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722 H.R. Rep. No. 109–702, at 976 (2006).
723 Transmittal letter forwarding DNFSB, *Eighteenth Annual Report to Congress*.
724 Transmittal letter forwarding DNFSB, *Eighteenth Annual Report to Congress*.
725 U.S. Congress, House of Representatives, Committee on Appropriations, *Nuclear Weapons Complex*, statement by Eggenberger, March 17, 2009, 5.

no longer suitable for prolonged use." As Eggenberger said, speaking of DOE's National Nuclear Security Administration facilities,

> NNSA continues to rely on aging facilities to carry out hazardous production missions in support of the nation's nuclear deterrent while planned replacement facilities suffer extended design and construction delays.

He acknowledged DOE/NNSA's "interim actions to improve the safety posture in the existing facilities," for example, "consolidating operations in the Chemistry and Metallurgy Research building into wings of the structure that do not lie directly above a seismic fault." However, he added,

> [T]hese are stop-gap measures. These facilities are structurally unsound, are unsuitable for use any longer than absolutely necessary, and will have to be shut down, perhaps before the replacement facilities are ready.
>
> Unfortunately, planned replacement facilities have been delayed beyond original projections and face continued scrutiny regarding cost, scope, and programmatic need. NNSA must continue to drive safety improvements at the existing facilities while, in parallel, building replacement facilities quickly or finding alternative, safer means of accomplishing mission related work.[726]

DOE/NNSA's "challenging task of operating aging facilities at a high tempo while designing, constructing, and making the transition to modern replacement facilities" ensured that the Board would continue to face growing challenges and expend increased efforts in the performance of its task of safety oversight of DOE/NNSA's activities.

THE BOARD GOING FORWARD

The Board's shift in recent years to greater emphasis on design/construction reviews, and its emphasis within that area of concentration on improving the processes for the early incorporation of safety in design serve as one example of the many adjustments made by the Board in its oversight operations in response to DOE's evolving mission and programs in the nuclear weapons complex. The Board always focused its oversight resources on the greatest potential sources of risk and the most pressing hazards in the complex, and it was adept at accommodating itself, as a small agency with a flexible management structure, to the shifts in DOE plans and priorities. As the mission of the complex changed in the early 1990s from the

[726] House, Appropriations Subcommittee on Energy and Water Development, *Nuclear Weapons Complex*, March 17, 2009.

production of nuclear weapons and materials to the maintenance of the nuclear deterrent and cleanup operations, the oversight demands on the Board also shifted, while simultaneously expanding. Oversight demands on the Board grew over the two decades of its existence, both because of the expansion by law of the Board's jurisdiction to include weapons responsibilities, and because of DOE's stepped-up activities requiring oversight. In its first decade of operations, the Board saw pressing and expanded responsibilities in the area of the stabilization and storage of nuclear materials, as well as in the area of maintaining the nuclear stockpile. The second decade brought further increases in oversight demands as the Board reviewed more DOE design and construction projects and new programs.

As the Board successfully met the challenges of increased oversight demands, Congress reaffirmed its view of the Board as an effective and cost-effective mechanism to accomplish vital safety oversight. Key congressional oversight committees expressed with satisfaction that the Board had more than met the expectations with which it was established in 1988, improving the state of nuclear safety at modest cost and, at the same time, promoting the appropriate balance between the national security mission of the nuclear weapons complex and safety. Acknowledging the "Board's unique capabilities," Congress placed ever-greater reliance on the Board. As the Board noted in its FY 2010 budget request, "The Board's Congressional oversight and appropriations committees . . . have called upon the Board to apply its health and safety expertise at higher and higher levels." The Board added,

> The committees have continued to demand that the Board increase both the scope and pace of its independent health and safety oversight reviews at all DOE defense nuclear facilities, with special attention on new facilities in various design and construction stages, while continuing to ensure that storage facilities are properly and competently maintained.[727]

In drawing up its FY 2010 budget request, the Board did not foresee that the augmentation of its oversight responsibilities would slacken. Indeed, the workload was projected to continue growing with expanding DOE design and construction, particularly the planned ramp-up of activities at Hanford. In addition, projections of the remediation activities involving nuclear wastes and residues called for continuing oversight of nuclear materials handling, including improved packaging to protect workers, storage, and long-term disposition for decades

[727] DNFSB, *FY 2010 Budget Request to the Congress*, 1.

to come.[728] Even under the most optimistic scenarios, the remediation of the Hanford tank wastes alone would continue until well beyond the middle of the 21st century.[729] The maintenance of the existing stockpile of nuclear weapons also would continue for the foreseeable future, calling for scrupulous safety oversight of the potentially hazardous operations of both weapons "life-extension" and weapons dismantlement. In addition, the Board's long-standing concern with standards would come to the fore again in connection with DOE's plans in the upcoming years to conduct a directive-by-directive review and revision of key nuclear safety directives. As Eggenberger stated in a June 2009 letter, the Board planned to maintain "an intense level of oversight over the revision of the directives system and the vitality of the directives being revised to ensure that the margin of safety embodied in DOE's directives is maintained or increased."[730] Finally, on themes the Board had struck from the earliest days of its operations, it planned to continue urging DOE to maintain strong, central authorities for internal safety oversight, and to develop an aggressive, proactive staffing plan.

[728] See Defense Nuclear Facilities Safety Board, *Recommendation 2005–1, Nuclear Material Packaging* (Washington, DC, March 10, 2005), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_2005_01.pdf.

[729] U.S. Department of Energy, Office of Environmental Management, *1996 Baseline Environmental Management Report: Executive Summary* (Washington, DC, July 1996), http://www.em.doe.gov/bemr/pages/bemr96.aspx. According to this 1996 study,

> The expected end dates for the five highest-cost sites are as follows: Hanford Site (2070), Idaho National Engineering Laboratory (2045), Oak Ridge Reservation (2070), Rocky Flats Environmental Technology Site (2055), and Savannah River Site (2050). Surveillance and monitoring activities will continue beyond these dates. All sites will be complete by 2070.

[730] Letter from Chairman Eggenberger to the Under Secretary of Energy, the Honorable Kristina Johnson, re: "Views of the Defense Nuclear Facilities Safety Board on the State of Nuclear Safety at the Department of Energy's Defense Nuclear Facilities," June 10, 2009, http://www.dnfsb.gov/pub_docs/correspondence/all/cor_20090610.pdf.

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The range of information available on the Defense Nuclear Facilities Safety Board Web site (http://www.dnfsb.gov/) is broad and includes, but is not limited to, Annual and Special Reports to Congress (1991–Present), Correspondence (2000–Present), Public Hearings (2003–Present), Strategic Plans and Performance Reports to Congress (1999–Present), Weekly Site Representative Reports (1996–Present), and all Recommendations. The Web site also provides a biweekly listing of all public documents received from the Department of Energy as part of the Board's oversight responsibility. Those documents are made available to the public through procedures detailed on the Web site. Other useful Web sites include the U.S. Department of Energy, Office of Health, Safety, and Security (HSS), Integrated Safety Management (ISM) (http://www.hss.energy.gov/healthsafety/ism/), Office of Environmental Management (http://www.em.doe.gov/), and the U.S. Nuclear Regulatory Commission (http://www.nrc.gov/).

APPENDIX 1: Board Enabling Legislation

ENABLING STATUTE OF THE DEFENSE NUCLEAR FACILITIES SAFETY BOARD 42 U.S.C. § 2286 et seq.

NATIONAL DEFENSE AUTHORIZATION ACT, FISCAL YEAR 1989
(Pub. L. No. 100-456, September 29, 1988),

AS AMENDED BY NATIONAL DEFENSE AUTHORIZATION ACT, FISCAL YEAR 1991
(Pub. L. No. 101-510, November 5, 1990),
NATIONAL DEFENSE AUTHORIZATION ACT FISCAL YEARS 1992 AND 1993
(Pub. L. No. 102-190, December 5, 1991),
ENERGY POLICY ACT OF 1992
(Pub. L. No. 102-486, October 24, 1992),
NATIONAL DEFENSE AUTHORIZATION ACT FISCAL YEAR 1994
(Pub. L. No. 103-160, November 30, 1993),
FEDERAL REPORTS ELIMINATION ACT OF 1998
(Pub. L. No. 105-362, November 10, 1998),
NATIONAL DEFENSE AUTHORIZATION ACT FISCAL YEAR 2001
(Pub. L. No. 106-398, October 30, 2000), AND
NATIONAL DEFENSE AUTHORIZATION ACT FISCAL YEAR 2003
(Pub. L. No. 107-314, December 2, 2002)
NATIONAL DEFENSE AUTHORIZATION ACT FISCAL YEAR 2004
(Pub. L. No. 108-136, November 7, 2003)
NATIONAL DEFENSE AUTHORIZATION ACT FISCAL YEAR 2009
(Pub. L. No. 110-417, October 14, 2008)

As of 10/14/2008

TITLE 42. THE PUBLIC HEALTH AND WELFARE
CHAPTER 23. DEVELOPMENT AND CONTROL OF ATOMIC ENERGY
SUBCHAPTER XVII.A.
DEFENSE NUCLEAR FACILITIES SAFETY BOARD
42 U.S.C. § 2286

§ 2286. Establishment of Defense Nuclear Facilities Safety Board [Atomic Energy Act, Sec. 311]

(a) Establishment.

There is hereby established an independent establishment in the executive branch, to be known as the Defense Nuclear Facilities Safety Board" (hereafter in this subchapter referred to as the "Board").

(b) Membership.

(1) The Board shall be composed of five members appointed from civilian life by the President, by and with the advice and consent of the Senate, from among United States citizens who are respected experts in the field of nuclear safety with a demonstrated competence and knowledge relevant to the independent investigative and oversight functions of the Board. Not more than three members of the Board shall be of the same political party.

(2) Any vacancy in the membership of the Board shall be filled in the same manner in which the original appointment was made.

(3) No member of the Board may be an employee of, or have any significant financial relationship with, the Department of Energy or any contractor of the Department of Energy.

(4) Not later than 180 days after September 29, 1988, the President shall submit to the Senate nominations for appointment to the Board. In the event that the President is unable to submit the nominations within such 180-day period, the President shall submit to the Committees on Armed Services and on Appropriations of the Senate and to the Speaker of the House of Representatives a report describing the reasons for such inability and a plan for submitting the nominations within the next 90 days. If the President is unable to submit the nominations within that 90-day period, the President shall again submit to such committees and the Speaker such a report and plan. The President shall continue to submit to such committees and the Speaker such a report and plan every 90 days until the nominations are submitted.

(c) Chairman and Vice Chairman.

(1) The President shall designate a Chairman and Vice Chairman of the Board from among members of the Board.

(2) The Chairman shall be the chief executive officer of the Board and, subject to such policies as the Board may establish, shall exercise the functions of the Board with respect to—

(A) the appointment and supervision of employees of the Board;

(B) the organization of any administrative units established by the Board; and

(C) the use and expenditure of funds.

(3) The Chairman may delegate any of the functions under this paragraph to any other member or to any appropriate officer of the Board.

(4) The Vice Chairman shall act as Chairman in the event of the absence or incapacity of the Chairman or in case of a vacancy in the office of Chairman.

(d) Terms.

(1) Except as provided under paragraph (2), the members of the Board shall serve for terms of five years. Members of the Board may be reappointed.

(2) Of the members first appointed—

(A) one shall be appointed for a term of one year;

(B) one shall be appointed for a term of two years;

(C) one shall be appointed for a term of three years;

(D) one shall be appointed for a term of four years; and

(E) one shall be appointed for a term of five years, as designated by the President at the time of appointment.

(3) Any member appointed to fill a vacancy occurring before the expiration of the term of office for which such member's predecessor was appointed shall be appointed only for the remainder of such term. A member may serve after the expiration of that member's term until a successor has taken office.

(e) Quorum.

Three members of the Board shall constitute a quorum, but a lesser number may hold hearings.

§ 2286a. Functions of the Board. [Atomic Energy Act, Sec. 312]

(a) In general.

The Board shall perform the following functions:

(1) Review and evaluation of standards.

The Board shall review and evaluate the content and implementation of the standards relating to the design, construction, operation, and decommissioning of defense nuclear facilities of the Department of Energy (including all applicable Department of Energy orders, regulations, and requirements) at each Department of Energy defense nuclear facility. The Board shall recommend to the Secretary of Energy those specific measures that should be adopted to ensure that public health and safety are adequately protected. The Board shall include in its recommendations necessary changes in the content and implementation of such standards, as well as matters on which additional data or additional research is needed.

(2) Investigations.

(A) The Board shall investigate any event or practice at a Department of Energy defense nuclear facility which the Board determines has adversely affected, or may adversely affect, public health and safety.

(B) The purpose of any Board investigation under subparagraph (A) shall be—

(i) to determine whether the Secretary of Energy is adequately implementing the standards described in paragraph (1) of the Department of Energy (including all applicable Department of Energy orders, regulations, and requirements) at the facility;

(ii) to ascertain information concerning the circumstances of such event or practice and its implications for such standards;

(iii) to determine whether such event or practice is related to other events or practices at other Department of Energy defense nuclear facilities; and

(iv) to provide to the Secretary of Energy such recommendations for changes in such standards or the implementation of such standards (including Department of Energy orders, regulations, and requirements) and such recommendations relating to data or research needs as may be prudent or necessary.

(3) Analysis of design and operational data.

The Board shall have access to and may systematically analyze design and operational data, including safety analysis reports, from any Department of Energy defense nuclear facility.

(4) Review of facility design and construction.

The Board shall review the design of a new Department of Energy defense nuclear facility before construction of such facility begins and shall recommend to the Secretary, within a reasonable time, such modifications of the design as the Board considers necessary to ensure adequate protection of public health and safety. During the construction of any such facility, the Board shall periodically review and monitor the construction and shall submit to the Secretary, within a reasonable time, such recommendations relating to the construction of that facility as the Board considers necessary to ensure adequate protection of public health and safety. An action of the Board, or a failure to act, under this paragraph may not delay or prevent the Secretary of Energy from carrying out the construction of such a facility.

(5) Recommendations.

The Board shall make such recommendations to the Secretary of Energy with respect to Department of Energy defense nuclear facilities, including operations of such facilities, standards, and research needs, as the Board determines are necessary to ensure adequate protection of public health and safety. In making its recommendations, the Board shall consider the technical and economic feasibility of implementing the recommended measures.

(b) Excluded functions.[731]

The functions of the Board under this subchapter do not include functions relating to the safety of atomic weapons. However, the Board shall have access to any information on atomic weapons that is within the Department of Energy and is necessary to carry out the functions of the Board.

§ 2286b. Powers of Board. [Atomic Energy Act, Sec. 313]

(a) Hearings.

(1) The Board or a member authorized by the Board may, for the purpose of carrying out this subchapter, hold such hearings and sit and act at such times and places, and require, by subpoena or otherwise, the attendance and testimony of such witnesses and the production of such evidence as the Board or an authorized member may find advisable.

(2)(A) Subpoenas may be issued only under the signature of the Chairman or any member of the Board designated by him and shall be served by any person designated by the Chairman, any member, or any person as otherwise provided by law. The attendance of witnesses and the production of evidence may be required from any place in the United States at any designated place of hearing in the United States.

(B) Any member of the Board may administer oaths or affirmations to witnesses appearing before the Board.

(C) If a person issued a subpoena under paragraph (1) refuses to obey such subpoena or is guilty of contumacy, any court of the United States within the judicial district within which the hearing is conducted or within the judicial district within which such person is found or resides or transacts business may (upon application by the Board)

[731] Added by § 3202 (b)(2)(B) of the National Defense Authorization Act for Fiscal Years 1992 and 1993 (Pub. L. 102-190).

order such person to appear before the Board to produce evidence or to give testimony relating to the matter under investigation. Any failure to obey such order of the court may be punished by such court as a contempt of the court.

(D) The subpoenas of the Board shall be served in the manner provided for subpoenas issued by a United States district court under the Federal Rules of Civil Procedure for the United States district courts.

(E) All process of any court to which application may be made under this section may be served in the judicial district in which the person required to be served resides or may be found.

(b) Staff.

(1) The Board may, for the purpose of performing its responsibilities under this subchapter—

(A) hire such staff as it considers necessary to perform the functions of the Board, including such scientific and technical personnel as the Board may determine necessary, but not more than the equivalent of 150[732] full-time employees; and

(B) procure the temporary and intermittent services of experts and consultants to the extent authorized by section 3109(b) of title 5 [United States Code] at rates the Board determines to be reasonable.

(2) The authority and requirements provided in section 2201(d) of this title [§ 161 d. of the Atomic Energy Act] with respect to officers and employees of the Commission shall apply with respect to scientific and technical personnel hired under paragraph (1)(A).[733]

(c) Regulations.

The Board may prescribe regulations to carry out the responsibilities of the Board under this subchapter.

(d) Reporting requirements.

The Board may establish reporting requirements for the Secretary of Energy which shall be binding upon the Secretary. The information which the Board may require the Secretary of Energy to report under this subsection may include any information designated as classified information, or any information designated as safeguards information and protected from disclosure under section 2167 or 2168 of this title [§ 147 or 148 of the Atomic Energy Act].

[732] Amended by § 3202 (a)(1) of the National Defense Authorization Act of 1992 and 1993 (Pub. L. 102-190).

[733] Added by the National Defense Authorization Act of 1991 (Pub. L. 101-510).

(e) Use of Government facilities, etc.

The Board may, for the purpose of carrying out its responsibilities under this subchapter, use any facility, contractor, or employee of any other department or agency of the Federal Government with the consent of and under appropriate support arrangements with the head of such department or agency and, in the case of a contractor, with the consent of the contractor.

(f) Assistance from certain agencies of the Federal Government.

With the consent of and under appropriate support arrangements with the Nuclear Regulatory Commission, the Board may obtain the advice and recommendations of the staff of the Commission on matters relating to the Board's responsibilities and may obtain the advice and recommendations of the Advisory Committee on Reactor Safeguards on such matters.

(g) Assistance from organizations outside the Federal Government.

Notwithstanding any other provision of law relating to the use of competitive procedures, the Board may enter into an agreement with the National Research Council of the National Academy of Sciences or any other appropriate group or organization of experts outside the Federal Government chosen by the Board to assist the Board in carrying out its responsibilities under this subchapter.

(h) Resident inspectors.

The Board may assign staff to be stationed at any Department of Energy defense nuclear facility to carry out the functions of the Board.

(i) Special studies.

The Board may conduct special studies pertaining to adequate protection of public health and safety at any Department of Energy defense nuclear facility.

(j) Evaluation of information.

The Board may evaluate information received from the scientific and industrial communities, and from the interested public, with respect to—

(1) events or practices at any Department of Energy defense nuclear facility; or

(2) suggestions for specific measures to improve the content of standards described in section 2286a(1) of this title [§ 312(1) of the Atomic Energy Act], the implementation of such standards, or research relating to such standards at Department of Energy defense nuclear facilities.

§ 2286c. Responsibilities of the Secretary of Energy. [Atomic Energy Act, Sec. 314]

(a) Cooperation.

The Secretary of Energy shall fully cooperate with the Board and provide the Board with ready access to such facilities, personnel, and information as the Board considers necessary to carry out its responsibilities under this subchapter. Each contractor operating a Department of Energy defense nuclear facility under a contract awarded by the Secretary shall, to the extent provided in such contract or otherwise with the contractor's consent, fully cooperate with the Board and provide the Board with ready access to such facilities, personnel, and information of the contractor as the Board considers necessary to carry out its responsibilities under this subchapter.

(b) Access to information.

The Secretary of Energy may deny access to information provided to the Board to any person who—

(1) has not been granted an appropriate security clearance or access authorization by the Secretary of Energy; or

(2) does not need such access in connection with the duties of such person.

§ 2286d. Board Recommendations. [Atomic Energy Act, Sec. 315]

(a) Public availability and comment.

Subject to subsections (g) and (h) and after receipt by the Secretary of Energy of any recommendations from the Board under section 2286a of this title [§ 312 of the Atomic Energy Act], the Board promptly shall make such recommendations available to the public in the Department of Energy's regional public reading rooms and shall publish in the Federal Register such recommendations and a request for the submission to the Board of public comments on such recommendations. Interested persons shall have 30 days after the date of the publication of such notice in which to submit comments, data, views, or arguments to the Board concerning the recommendations.

(b) Response by Secretary.

(1) The Secretary of Energy shall transmit to the Board, in writing, a statement on whether the Secretary accepts or rejects, in whole or in part, the recommendations submitted to him by the Board under section 2286a of this title [§ 312 of the Atomic Energy Act], a description of the actions to be taken in response to the recommendations, and his views on such recommendations. The Secretary of Energy shall transmit his response to the Board within 45 days after the date of the publication, under subsection (a), of the notice with respect to such recommendations or within such additional period, not to exceed 45 days, as the Board may grant.

(2) At the same time as the Secretary of Energy transmits his response to the Board under paragraph (1), the Secretary, subject to subsection (h), shall publish such response, together with a request for public comment on his response, in the Federal Register.

(3) Interested persons shall have 30 days after the date of the publication of the Secretary of Energy's response in which to submit comments, data, views, or arguments to the Board concerning the Secretary's response.

(4) The Board may hold hearings for the purpose of obtaining public comments on its recommendations and the Secretary of Energy's response.

(c) Provision of information to Secretary.

The Board shall furnish the Secretary of Energy with copies of all comments, data, views, and arguments submitted to it under subsection (a) or (b) of this section.

(d) Final decision.

If the Secretary of Energy, in a response under subsection (b)(1), rejects (in whole or part) any recommendation made by the Board under section 2286a of this title [§ 312 of the Atomic Energy Act], the Board shall either reaffirm its original recommendation or make a revised recommendation and shall notify the Secretary of its action. Within 30 days after receiving the notice of the Board's action under this subsection, the Secretary shall consider the Board's action and make a final decision on whether to implement all or part of the Board's recommendations. Subject to subsection (h), the Secretary shall publish the final decision and the reasoning for such decision in the Federal Register and shall transmit to the Committees on Armed Services and on Appropriations of the Senate and to the Speaker of the House of Representatives a written report containing that decision and reasoning.

(e) Implementation plan.

The Secretary of Energy shall prepare a plan for the implementation of each Board recommendation, or part of a recommendation, that is accepted by the Secretary in his final decision. The Secretary shall transmit the implementation plan to the Board within 90 days after the date of the publication of the Secretary's final decision on such recommendation in the Federal Register. The Secretary may have an additional 45 days to transmit the plan if the Secretary submits to the Board and to the Committees on Armed Services and on Appropriations of the Senate and to the Speaker of the House of Representatives a notification setting forth the reasons for the delay and describing the actions the Secretary is taking to prepare an implementation plan under this subsection. The Secretary may implement any such recommendation (or part of any such recommendation) before, on, or after the date on which the Secretary transmits the implementation plan to the Board under this subsection.

(f) Implementation.

(1) Subject to paragraph (2), not later than one year after the date on which the Secretary of Energy transmits an implementation plan with respect to a recommendation (or part thereof) under subsection (e), the Secretary shall carry out and complete the implementation plan. If complete implementation of the plan takes more than 1 year, the Secretary of Energy shall submit a report to the Committees on Armed Services and on Appropriations of the Senate and to the Speaker of the House of Representatives setting forth the reasons for the delay and when implementation will be completed.

(2) If the Secretary of Energy determines that the implementation of a Board recommendation (or part thereof) is impracticable because of budgetary considerations, or that the implementation would affect the Secretary's ability to meet the annual nuclear weapons stockpile requirements established pursuant to section 2121 of this title [§ 91 of the Atomic Energy Act], the Secretary shall submit to the President, to the Committees on Armed Services and on Appropriations of the Senate, and to the Speaker of the House of Representatives a report containing the recommendation and the Secretary's determination.

(g) Imminent or severe threat.

(1) In any case in which the Board determines that a recommendation submitted to the Secretary of Energy under section 2286a of this title [§ 312 of the Atomic Energy Act] relates to an imminent or severe threat to public health and safety, the Board and the Secretary of Energy shall proceed under this subsection in lieu of subsections (a) through (d) of this section.

(2) At the same time that the Board transmits a recommendation relating to an imminent or severe threat to the Secretary of Energy, the Board shall also transmit the recommendation to the President and for information purposes to the Secretary of Defense. The Secretary of Energy shall submit his recommendation to the President. The President shall review the Secretary of Energy's recommendation and shall make the decision concerning acceptance or rejection of the Board's recommendation.

(3) After receipt by the President of the recommendation from the Board under this subsection, the Board promptly shall make such recommendation available to the public and shall transmit such recommendation to the Committees on Armed Services and on Appropriations of the Senate and to the Speaker of the House of Representatives. The President shall promptly notify such committees and the Speaker of his decision and the reasons for that decision.

(h) Limitation.

Notwithstanding any other provision of this section, the requirements to make information available to the public under this section—

(1) shall not apply in the case of information that is classified; and

(2) shall be subject to the orders and regulations issued by the Secretary of Energy under sections 2167 and 2168 of this title [§§ 147 and 148 of the Atomic Energy Act] to prohibit dissemination of certain information.

§ 2286e. Reports. [Atomic Energy Act, Sec. 316]

(a) Board report.

(1) The Board shall submit to the Committees on Armed Services and on Appropriations of the Senate and to the Speaker of the House of Representatives each year, at the same time that the President submits the budget to Congress pursuant to section 1105(a) of Title 31 [United States Code], a written report concerning its activities under this subchapter, including all recommendations made by the Board, during the year preceding the year in which the report is submitted. The Board may also issue periodic unclassified reports on matters within the Board's responsibilities.

(2) The annual report under paragraph (1) shall include an assessment of—

(A) the improvements in the safety of Department of Energy defense nuclear facilities during the period covered by the report;

(B) the improvements in the safety of Department of Energy defense nuclear facilities resulting from actions taken by the Board or taken on the basis of the activities of the Board; and

(C) the outstanding safety problems, if any, of Department of Energy defense nuclear facilities.

(b) DOE report.

The Secretary of Energy shall submit to the Committees on Armed Services and on Appropriations of the Senate and to the Speaker of the House of Representatives each year, at the same time that the President submits the budget to Congress pursuant to section 1105(a) of Title 31 [United States Code], a written report concerning the activities of the Department of Energy under this subchapter during the year preceding the year in which the report is submitted.

(c) Requirements for first annual report.

(1) Before submission of the first annual report by the Defense Nuclear Facilities Safety Board under section 316(a) of the Atomic Energy Act of 1954 (as added by subsection (a)), the Board shall conduct a study on whether nuclear facilities of the Department of Energy that are excluded from the definition of "Department of Energy defense nuclear facility" in section 318(1)(C) of such Act (hereafter in this subsection referred to as "non-defense nuclear facilities") should be subject to independent external oversight. The Board shall include in such first annual report the results of such study and the recommendation of the Board on whether non-defense nuclear facilities should be subject to independent external oversight.

(2) If the Board recommends in the report that non-defense nuclear facilities should be subject to such oversight, the report shall include a discussion of alternative mechanisms for implementing such oversight, including mechanisms such as a separate executive agency and oversight as a part of the Board's responsibilities. The discussion of alternative mechanisms of oversight also shall include considerations of budgetary costs, protection of the security of sensitive nuclear weapons information, and the similarities and differences in the design, construction, operation, and decommissioning of defense and non-defense nuclear facilities of the Department of Energy.

(d) Requirements for fifth annual report.

The fifth annual report submitted by the Defense Nuclear Facilities Safety Board under section 316(a) of the Atomic Energy Act of 1954 (as added by subsection (a)) shall include—

(1) an assessment of the degree to which the overall administration of the Board's activities are believed to meet the objectives of Congress in establishing the Board;

(2) recommendations for continuation, termination, or modification of the Board's functions and programs, including recommendations for transition to some other independent oversight arrangement if it is advisable; and

(3) recommendations for appropriate transition requirements in the event that modifications are recommended.

§ 2286f. Judicial Review. [Atomic Energy Act, Sec. 317]

Chapter 7 of Title 5 [5 U.S.C. §§ 701 et seq.] shall apply to the activities of the Board under this subchapter.

§ 2286g. "Department of Energy Defense Nuclear Facility" Defined. [Atomic Energy Act, Sec. 318]

As used in this subchapter, the term "Department of Energy defense nuclear facility" means any of the following:

(1) A production facility or utilization facility (as defined in section 2014 of this title [§ 11 of the Atomic Energy Act]) that is under the control or jurisdiction of the Secretary of Energy and that is operated for national security purposes, but the term does not include—

(A) any facility or activity covered by Executive Order No. 12344, dated February 1, 1982 [42 U.S.C. § 7158 note], pertaining to the Naval nuclear propulsion program;

(B) any facility or activity involved[734] with the transportation of nuclear explosives or nuclear material;

(C) any facility that does not conduct atomic energy defense activities; or

(D) any facility owned by the United States Enrichment Corporation.[735]

(2) A nuclear waste storage facility under the control or jurisdiction of the Secretary of Energy, but the term does not include a facility developed pursuant to the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101 et seq.) and licensed by the Nuclear Regulatory Commission.

§ 2286h. Contract Authority Subject to Appropriations. [Atomic Energy Act, Sec. 319]

The authority of the Board to enter into contracts under this subchapter is effective only to the extent that appropriations (including transfers of appropriations) are provided in advance for such purpose.

§ 2286h-1. Transmittal of Certain Information to Congress. [Atomic Energy Act, Sec. 320]

Whenever the Board submits or transmits to the President or the Director of the Office of Management and Budget any legislative recommendation, or any statement or information in preparation of a report to be submitted to the Congress pursuant to section 2286e(a) of this title [§ 316(a) of the Atomic Energy Act], the Board shall submit at the same time a copy thereof to the Congress.

§ 2286i. Annual Authorization of Appropriations. [Atomic Energy Act, Sec. 321]

Authorizations of appropriations for the Board for fiscal years beginning after fiscal year 1989 shall be provided annually in authorization Acts.

RELATED LEGISLATIVE PROVISIONS

§ 3135 of the National Defense Authorization Act of 1992 and 1993 (Public Law 102-190), as amended by § 401 of the Federal Reports Elimination Act of 1998 (Public Law 105-362):

§ 3135. RESUMPTION OF PLUTONIUM OPERATIONS IN BUILDINGS AT ROCKY FLATS.

(a) RESUMPTION OF PLUTONIUM OPERATIONS.

The Secretary of Energy may not resume plutonium operations in a plutonium operations

[734] Pantex and NTS were added to the Board's jurisdiction by the National Defense Authorization Act of 1992 and 1993 (Pub.L. 102-190) which struck the following language: "with the assembly or testing of nuclear explosives or."

[735] Added by amendment through the Energy Policy Act of 1992 (Pub.L. 102-486, § 902(a)(7)).

building at the Rocky Flats Plant, Golden, Colorado, until the Defense Nuclear Facilities Safety Board determines, to the satisfaction of the Board, that the Secretary's response to the Board's recommendations numbered 90-2, 90-5, and 91-1 adequately protects public health and safety with respect to the operation of such building.

(b) RESUMPTION OF PRODUCTION OF PLUTONIUM WARHEAD COMPONENTS.

The production of plutonium warhead components for any particular type of warhead may not be resumed at the Rocky Flats Plant until the later of—

(1) April 1, 1992; or

(2) 30 days after the date on which the Secretary of Defense and the Secretary of Energy certify to Congress that the production of that type of warhead is necessary in the interest of the national security of the United States.

(c) DEFINITION.

For purposes of this section, the term "plutonium operations building" means the building numbered 371, 559, 707, 771, 776, 777, or 779 at the Rocky Flats Nuclear Weapons Plant, Golden, Colorado, or any other building at such Plant in which plutonium operations are conducted.

§ 3137 of the National Defense Authorization Act for Fiscal Year 2001 (Public Law 106-398), as amended by § 3115 of the National Defense Authorization Act for Fiscal Year 2004 (Public Law 108-136):

§ 3137. CONTINUATION OF PROCESSING, TREATMENT, AND DISPOSITION OF LEGACY NUCLEAR MATERIALS.

(a) CONTINUATION.

The Secretary of Energy shall continue operations and maintain a high state of readiness at the H-canyon facility at the Savannah River Site, Aiken, South Carolina, and shall provide technical staff necessary to operate and so maintain such facility.

(b) LIMITATION ON USE OF FUNDS FOR DECOMMISSIONING OF F-CANYON FACILITY.

No amounts authorized to be appropriated or otherwise made available for the Department of Energy by this or any other Act may be obligated or expended for purposes of commencing the decommissioning of the F-canyon facility at the Savannah River Site until the Secretary submit to the Committee on Armed Services of the Senate and the Committee on Armed Services of the House of Representatives, and the Defense Nuclear Facilities Safety Board jointly a report setting forth—

(1) an assessment whether or not all materials present in the F-canyon facility as of the date of the report that required stabilization have been safely stabilized as of that date;

(2) an assessment whether or not the requirements applicable to the F-canyon facility to meet the future needs of the United States for fissile materials disposition can be met through full use of the H-canyon facility at the Savannah River Site; and

(3) if it appears that one or more of the requirements described in paragraph (2) cannot be met through full use of the H-canyon facility—

(A) an identification by the Secretary of each such requirement that cannot be met through full use of the H-canyon facility; and

(B) for each requirement so identified, the reasons why such requirement cannot be met through full use of the H-canyon facility and a description of the alternative capability for fissile materials disposition that is needed to meet such requirement."

(C) REPEAL OF SUPERSEDED PLAN REQUIREMENT.

Subsection (C) of such section is repealed.

§ 3183 of the National Defense Authorization Act for Fiscal Year 2003 (Public Law 107-314):

§ 3183. STUDY OF FACILITIES FOR STORAGE OF PLUTONIUM AND PLUTONIUM MATERIALS AT SAVANNAH RIVER SITE.

(a) STUDY.

The Defense Nuclear Facilities Safety Board shall conduct a study of the adequacy of the K-Area Materials Storage facility (KAMS), and related support facilities such as Building 235-F, at the Savannah River Site, Aiken, South Carolina, for the storage of defense plutonium and defense plutonium materials in connection with the disposition program provided in section 3182[736] and in connection with the amended Record of Decision of the Department of Energy for fissile materials disposition.

[736] Subtitle E (including § 3182) of the National Defense Authorization Act for Fiscal Year 2003 provides for the disposition of 34 metric tons of weapons-usable plutonium pursuant to the 2000 United States and Russian Federation agreement. § 3182 of the Act requires the Department of Energy to submit to Congress a plan for the construction of the MOX facility at the Savannah River Site to process the 34 metric tons of weapons-usable plutonium.

(b) REPORT.

Not later than one year after the date of the enactment of this Act [enacted December 2, 2002], the Defense Nuclear Facilities Safety Board shall submit to Congress and the Secretary of Energy a report on the study conducted under subsection (a).

(c) REPORT ELEMENTS.

The report under subsection (b) shall—

(1) address—

(A) the suitability of KAMS and related support facilities for monitoring and observing any defense plutonium or defense plutonium materials stored in KAMS;

(B) the adequacy of the provisions made by the Department for remote monitoring of such defense plutonium and defense plutonium materials by way of sensors and for handling of retrieval of such defense plutonium and defense plutonium materials; and

(C) the adequacy of KAMS should such defense plutonium and defense plutonium materials continue to be stored at KAMS after 2019; and

(2) include such proposals as the Defense Nuclear Facilities Safety Board considers appropriate to enhance the safety, reliability, and functionality of KAMS.

(d) REPORTS ON ACTIONS ON PROPOSALS.

Not later than 6 months after the date on which the report under subsection (b) is submitted to Congress, and every year thereafter, the Secretary and the Board shall each submit to Congress a report on the actions taken by the Secretary in response to the proposals, if any, included in the report.

§ 3112 of the National Defense Authorization Act for Fiscal Year 2009 (Public Law 110-417):

§ 3112. LIMITATION ON FUNDING FOR PROJECT 04-D-125 CHEMISTRY AND METALLURGY RESEARCH REPLACEMENT FACILITY PROJECT, LOS ALAMOS NATIONAL LABORATORY, LOS ALAMOS, NEW MEXICO.

Of the amounts appropriated pursuant to an authorization of appropriations in this Act or otherwise made available for fiscal year 2009 for Project 04-D-125 Chemistry and Metallurgy Research Replacement (in this section referred to as ‘‘CMRR’’) facility project, Los Alamos National Laboratory, Los Alamos, New Mexico, not more than $50,200,000 may be made available until—

(1) the Administrator for Nuclear Security and the Defense Nuclear Facilities Safety Board have each submitted a certification to the congressional defense committees stating that the concerns raised by the Defense Nuclear Facilities Safety Board regarding the design of CMRR safety class systems (including ventilation systems) and seismic issues have been resolved; and

(2) a period of 15 days has elapsed after both certifications under paragraph (1) have been submitted.

APPENDIX 2: Board Recommendations

90-1, Restart of K, L, and P Reactors at DOE Savannah River Site
90-2, DOE High Priority Defense Nuclear Facilities; Design, Construction, Operation and Decommissioning Standards
90-3, Future Monitoring Programs at the Department of Energy's Hanford Site, WA
90-4, Operational Readiness Review at the Department of Energy's Rocky Flats Plant, CO
90-5, Systematic Evaluation Program at Department of Energy's Rocky Flats Plant, CO
90-6, Criticality Safety at the Department of Energy's Rocky Flats Plant, CO
90-7, Ferrocyanide Tank Safety at the Hanford Site

91-1, Strengthening the Nuclear Safety Standards Program for DOE's Defense Nuclear Facilities
91-2, Closure of Safety Issues Prior to Restart of K-Reactor at the Savannah River Site
91-3, DOE's Comprehensive Readiness Review Prior to Initiation of the Test Phase at the Waste Isolation Pilot Plant (WIPP)
91-4, DOE's Operational Readiness Review Prior to Resumption of Plutonium Operations at the Rocky Flats Plant
91-5, Power Limits for K-Reactor Operation at the Savannah River Site
91-6, Radiation Protection for Workers and the General Public at DOE Defense Nuclear Facilities

92-1, Operational Readiness of the HB-Line at the Savannah River Site
92-2, DOE's Facility Representative Program at Defense Nuclear Facilities
92-3, Operational Readiness Reviews for the HB-Line at the Savannah River Site, SC
92-4, Multi-Function Waste Tank Facility at the Hanford Site
92-5, Discipline of Operation in a Changing Defense Nuclear Facilities Complex
92-6, Operational Readiness Reviews
92-7, Training and Qualification

93-1, Standards Utilization in Defense Nuclear Facilities
93-2, The Need for Critical Experiment Capability
93-3, Improving DOE Technical Capability in Defense Nuclear Facilities Programs
93-4, DOE's Management and Direction of Environmental Restoration Management Contracts
93-5, Hanford Waste Tanks Characterization Studies
93-6, Maintaining Access to Nuclear Weapons Expertise in the Defense Nuclear Facilities Complex

94-1, Improved Schedule for Remediation in the Defense Nuclear Facilities Complex
94-2, Conformance with Safety Standards at DOE Low-Level Nuclear Waste and Disposal Sites
94-3, Rocky Flats Seismic and Systems Safety
94-4, Deficiencies in Criticality Safety at Oak Ridge Y-12 Plant
94-5, Integration of DOE Safety Rules, Orders, and Other Requirements

95-1, Improved Safety of Cylinders Containing Depleted Uranium
95-2, Safety Management

96-1, In-Tank Precipitation System at the Savannah River Site

97-1, Safe Storage of Uranium-233
97-2, Continuation of Criticality Safety at Defense Nuclear Facilities in the Department of Energy

98-1, Resolution of Safety Issues Identified by DOE Internal Oversight
98-2, Safety Management at the Pantex Plant

99-1, Safe Storage of Fissionable Material Called "Pits"

2000-1, Prioritization for Stabilizing Nuclear Materials
2000-2, Configuration Management, Vital Safety Systems

2001-1, High-Level Waste Management at the Savannah River Site

2002-1, Quality Assurance for Safety-Related Software
2002-2, Weapons Laboratory Support of the Defense Nuclear Complex
2002-3, Requirements for the Design, Implementation, and Maintenance of Administrative Controls

2004-1, Oversight of Complex, High-Hazard Nuclear Operations
2004-2, Active Confinement Systems

2005-1, Nuclear Material Packaging

2007-1, Safety-Related In Situ Nondestructive Assay of Radioactive Materials

2008-1, Safety Classification of Fire Protection Systems

2009-1, Risk Assessment Methodologies at Defense Nuclear Faclities

APPENDIX 3: Board Technical Reports

Updated February 1, 2008

Report Number	Date	Report Title	Author(s)
TECH-36	12/2005	Integrated Safety Management: The Foundation for a Successful Safety Culture	Matthews
TECH-35	12/2004	Safety Management of Complex, High-Hazard Organizations	Matthews
TECH-34	10/2004	Confinement of Radioactive Materials at Defense Nuclear Facilities (Part of Recommendation 2004-2)	Bamdad and Zavadoski
TECH-33	11/2003	Control of Red Oil Explosions in Defense Nuclear Facilities	Robinson, Gutowski, and Yeniscavich
TECH-32	03/2002	Savannah River Site Canyon Utilization	Eggenberger and Ogg
TECH-31	03/2001	Engineering Quality Into Safety Systems	DiNunno
TECH-30	02/2001	Safety Review of the Hanford Spent Nuclear Fuel Project During the Design and Construction Phase	Wille
TECH-29	02/2001	Criticality Safety at DOE Defense Nuclear Facilities	Burns, Ogg, and Bamdad
TECH-28	10/2000	Safety Basis Expectations for Existing DOE Defense Nuclear Facilities and Activities	Bamdad, McConnell, and Andrews
TECH-27	06/2000	Fire Protection at Defense Nuclear Facilities	Shields, Bamdad, and Gwal
TECH-26	02/2000	Improving Operation and Performance of Confinement Ventilation systems at Hazardous Facilities of the DOE	Zavadoski, and Thompson
TECH-25	01/2000	Quality Assurance for Safety-Related Software at DOE Defense Nuclear Facilities	Burns, Forsbacka, and Martin
TECH-24	09/1999	Safety Handling of Insensitive High Explosive Weapon Subassemblies at the Pantex Plant	Von Holle and Martin
TECH-23	05/1999	HEPA Filters Used in the DOE's Hazardous Facilities	Zavadoski, and Thompson
TECH-22	04/1999	Savannah River Site Spent Nuclear Fuel	Fortenberry
TECH-21	03/1999	Status of Emergency Management at Defense Nuclear Facilities of the DOE	Thompson

Report Number	Date	Report Title	Author(s)
TECH-20	02/1999	Protection of Collocated Workers at the DOE's Defense Nuclear Facilities and Sites	Kouts
TECH-19	04/1998	Authorization Agreements for Defense Nuclear Facilities and Activities	Bamdad
TECH-18	11/1997	Review of the Safety of Storing Plutonium Pits at the Pantex Plant (OUO)	Keilers and Tontodonato
TECH-17	10/1997	Review of the Hanford Spent Nuclear Fuel Project	Arcaro, Barton, Grover, Gwal, Hadjian, Moury, Ogg, Roarty, Stokes, Thompson, Wille, Yensicavich, and Zavadoski
TECH-16	06/1997	Integrated Safety Management	DiNunno
TECH-15	03/1997	Operational Formality for DOE Nuclear Facilities and Activities	Krahn and Moury
TECH-14 Rev. 2	06/1007	Savannah River Site In-Tank Precipitation Facility Benzene Generation: Safety Implications	Rovinson, Sanders, Miyoshi, Fortenberry, and Zavadoski
TECH-14	02/1997	Savannah River Site In-Tank Precipitation Facility Benzene Generation: Safety Implications	Robinson, Sanders, Miyoshi, Fortenberry, and Savadoski
TECH-13	02/1997	Uranium-233 Storage Safety at DOE Facilities	Andrews, Hunt, Krahn, and Sautman
TECH-12	08/1996	Regulation and Oversight of Decommissioning Activities at DOE Defense Nuclear Facilities	Andersen and MacEvoy
TECH-11		**NOT ISSUED**	
TECH-10	03/1996	An Assessment Concerning Safety at Defense Nuclear Facilities – The DOE Technical Personnel Problem	Crawford
TECH-9	12/1995	Status of Highly Enriched Uranium Processing Capability at Building 9212 Oak Ridge Y-12 Plant	Ogg, Andrews, and Robinson
TECH-8		**NOT ISSUED**	
TECH-7	11/1995	Stabilization of Deteriorating Mark 16 and Mark 22 aluminum-Alloy Spent Nuclear Fuel at the Savannah River Site	Fortenberry, Yeniscavich, Keilers, Robinson, Moore, Merritt, Stiles, and Hayes

Report Number	Date	Report Title	Author(s)
TECH-6	10/1995	Safety Management and Conduct of Operations at the DOE's Defense Nuclear Facilities (Part of Recommendation 95-2)	Kouts and DiNunno
TECH-5	05/1995	Fundamentals for Understanding Standards-Based Safety Management of DOE Dense Nuclear Facilities (Part of Recommendation 95-2)	DiNunno
TECH-4	05/1995	Integrity of Uranium Hexaflouride Cylinders (Part of Recommendation 95-1)	Grover, Krahn, Martin, Miller, Tontodonato, and Yeniscavich
TECH-3	03/1995	Overview of Ventilation Systems at Selected DOE Plutonium Processing and Handling Facilities	Zavadoski
TECH-2	09/1994	Low-Level Waste Disposal Policy for DOE Defense Nuclear Facilities	Napolitano, Sautman, Helfrich, and Stokes
TECH-1	04/1994	Plutonium Storage at Major DOE Facilities	Hurt, De La Paz, Fortenberry, Tontodonato, and Von Holle

APPENDIX 4: Board Biographies

JOSEPH F. BADER

Mr. Joseph F. Bader, of the District of Columbia, has been appointed a Member of the Defense Nuclear Facilities Safety Board on November 29, 2004. Mr. Bader has held executive and senior management positions primarily in the nuclear weapons complex and nuclear power sectors for Hill International, Inc., Fluor Daniel, Inc., Exxon Nuclear and Westinghouse Electric Corporation. He has conducted numerous program/project reviews and has extensive knowledge of design, construction management and operations of R&D facilities, materials production, and power plants.

Career Highlights

Mr. Bader, serving as Vice President, Hill International, Inc., planned and managed a variety of programmatic and design reviews of complex DOE capital construction projects for the Office of Engineering and Construction Management. These independent reviews of DOE projects are mandated by Congress and were performed for the Office of Engineering and Construction Management.

Mr. Bader, as Senior Project Director, Fluor Daniel, Inc., started up and managed Fluor Daniel's Washington program office to perform design and construction management services in support of the $2.5 billion program to build a “safer, more modern, and more environmentally benign” DOE Nuclear Weapons Complex. Mr. Bader and his multi-disciplined staff provided regulatory compliance, master scheduling, systems engineering and integration, design and construction issues identification, and management for eight projects over eight years.

Subsequent to his assignment to lead the Weapons Complex Reconfiguration Washington office, Mr. Bader supported the $5.6 billion contract to manage and operate the DOE Hanford Reservation. He led a team of managers, professionals and workers in developing a seven-year strategic plan to double the percentage of the annual billion dollar budget applied to actual cleanup and closure activities at the DOE Hanford Site. A major focus was revising the philosophy and application of maintenance and operating procedures for the non-nuclear facilities and systems. He co-authored a Hanford site-wide “Critical Self-Assessment” of the contractors architectural, engineering, construction, construction management, operations, and maintenance performance. The Assessment was prepared for the Democratic Senator from Washington and the DOE in response to Congressional and State concern over the contractor’s performance. The final report included recommended actions to resolve performance problems uncovered in the review.

Following the completion of an internal review for Fluor Daniel to determine the causes of the Duratek Duramelter™ pilot plant failure at Fernald, Mr. Bader prepared a technical risk-based plan for treatment of silo wastes to avoid future failures. Mr. Bader performed a corporate risk analysis to determine which of the several technically feasible paths for silo waste treatment involved the least risk to worker and public health and safety.

As Vice President, Duratek Corporation, responsible for managing technology development and deployment, Mr. Bader addressed major issues from the processing of Department of Energy wastes to radioactive wastewater treatment technologies for reducing nuclear power plant waste volumes and thus operating costs. He introduced the use of vitrification for radioactive waste encapsulation to the company's products and services. He established joint ventures with Bechtel, Westinghouse and major overseas companies such as Siemens and JGC of Japan to deploy vitrification and other waste processing technology domestically. He oversaw design, installation, construction and startup of several systems resulting from these joint ventures.

As Senior Manager, Facilities and Licenses, for Urenco, Inc., Mr. Bader helped establish and manage a multi-national, United States based consortium to design and build a $750 million U.S. ultracentrifuge uranium enrichment plant based on European technology. Mr. Bader led the preparation of the technical, commercial, conceptual design and regulatory basis for the facility. A public acceptance and political acceptance program was developed and implemented.

As Westinghouse Program Manager, Mr. Bader had programmatic oversight responsibilities of the 100,000 kg/yr mixed oxide production facility. He participated in the final design decision, the development of safeguards and security requirements, and Nuclear Regulatory Commission and State of South Carolina compliance activities. He prepared and participated in the public and political acceptance activities in the State and in Washington, DC.

Mr. Bader was responsible as Senior Engineer, Babcock and Wilcox, for the thermal/hydraulic design of the nuclear reactor cores for the German commercial nuclear ship, the Otto Hahn, the Japanese commercial nuclear ship, the Mutsu, and for the nuclear reactor power upgrade of the United States commercial nuclear ship, the N.S. Savannah.

Education: M. S., Nuclear Engineering, University of Virginia, 1970
B. S., Mechanical Engineering, Villanova University, 1962

Professional American Society of Mechanical Engineers
Memberships: American Nuclear Society

Honors: Pi Tau Sigma

Others: Providence Hospital Citizens Board
Chairman, Audit Committee
Member, Finance Committee

LARRY W. BROWN

Larry W. Brown was confirmed by the U.S. Senate in September 2006 to be a member of the Defense Nuclear Facilities Safety Board for a term expiring October 18, 2010.

Prior to 2001, Mr. Brown served on active duty in the United States Navy, and on retirement in 1996 completed a law degree. He began his military service as a Seaman Recruit and retired as a United States Navy Captain after having served from 1963 to 1996 onboard ten ships, including nuclear submarines, destroyers, frigates, supply ships, and a nuclear aircraft carrier. Early in his career he qualified in nuclear plant operations on three naval nuclear reactors.

His last two sea tours were as Commanding Officer of the Guided Missile Destroyer USS LUCE (1989-91), and of the Guided Missile Frigate USS MAHLON S. TISDALE (1991-92), respectively. While serving as Commanding Officer, his ships earned many awards including the Chief of Naval Operations Safety Award and the Squadron nomination for the Pacific Fleet Lamps (Helicopter) Safety Award. He earned six personal awards while serving in the United States Navy, including the Legion of Merit for service on the staff of the Chief of Operations in 1996.

Upon retirement he completed law school and subsequently worked as an attorney before joining the Administration in 2001. Mr. Brown was assigned to the U.S. Department of Energy (DOE) and worked as the Senior Policy Advisor for nuclear, spent fuel and non-proliferation and nuclear security issues. In this role he provided recommendations on a broad cross-section of key issues to the Office of Nuclear Energy, the Office of Environmental Management, the Office of Non-proliferation and International Security, the Under Secretary, and the Deputy Secretary of Energy.

As a DOE Senior Policy Advisor he coordinated efforts to capture value from the government's uranium inventories, while encouraging private industry to modernize nuclear fuel cycle facilities in the United States. His efforts contributed to the resolution of private claims for prior transfers of 9,950 tons of contaminated natural uranium, decontamination of nearly 15,000 tons of technetium contaminated natural uranium, and recognition of the value of the government's large inventory of high assay depleted uranium. At the end of his term at DOE, the stagnant U.S. uranium enrichment industry, which previously had no concrete plans for deployment of new enrichment technology, had begun two privately funded technology development and deployment initiatives.

In 2005 the Deputy Secretary directed him to lead the DOE Task Force that developed the Global Nuclear Energy Partnership (GNEP), subsequently a Presidential initiative, with the objective of eliminating the major impediments to the expansion of commercial nuclear energy, including—on a global scale—closing the nuclear fuel cycle, reducing commercial nuclear waste and stemming the illicit spread of sensitive nuclear technologies. In 2006 Mr. Brown was presented the Secretary of Energy's Silver Award in special recognition of his work on the President's Global Nuclear Energy Partnership.

His last position at the Department of Energy before joining the Board was the Deputy Assistant Secretary for Corporate Business Operations in the Office of Nuclear Energy where he spearheaded the GNEP international initiative, which has since been embraced by all the world's major nuclear power nations, and many others.

Since reporting to the Board, Mr. Brown has visited all the defense nuclear sites multiple times, focusing attention on the facilities' material condition, formality of operations, and safety issues associated with wet chemistry operations. In addition he has highlighted the importance of DOE establishing the robust radiological safety Research and Development program discussed in the Board's recommendation 2004-

1, and strengthening government contractor oversight principally through thoroughly qualified and adequately staffed Facility Representative (FACREP) programs at each defense nuclear site.

Separate and apart from his duties as a Board Member, he has continued to participate in conferences discussing the future of commercial nuclear power, speaking principally on the issues of non-proliferation of sensitive technologies. In 2007 he spoke on the subject of non-proliferation at the GNR2 (Global Nuclear Fuel Reprocessing and Recycling) Conference, and at the Howard H. Baker Center for Public Policy conference on “The Role of Nuclear Power in Global and Domestic Energy Policy: Recent Developments and Future Expectations”, and for the third time he participated in the bi-annual US-Japan Workshop on Nuclear Energy.

Education:

J.D., Georgetown University Law Center, 1998. He is licensed to practice law in the Commonwealth of Virginia, the State of Maryland, and the District of Columbia.

M.A., United States Naval War College, Newport, RI, 1993. (National Security and Strategic Studies)
B.A., University of Colorado, 1972. (Physics)

EDSON G. CASE

During his military and civilian careers, Edson Case has been in the forefront of the development and implementation of nuclear safety policy.

Case graduated from the United States Naval Academy in 1946 as an Ensign and spent the next 15 years as a Naval Officer. For several years during the 1950's, Case worked directly for Admiral Hyman Rickover as a Project Officer in the Naval Nuclear Propulsion program.

In his 30-year civilian career, Case was a senior staff member of the U.S. Atomic Energy Commission and the Nuclear Regulatory Commission (NRC). For over 10 years at the NRC, he was Deputy Director and Director of the Office of Nuclear Reactor Regulation, responsible for all safety aspects of commercial nuclear power plants, including their location, design, construction, and operation.

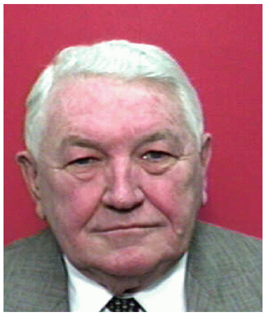
Case retired from the NRC in 1985 and until recently provided consulting services to the Commission. In August 1989, President George Bush nominated Edson Case to be a Member of the newly established Defense Nuclear Facilities Safety Board. In his appearance before the Senate Committee on Armed Services, Case stated his belief in timely decision-making, firm yet fair decisions, and his strong support of a competent technical staff. Following confirmation by the United States Senate, Case was sworn-in as a Member of the Board in October 1989.

In early 1991, following renomination by President Bush, the United States Senate confirmed Mr. Case as a Member of the Defense Nuclear Facilities Safety Board for a full five-year term.

Case received degrees from the United States Naval Academy and the Massachusetts Institute of Technology. In 1982 he received the Meritorious Executive Award in the Senior Executive Service.

Case and his wife, Rita, have six grown children.

June 1991



JOHN T. CONWAY

John T. Conway, an engineer and attorney, is Chairman of the Defense Nuclear Facilities Safety Board. In October 1989, President Bush appointed him to a five-year term as Chairman of the newly established Defense Nuclear Facilities Safety Board to which he was reappointed by President Clinton to a second five-year term. His nuclear experience includes 12 years on the staff of the Joint Committee on Atomic Energy, U.S. Congress (six years as Staff Director), and 11 years as President/Chairman of the Board of the American Nuclear Energy Council. Following is a brief resume:

Oct. 1989 - 2005	Defense Nuclear Facilities Safety Board, Chairman
1982 - 1989	Consolidated Edison Company, Executive Vice President
1982 - 1989	American Nuclear Energy Council (ANEC), Chairman
1978 - 1982	American Nuclear Energy Council (ANEC), President and Chief Executive Officer
1968 - 1978	Consolidated Edison Company, Executive Assistant to Charles F. Luce, Chairman of the Board (1970-78, duties included Chairman, Nuclear Facilities Safety Committee)
1956 - 1968	United States Congress, Staff, Joint Committee on Atomic Energy (1958-62, Assistant Staff Director; 1962-68, Executive Director)
1950 - 1956	Federal Bureau of Investigation, Department of Justice, Special Agent – served in Kentucky, New York, Washington, D.C.
1949 - 1950	Meighan & Necarsulmer Law Firm, Associate
Education	Columbia University School of Law, LLB, 1949 (converted to Juris Doctor, 1969)
	Tufts University, BS Engineering, 1947
Military Service	U.S. Navy, active duty February 4, 1943 to September 1946; Saw service in North Atlantic, USPC78l, Discharged Lt. (j.g.)
Professional Memberships	Admitted to New York Bar, 1949, and Supreme Court of the United States, 1953
Awards	Grand Council of Hispanic Societies in Public Service Humanitarian Award
	The James and Jane Hoey Award for Interracial Justice

JOHN W. CRAWFORD, JR.

Jack Crawford has spent almost his entire working career in the applications of military and civilian nuclear technology. He began his naval career during World War II serving in USS YORKTOWN at Midway and then in USS SANTEE, and USS BROOKLYN. Following duty as Submarine Repair Superintendent at the Philadelphia Naval Shipyard, Crawford served in various assignments with the Atomic Energy Commission (AEC) in the Naval Reactors program. His responsibilities included providing guidance and direction to ensure that required safety, quality and reliability standards were incorporated in the planning and construction of naval nuclear power plants. In his final assignment in the program he was Deputy Manager under Admiral Rickover.

Following retirement from the United States Navy with the rank of Captain, Crawford returned to the Atomic Energy Commission (subsequently the Department of Energy) to begin a career in civilian nuclear technology. He held increasingly responsible positions culminating in being appointed Principal Deputy Assistant Secretary for Nuclear Energy. As Principal Deputy he carried out a comprehensive "post-TMI" assessment of the safety of DOE nuclear reactors, the widely publicized "Crawford Report." He retired from the Department of Energy in 1981, having been awarded its Distinguished Service Medal.

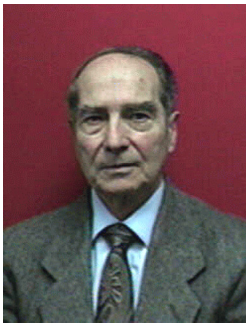
After graduation from Tilton School, Crawford attended Norwich University, was appointed to the United States Naval Academy from New Hampshire, and graduated with distinction in the class of 1942. He earned two Masters Degrees from the Massachusetts Institute of Technology (Naval Construction and Engineering, 1946, and Physics, 1950) and completed the curriculum at the Federal Executive Institute in 1968.

Renominated by President George Bush and confirmed by the United States Senate for a full five-year term to serve as a Member of the Defense Nuclear Facilities Safety Board, Crawford has brought to this position comprehensive knowledge and experience in the engineering and construction of nuclear reactors and over forty years of government service.

Married to the former Elizabeth F. Edwards, Crawford and his wife have four grown children and reside in Maryland.

July 1994

JOSEPH JOHN DiNUNNO



In May 1992, President George Bush nominated Joseph J. DiNunno to the Defense Nuclear Facilities Safety Board. Following confirmation by the United States Senate, Mr. DiNunno assumed his official duties on August 13, 1992. Mr. DiNunno was renominated by President William Clinton for an additional 5-year term. Confirmation by the Senate and reappointment were completed on April 22, 1996.

Mr. DiNunno brings to the Board more than five decades of diverse engineering and environmental experience, including 40 years in the nuclear field in senior positions within both the Federal Government and private industry.

Mr. DiNunno began his professional career in 1942 as an electrical engineer with Westinghouse Electric Corporation. Shortly thereafter, he joined the Department of the Navy, and for the next 17 years assumed increasingly responsible positions with the Bureau of Ships, the Naval Ordnance Laboratory, and the Naval Reactors Branch of the Bureau of Ships/Atomic Energy Commission (AEC). His initial assignment at Naval Reactors was oversight of the development of advanced instrumentation and controls for naval nuclear reactors. Admiral Rickover subsequently assigned Mr. DiNunno as Project Officer for the nuclear power plant of the USS Long Beach.

Upon transferring to AEC in 1959, Mr. DiNunno became a member of the regulatory staff that reviewed the safety aspects of the design, construction and operation of nuclear reactors, Space Nuclear Auxiliary Power systems and a variety of uranium and plutonium processing facilities. Among his assignments was the matrix management of subject matter experts in reactor pressure vessel design, instrumentation and control systems, emergency power systems, core designs and containment systems. Mr. DiNunno also coordinated the regulatory program of reactor safety research and directed the development of reactor siting and safety standards. In 1967 he was assigned to Paris as AEC's Scientific Representative, where he served as technical liaison with atomic energy authorities in ten European countries, the Nuclear Energy Agency and the International Atomic Energy Agency. In 1969 Mr. DiNunno returned to AEC headquarters to head the agency's first Office of Environmental Affairs. This office served as the principal AEC interface with local and national environmental groups concerned about the impact of nuclear power development on the environment and with the federal Council on Environmental Quality and other federal agencies in the development of plans for AEC implementation of the National Environmental Policy Act.

From 1972 to 1983, Mr. DiNunno was employed by the NUS Corporation. As Vice President and General Manager of the Environmental Safeguards Division, and later Technical Director of the Environmental Systems Group, he was responsible for engineering and environmental services provided to both industry and the government. He managed and technically directed an interdisciplinary staff of meteorologists, hydrologists, geologists, ecologists, socio-economists, geographers, land use planners and nuclear engineers. The Environmental Systems Group included both an Ecological Science Laboratory and a Radiation Environmental Monitoring Laboratory. It provided support services to a broad range of clients in the areas of site selection, site qualification, environmental reports, air and waste water discharge permitting, and licensing as required to satisfy federal and state environmental protection requirements (National Environmental Policy Act, Nuclear Regulatory Commission, Environmental Protection Agency, Department of Transportation). These services were performed on a wide variety of nuclear and nonnuclear projects, including environmental investigations of sites for both low- and high-level radioactive wastes.

With the exception of 2 years of full-time employment with R. F. Weston (1986-88) in support of Department of Energy's Civilian Radioactive Waste Management Program, Mr. DiNunno continued his professional career part-time (1983-92) as an independent consultant, providing environmental and nuclear safety advisory services to both industry and the government. His career included a number of years as a member of both the Space Applications Board of the National Research Council and the Citizens' Advisory Panel on the Cleanup of Three Mile Island.

Mr. DiNunno has written extensively on such issues as the safety of nuclear reactors and environmental considerations in power plant siting. He also has lectured on these topics at universities and industry seminars.

Mr. DiNunno graduated in 1942 with a Bachelor of Science in Electrical Engineering from Pennsylvania State University. In 1954 he earned a Master of Science degree in Electrical Engineering from the University of Maryland. In 1956-57, he received training in nuclear engineering at the Oak Ridge School of Reactor Technology.

July 1996

A.J. EGGENBERGER

An expert in nuclear safety and earthquake engineering, A. J. Eggenberger was appointed in August 1989 to be Vice Chairman of the newly established Defense Nuclear Facilities Safety Board and continued to serve in this capacity until July 2005, when he was appointed Chairman. At the Defense Nuclear Facilities Safety Board he has been directly involved in all aspects of the safety oversight of the Department of Energy's nuclear facilities. This includes design, operational, decommissioning, and construction nuclear safety.

Prior to this, Eggenberger was a senior official at the National Science Foundation serving as Program Director and Leader of the Earthquake Hazard Mitigation Program. In addition to his significant contribution at the Foundation, the Department of Energy recognized Eggenberger's broad experience and knowledge by selecting him to be a member of the Committee on Seismic Isolation for the New Production Reactor Program and as a member of the Board of Governors for the Seismic Technology Program.

Eggenberger's expertise in the area of nuclear technology was acknowledged by the international community when officials of the International Atomic Energy Agency in Vienna, Austria, requested him to serve as an expert consultant with the Division of Nuclear Safety. For five years, until he assumed his Defense Nuclear Facilities Safety Board position, Eggenberger was able to share his considerable knowledge, providing expertise to the Agency and its member states on nuclear safety issues related to the siting and construction of nuclear facilities.

Until joining the National Science Foundation in 1984, Eggenberger was an Associate Partner with D'Appolonia Consulting Engineers in Pittsburgh, Pennsylvania, where he was directly in charge of the Nuclear Facilities Group. Under his direct management the Group dealt with engineering issues ranging from mining, milling, fabrication, and reprocessing to disposal facilities in the U.S. and abroad. Eggenberger also has extensive participation in Naval Reactors prototype programs.

Early in his career (1967 to 1972), Eggenberger was a Professor and Researcher at the University of South Carolina in Columbia.

Eggenberger graduated with a Bachelor of Science from Carnegie Mellon University in 1961. He earned a Master of Science from The Ohio State University in 1963, followed by a Doctor of Philosophy in 1967 from Carnegie Mellon University.

HERBERT JOHN CECIL KOUTS

Dr. Kouts is well known and highly respected in the scientific community. His renown in the nuclear area was acknowledged when he was nominated to be one of the charter Members of the Defense Nuclear Facilities Safety Board. Upon confirmation by the United States Senate, Kouts was sworn into office in October 1989.

At the close of World War II, Kouts left active service with the rank of Major to continue his education. In 1950 he joined Brookhaven National Laboratory where he headed research groups in nuclear reactor shielding and reactor physics. In 1968 he founded the Technical Support Organization, a "think tank" for the Department of Energy in nuclear materials safeguards.

In 1973 Kouts was selected as Director of Reactor Safety Research for the Atomic Energy Commission. From 1975 to 1976, he was Director of Nuclear Regulatory Research in the newly formed Nuclear Regulatory Commission.

Returning to Brookhaven, Kouts headed the International Safeguards Project Office for two years. For over a decade he was the Chairman of the Department of Nuclear Energy, relinquishing the position in 1988; however, he remained Senior Physicist at Brookhaven until officially taking up his present duties.

Over the past 30 years, Kouts has received many awards for his distinguished and significant scientific contributions including the Atomic Energy Commission's E. O. Lawrence Award. He has been chosen to serve on numerous advisory committees and panels, among them the statutory Advisory Committee on Reactor Safeguards. He has been a member and chairman of the International Nuclear Safety Advisory Group to the Director General of the International Atomic Energy Agency on nuclear safety matters. Currently he is a member of the Nuclear Power Advisory Group, advising the European Bank for Reconstruction and Development on activities of the Bank concerning nuclear plants in Eastern Europe, particularly the safety aspects.

During his illustrious career, Kouts, a well-published scientist, has authored (and coauthored) several score of articles, speeches, and research papers. He has shared his experience and expertise in seeking to resolve difficult issues in nuclear materials research and development, international safeguards, and reactor safety.

Dr. Kouts holds a Bachelor of Science in Mathematics and a Master of Science in Physics from Louisiana State University. In 1952 he earned a Doctorate in Physics from Princeton University.

July 1994

JOHN E. MANSFIELD

Dr. Mansfield is an accomplished theoretical physicist with an exceptionally broad range of experience, both within and outside government, in the management of technology support to national defense programs. From the base of his academic work in elementary particle theory, philosophy, and classical languages, Dr. Mansfield has expanded his interests and contributions to a wide variety of areas of physics, engineering, operations analysis, and political-military studies in support of the national defense and civil space programs. Following is a brief resume:

1997 – Present	Member, Defense Nuclear Facilities Safety Board Nominated by President Clinton, re-nominated by President Bush and confirmed in 2003. Nominated as Vice Chairman by President Bush and confirmed in 2007
1994 – 1997	Associate Administrator for Space Access and Technology, National Aeronautics and Space Administration, development of advanced technologies for space launch and satellite systems
1989 – 1994	Professional Staff Member, Committee on Armed Services, United States Senate, strategic submarines, missiles, aircraft, and nuclear weapons
1986 – 1989	Defense Advanced Research Projects Agency, Director of Strategic Technology Office and Chief Scientist of DARPA, research on target recognition, precision weapons, and advanced technologies
1984 – 1986	House Armed Services Committee, Professional Staff Member, nuclear weapons and testing, strategic systems, Air Force research and development
1982 – 1984	Defense Nuclear Agency, Assistant to the Deputy Director (Science and Technology) for Theoretical Research, nuclear weapons effects, radiation simulators, underground tests, support to theater commanders, security and survivability of nuclear weapons
1976 – 1982	Defense Intelligence Agency, Chief, Nuclear Energy and Applied Sciences Division, foreign nuclear weapons, reactors, and advanced technologies
1971 – 1976	Science Applications, Inc., Staff Scientist, Principle Scientist, Program Manager, nuclear weapons effects, nuclear reactor safety
1968 – 1970	University of Notre Dame, postdoctoral fellow, theoretical physics, elementary particles
Education	Ph.D., Harvard University, 1970: Theoretical Physics A.M., Harvard University, 1966: Physics Ph.L., St. Louis University, 1963: Philosophy M.S., St. Louis University, 1963: Mathematics A.B., University of Detroit, 1960: Classical Latin and Greek

R. BRUCE MATTHEWS

Dr. Matthews has more than thirty years of scientific and engineering experience in nuclear technologies with a primary focus on special nuclear materials, weapons plutonium, and nuclear reactor fuels. In addition, Dr. Matthews has managed nuclear facilities including operations, construction, regulatory compliance, integrated safety management, and safeguards and security. Dr. Matthews received a BS in Metallurgy from Penn State, an MS in Materials Science from the University of Denver, and a Ph.D. in Materials Science from the University of Wales.

Dr. Matthews was appointed by President George W. Bush on April 22, 2003, to be a Member of the Defense Nuclear Facilities Safety Board, which oversees the safe operation of the Nation's nuclear weapon plants.

Dr. Matthews spent eight years as a Research Scientist at Atomic Energy of Canada where he developed advanced nuclear fuels and structural materials. He subsequently spent two years as a Research Scientist at Pacific Northwest Labs working on proliferation resistant fuels for advanced nuclear power systems. Dr. Matthews worked as a line and program manager at Los Alamos National Laboratory since 1980, and has been involved in DOE programs in stockpile stewardship, nuclear materials disposition, environmental management, and space and terrestrial nuclear power systems. Dr. Matthews was Director of the Nuclear Materials Technology Division from 1993 to 1999 and had overall responsibility for facility operations, base technologies, and program execution involving plutonium and other actinide materials at the Los Alamos' TA–55 Plutonium Facility and the Chemistry Metallurgy Research Building. That position had two major aspects: (1) Managing the nuclear facilities infrastructure including nuclear facility construction projects, facilities operations, nuclear materials control and accountability, waste management, environmental compliance, industrial and radiation safety, training, quality assurance, and safeguards and security. (2) Managing technical and programmatic nuclear materials activities including DOE/Defense Program plutonium activities in stockpile manufacturing, surveillance and R&D; DOE/Environmental Management actinide materials projects in waste management, residue stabilization, and legacy materials cleanup; DOE/Nuclear Energy projects in Pu^{238} heat sources, advanced reactor fuels, and transmutation of nuclear wastes; and DOE/Materials Disposition projects in nuclear materials management, pit disassembly, mixed-oxide fuels, and long-term storage.

In 2000 Dr. Matthews received a Senior Scientific Manager Return to Research grant at the University of California at Santa Barbara. Dr. Matthews is the author or co-author of more than eighty journal publications, conference proceedings and technical reports. He initiated the international Plutonium Futures Conference and is a Fellow of the American Nuclear Society.

JESSIE HILL ROBERSON

In September 1999, President Bill Clinton nominated Ms. Jessie Hill Roberson, of Evergreen, Alabama, to the Defense Nuclear Facilities Safety Board. After confirmation by the United States Senate, Ms. Roberson began her duties as a Board Member on January 18, 2000.

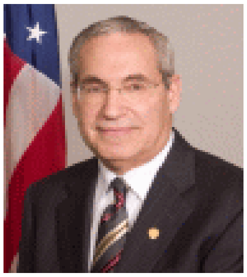
She has more than 17 years of experience in the nuclear field, with in-depth experience in low level waste management, environmental restoration, reactor operations and project management.

Prior to her appointment to the Board, Ms. Roberson served with the Department of Energy (DOE) in a variety of responsible and challenging positions. In 1996 she became the Manager of DOE's Rocky Flats Field Office at the Rocky Flats Environmental Technology Site in Colorado, with the responsibility for integration and performance of all environmental cleanup activities on the Site. She served with distinction in this position until December 1999. In her ten years with the Department of Energy, she has held numerous technical and managerial positions at DOE's Rocky Flats Environmental Technology Site and the Savannah River Site in Aiken, South Carolina, including environmental cleanup, waste management, safeguards and security, as well as nuclear reactors and weapons.

Before joining the Department of Energy, she worked with Georgia Power Company as a system engineering specialist from 1987 to 1989. At Georgia Power, Ms. Roberson focused on maintenance, testing, upgrades and performance reliability of electrical and mechanical plant systems and equipment. She has extensive experience in nuclear reactor operations and successfully completed the testing requirements for reactor operations with E. I. DuPont in 1982. Later with DuPont she trained nuclear reactor operators and supervisors in both nuclear and field operations. Before leaving DuPont in 1987 Ms. Roberson worked as a nuclear reactor operations manager at several sites.

From 1977 to 1980, Ms. Roberson completed work assignments as a student engineer for Westinghouse at the Clinch River Breeder Reactor in Oak Ridge, Tennessee and the Nuclear Center in Monroeville, Pennsylvania. Ms. Roberson received a B.S. in Nuclear Engineering from the University of Tennessee in Knoxville, Tennessee.

March 2000



PETER S. WINOKUR

Dr. Peter S. Winokur of Maryland has been appointed a Member of the Defense Nuclear Facilities Safety Board for a term expiring October 18, 2009. Dr. Winokur has 37 years of experience as a scientist and engineer in the field of radiation effects science, technology, and hardness assurance in support of military and space systems. A Fellow of the Institute of Electrical and Electronic Engineers and the American Physical Society, he was selected as one of the most highly cited researchers in Engineering by the Institute for Scientific Information, which lists the 250 most highly cited researchers in the world in given scientific fields. Following is a brief resume:

2006 – Present	Member, Defense Nuclear Facilities Safety Board
2005 – 2006	Senior Policy Analyst, Congressional Affairs, National Nuclear Security Administration. Liaison to Congress on a broad range of policy, legislative, and budget issues dealing with nuclear weapons, nuclear nonproliferation, energy, and research and development.
2001 – 2004	IEEE Congressional Fellow, Office of Senator Harry Reid. As Energy and Transportation Advisor, crafted energy policy that included tax legislation for renewable energy, resulting in billions in economic development and the creation of tens of thousands of jobs.
1989 – 2000	Manager, Radiation Technology and Assurance Department, Sandia National Laboratories. Led programs focused on radiation-effects science and technology, hardness assurance, and development of radiation-hardened microelectronics for military and space applications.
1987 – 1989	Supervisor, Radiation Technology and Materials Division, Sandia National Laboratories. Radiation physics, materials, and modeling in support of advanced technologies with severe reliability and radiation hardness requirements. Initiated SEMATECH programs dealing with equipment and processes for improved yield and reliability.
1983 – 1987	Member Technical Staff, Advanced Microelectronics Development Division, Sandia National Laboratories, Albuquerque, NM.
1979 – 1983	Senior Staff Physicist, Radiation Effects Branch Harry Diamond Laboratories, Adelphi, MD.
1969 – 1979	Physicist, Radiation Effects Branch Harry Diamond Laboratories, Washington, DC.
1968 – 1969	Scientist, Optical Character Reader Division Control Data Corporation, Rockville, MD.

Dr. Winokur has won numerous awards including the 2000 IEEE Millennium Medal, IEEE Nuclear & Plasma Sciences Merit Award, R&D 100 Award, Industry Week's Top 25 Technologies of Year, Discover Award, and prize-winning papers. He is the author of 140 publications in the open referred literature, including more than 30 invited papers, book chapters, and short courses.

Education	Ph.D., University of Maryland, 1974: Physics
	M.S., University of Maryland, 1971: Physics
	B.S., The Cooper Union, 1968: Physics

DNFSB Board Members taking the oath of office at the White House – October 25, 1989.
From left to right, John H. Sununu – White House Chief of Staff, John W. Crawford, Edson G. Case, John T. Conway – Chairman, A.J. Eggenberger – Vice Chairman, Herbert J.C. Kouts

Senators John Glenn (2nd from left) and Strom Thurmond (2nd from right) with Board Members at the White House oath of office ceremony – October 25, 1989.

DNFSB Board Members conducting a site visit at the Waste Isolation Pilot Plant (WIPP) located in Carlsbad, New Mexico – January 1990 From left to right, Herbert J.C. Kouts, John T. Conway - Chairman, Wendell Weart – Sandia lead engineer for WIPP, Edson G. Case, John W. Crawford, A.J. Eggenberger – Vice Chairman

DNFSB Board Members – December 1997. From left to right, John E. Mansfield, Herbert J.C. Kouts, John T. Conway – Chairman, A.J. Eggenberger – Vice Chairman, Joseph J. DiNunno

DNFSB Board Members – August 2002. From left to right, Jessie Hill Roberson, John T. Conway – Chairman, John E. Mansfield, A.J. Eggenberger – Vice Chairman, Joseph J. DiNunno

DNFSB Board Members – March 2004. From left to right, John E. Mansfield, John T. Conway – Chairman, A.J. Eggenberger – Vice Chairman, R. Bruce Matthews

DNFSB Board Members – October 2007. From left to right, John E. Mansfield – Vice Chairman, Larry W. Brown, A.J. Eggenberger – Chairman, Peter S. Winokur, Joseph F. Bader

DNFSB Site Representatives – August 1994. From left to right, Harry Waugh – Pantex, Jim McConnell – Pantex, Dan Ogg – Hanford, Joe Sanders – Savannah River, Bob Warther – Rocky Flats, Kent Fortenberry – Savannah River, Paul Gubanc – Hanford, Mark Sautman – Rocky Flats

DNFSB Professional Development Program employees – November 1992.
From left to right, William (Ike) White, Derek Barboza, Joe Sanders, Jessica Booher, Paul Ret, Victor Williams, Walter Moore, Russell Green, Herb Massie – Senior Technical Mentor for the PDP Program

DNFSB Board Members conducting a public meeting and hearing in Los Alamos, New Mexico to assess the current safety posture at Los Alamos National Laboratory – December 5, 2007.

Board Staff on the steps of the Canadian Embassy taken by Mike Leggett and Andy Thibadeau - November 1996

For key to staff photo,see numbered list below.

Key to Board Staff Photograph on the steps of the Canadian Embassy, November 1996

1. Cindy Fleenor
2. Dudley Thompson
3. Rich Tontodonato
4. Jim Troan
5. Bill Von Holle
6. Ike White
7. Don Wille
8. Dermot Winters
9. Bill Yeniscavich
10. Roger Zavadoski
11. Larry Zull
12. Dave Drop
13. Donita Vines
14. Sue Megary
15. Mike Merritt
16. Cynthia Miller
17. Matt Moury
18. Dominic Napolitano
19. Jan Preston
20. Joe Roarty
21. Randy Robinson
22. Louise Sabo
23. Herb Massie
24. David Ralston
25. Tim Hunt
26. Tonya Huntley
27. Davis Hurt
36. David Hayes
37. Monique Helfrich
38. Ron Barton
39. Connie Hundemer
40. Joel Blackman
41. Colleen Snyder
42. Lora Steed
43. Dan Burnfield
44. Alice Waagner
45. Lester Clemons
46. Sheree Ward
47. Ray Daniels
48. Joyce Davis
49. Todd Davis
50. Tim Dwyer
51. Jay DeLoach
52. Jack Deplitch
53. Woody Cunningham
54. Mark Flynn
55. Vi Johnson
56. Dana Hienz
57. Nadine Loften
58. Laureen Manning
59. Brenda Atkins
60. Wayne Andrews
61. Ralph Arcaro
62. Elaine Baer

28. Loretta Borostovik
29. Lisa Jellett
30. Roy Kasdorf
31. Martina Felton-McCree
32. Bruce Graham
33. Russell Green
34. Ajit Gwal
35. Asa Hadjian

63. Farid Bamdad
64. Rich Azzaro
65. Sandy Hairston
66. John MacEvoy
67. Rick Schapira
68. Bill Shields
69. Gloria Jones
70. Ken Pusateri
71. Christine Centeno
72. Joe Neubeiser
73. Sue Dickerson
74. Dea Ruff
75. Nancy Creason

Top Row (Left to Right): Larry W. Brown, Peter S. Winokur, Joseph F. Bader, John E. Mansfield

Bottom Row (Left to Right): John W. Crawford, Jr., Jessie Hill Roberson, A.J. Eggenberger, John T. Conway, Joseph John DiNunno, R. Bruce Matthews

Photo by A. Thibadeau