Post-Hearing Questions for the Record
Submitted to the Honorable Joseph F. Bader
From Senator Ron Johnson

"Contract Management by the Department of Energy"
June 27, 2013

1. How many recommendations has the DNFSB made to DOE since it was created? Have any not been accepted by DOE?

   Board's Response:

   Over the 23-year period of 1990 to 2013, the Board has issued 57 Recommendations to the Secretary of Energy. Only one of the Board's Recommendations has been partially rejected. This was Recommendation 2010-1, "Safety Analysis Requirements for Defining Adequate Protection for the Public and Workers." Currently, there are 12 open Recommendations.

2. The hearing highlighted a number of cases, including the Hanford Waste Treatment Plant and the Idaho National Lab Integrated Waste Treatment Unit where DNFSB recommendations or other input received midway through a project caused delays and cost increases. In your written testimony, you discussed DNFSB and DOE efforts since 2005 to better coordinate on review of safety design elements early in the process. How have these efforts changed DNFSB involvement in project oversight since 2005? Please provide an example of a project where DNFSB-DOE early collaboration has yielded benefits.

   Board's Response:

   The Board disagrees with the contention that the Board caused delays and cost increases in DOE's design and construction projects, including Hanford's Waste Treatment and Immobilization Plant and the Idaho National Laboratory's Integrated Waste Treatment Plant. The Board conducts its formal reviews of DOE's project information in accordance with the availability of documentation associated with DOE's acquisition decision process as laid out in DOE Order 413.3B, "Program and Project Management for the Acquisition of Capital Assets." Within this process, DOE's Critical Decision phases are aligned with the production of safety documentation and resolution of project issues. This allows the Board to identify and communicate any concerns it may have to DOE and stay off DOE's critical path. This is the Board's goal. DOE has experienced cost increases and project delays as a result of its decisions to implement significant project design changes after beginning construction or failure to adequately resolve known safety issues.

   On the question about how the Board's involvement in project oversight changed since 2005, incorporating safety issues into project planning was the topic of a series of three Board public hearings and meetings from December 7, 2005, to March 22, 2007. The purpose of these public hearings and meetings was to discuss policies, expectations, and processes for integrating safety into the design of DOE's defense nuclear facilities.

The meetings were the result of the Board's observation that DOE demonstrated considerable difficulty integrating safety into the design of certain defense nuclear facilities. DOE's difficulties are attributed to the lack of integration of safety during the design development process, inadequate development of design criteria, or proposed designs that do not meet intended safety goals. The situation is further complicated because construction usually starts before the design is complete and typically DOE's unresolved safety issues are closely coupled with broader concerns that include technical, operational, maturation of technology, and construction schedule issues. In the 2007 public hearing and meeting on safety-in-design, the Board and DOE agreed that implementation of safety at the earliest stages in the design of an environmental clean-up or construction project is crucial to achieving mission related goals and reducing cost increases and schedule delays. It was also agreed that integrating safety late in the design process can lead to cost increases and schedule delays.

A summary of how the efforts to identify and resolve safety issues early in the design process changed DNFSB involvement in project oversight is contained in the July 19, 2007, "Report to Congress on the Status of Significant Unresolved Technical Differences between the Board and the Department of Energy on Issues Concerning the Design and Construction of DOE's Defense Nuclear Facilities." Enclosure (1) of that report summarizes the actions the Board and DOE took to provide for more timely identification and resolution of safety-related technical issues raised by the Board. These actions include the following:

- *Issuance of "Project Letters" that summarize unresolved safety issues and the Board's view of the safety status of projects at appropriate critical decisions. For example, Board Project Letters are typically issued as the project advances from conceptual, to preliminary, and to final design. Starting in 2007, the Board has issued 15 Project Letters on 10 different design and construction projects with the latest being issued in July 2012.*

- *Issuance of "Periodic Reports to Congress" that summarize to the Congress unresolved safety issues on a project by project basis. To date, the Board has issued 19 Periodic Reports to Congress with the latest being issued in July 2013.*

- *DOE updated DOE Order 413.3A, "Program and Project Management for the Acquisition of Capital Assets," which implements changes focused on early integration of safety into design.*

- *DOE implemented a new Standard 1189, "Integration of Safety into the Design Process." The standard implements specific actions during the project design phase to achieve the safety-in-design objectives incorporated into DOE Order 413.3A. DOE committed to updating Standard 1189 as part of the implementation plan to resolve the Board's Recommendation 2010-1, "Safety Analysis Requirements for Defining Adequate Protection for the Public and the Workers."*

- *DOE and the Board selected two major projects, the Uranium Processing Facility and the Integrated Waste Treatment Unit (IWTU), to demonstrate safety-in-design requirements of Order 413.3A and Standard 1189.*

DOE and the Board chose the IWTU at the Idaho National Laboratory to pilot the integration of the safety and design initiative. In the Board's view, the IWTU project represents a good example of how the Board's collaboration with DOE yielded positive safety-related results. The Board issued two letters on IWTU, a Board Project Letter and a Board Letter containing a staff issue report. In the first Project Letter, dated January 24, 2007, the Board stated that it did not have any significant safety issues regarding the IWTU at that time. However, the Board believed that several safety-related items should be resolved prior to final design and construction. These items were reported as open Board issues in the Board's Periodic Reports to Congress from 2007 to 2009. The Board documented DOE's resolution of these issues in the Board's February 9, 2009, Periodic Report to Congress.

The topic of the second Board Letter, dated May 1, 2008, addressed IWTU's seismic and structural design. The Board's reviews revealed a number of issues related to the development of the design basis ground motion and overall seismic design for the facility. This letter further stated that as a result of significant efforts made by the DOE's Idaho Operations Office (DOE-ID) and the IWTU structural designer, Simpson, Gumpertz & Heger, all issues were resolved and appropriate changes to the design were made. The Board commended both DOE-ID and Simpson, Gumpertz & Heger for resolving these issues in an expeditious manner. IWTU is currently progressing to the hot commissioning stage of operations, which is anticipated for 2014.

3. In your testimony, you stated that while the DNFSB does not conduct cost-benefit analyses of its recommendations, it does consider their "economic feasibility." What standard does the DNFSB use to assess economic feasibility?

Board's Response:

The Board's interpretation of the technical and economic feasibility of Recommendations is documented in a February 14, 2013, report to the Chairmen and Ranking Members of the Senate and House Armed Services Committees [copy enclosed]. The report states that each of the Board's five members individually assess the economic feasibility of a Recommendation based on careful consideration of the data, briefings, and technical discussions held with/provided by DOE and the Board's staff. The Board considers economic feasibility by comparing the rough order of magnitude[1] cost of alternative approaches and structuring Recommendations so as to allow the Secretary flexibility in designing cost-effective actions needed to address Board Recommendations. Congressional guidance on the criterion for economic feasibility states that (1) the Board is not required "to make formal findings concerning economic or technical feasibility"[2] and (2) "the burden of demonstrating that a Recommendation is not technically or economically feasible rests with the Secretary."[3]

Enclosure

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[1] Rough-order-of-magnitude cost estimates are described in "GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs" (GAO-09-3SP, March 2, 2009).
[2] *S. REP.* NO. 100-173, at 28-29 (1987).
[3] *Id.*

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

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

February 14, 2013

The Honorable Carl Levin
Chairman
Senate Armed Services Committee
United States Senate
269 Russell Senate Office Building
Washington, DC 20510

The Honorable James Inhofe
Ranking Member
Senate Armed Services Committee
United States Senate
205 Russell Senate Office Building
Washington, DC 20510

Dear Chairman Levin and Ranking Member Inhofe:

The Joint Explanatory Statement of the Committee of Conference accompanying the Conference Report for the National Defense Authorization Act for Fiscal Year 2013 directed the Chairman of the Defense Nuclear Facilities Safety Board to ". . . submit a report to the congressional defense committees by February 15, 2013, regarding how the DNFSB considers the technical and economic feasibility of implementing its recommended measures." (Report, p. 394)

On behalf of the DNFSB, I am pleased to submit the report appended to this letter in response to the Conference Committee's direction.

Sincerely,

Peter S. Winokur, Ph.D.
Chairman

cc: The Hon. Ben Nelson, Chairman, Senate Armed Services Strategic Forces Subcommittee
The Hon. Jeff Sessions, Ranking Member, Senate Armed Services Strategic Forces Subcommittee

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

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

February 14, 2013

The Honorable Howard P. "Buck" McKeon
Chairman
House Armed Services Committee
United States House of Representatives
2310 Rayburn House Office Building
Washington, DC 20515

The Honorable Adam Smith
Ranking Member
House Armed Services Committee
United States House of Representatives
2264 Rayburn House Office Building
Washington, DC 20515

Dear Chairman McKeon and Ranking Member Smith:

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Peter S. Winokur, Ph.D.
Chairman

cc: The Hon. Mike Rogers, Chairman, House Armed Services Strategic Forces Subcommittee
The Hon. Jim Cooper, Ranking Member, House Armed Services Strategic Forces Subcommittee

Board Interpretation of "Technical and Economic Feasibility"

I. Introduction

The Board's enabling act, 42 U.S.C. § 2286 et seq., tasks the Board with issuing recommendations to the Secretary of Energy regarding public health and safety at the Department of Energy's (DOE's) defense nuclear facilities. Section 2286(a)(5) contains the following requirement: "In making its recommendations, the Board shall consider the technical and economic feasibility of implementing the recommended measures."[1] In this report, the Board explains how it implements this statutory requirement.

II. Overview

It is the role of the five Board Members, nominated by the President and confirmed by the Senate as recognized experts in nuclear safety matters, to individually make their own decision on whether the recommendation they are considering is technically and economically feasible. Such a decision is made based on a careful consideration by each Board Member individually of the sum total of the information, data, briefings and technical discussions held with/provided by DOE and Board staff. This material is made available over the considerable period of time from initial consideration of a safety issue and whether it rises to the level of a recommendation through final approval/denial of the proposed draft before the Board Member.

The Board considers technical feasibility by ensuring that each recommendation is capable of implementation using generally accepted scientific and engineering principles. The Board considers economic feasibility by comparing the rough order of magnitude cost of alternative approaches and structuring recommendations so as to allow the Secretary flexibility in designing cost-effective actions needed to address Board recommendations. The Board does not use a cost-benefit analysis formula.

The Board's consideration of technical and economic feasibility is guided by the substantial legislative record surrounding the development and approval of the Board's enabling act by Congress. The principal sponsor of the Board's enabling act in the late 1980s was Senator John Glenn of Ohio, then Chairman of the Senate Committee on Governmental Affairs. Senator Glenn introduced S. 1085, the "Nuclear Protections and Safety Act of 1987," in April of 1987. The Committee on Governmental Affairs reported on the bill on September 24, 1987, in Senate Report 100-173 which addressed the subject of "technical and economic feasibility," quoted in full below:

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[1] This provision was recently amended by the National Defense Authorization Act for Fiscal Year 2013 to read: "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" (emphasis added).

> [I]n making its recommendations, the Board is directed to consider technical and economic feasibility. This is not a cost-benefit analysis formula. The Board's recommendations to substantially reduce the likelihood that events will occur at any DOE nuclear facilities should not be restricted by cost. Technical feasibility requires that the Board's recommendation be capable of implementation using generally accepted scientific and engineering principles. Addressing economic feasibility means that in seeking to reduce risks, the Board should compare the costs of alternative approaches so as to structure any recommendation in an economic manner. For example, the Board may determine that it will cost five hundred million dollars ($500,000,000) to reduce substantially the likelihood of a nuclear event at a twenty-year-old DOE production reactor, which has an expected useful life of twenty-three to twenty-five years and a replacement value of one billion dollars ($1,000,000,000). Under those circumstances, the Board could indicate what technical and engineering improvements would be needed to repair the existing facility so that it could achieve acceptable standards for continued operation, but recommend closing such an old facility and accelerating the planning and construction of a new, replacement facility as a more economic use of federal dollars.[2]
>
> Fifth, subsection (g)(6)(A) directs the Board in making recommendations to consider technical and economic feasibility. This standard does not require the Board to make formal findings concerning economic or technical feasibility. It is further recognized that the Board's recommendations will never be subject to scientific or economic certainties or be without controversy. Inevitably there will be instances where the Secretary believes the Board has not properly evaluated the data and reached correct conclusions concerning the safety of DOE's facilities. In those instances where the Secretary believes the Board's recommendation addresses a non-existent or extremely remote technical possibility, and implementing the changes will be extremely burdensome, the Secretary may disagree with the Board utilizing subsections (h)(1)(A) and (h)(2)(B)(i). The burden of demonstrating that a recommendation is not technically or economically feasible rests with the Secretary. If the Secretary disagrees with the Board's recommendation on these grounds, subsection (h)(2)(B)(i) requires the Secretary to report the disagreement to Congress and the President, along with the reasons for the Secretary's decision.[3]

S. 1085 was referred to the Senate Committee on Armed Services, then chaired by Senator Sam Nunn of Georgia. This committee reported on the bill on November 20, 1987. While the committee recommended a number of changes to the bill, it did not modify the "technical and economic feasibility" requirement for Board recommendations. The committee offered the following comment:

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[2] S. Rep. No. 100-173, at 28-29 (1987).
[3] *Id.* at 30.

> [I]n making its recommendations, the Board is directed to consider technical and economic feasibility. Technical feasibility requires that the Board's recommendations be capable of implementation using generally accepted scientific and engineering principles. Economic feasibility means that the Board may compare the cost of alternative approaches and structure its recommendations so as to reflect cost comparisons. The Board may compare the costs of alternative approaches to achieving adequate protection of public health and safety. The Board may consider such factors as the remaining useful life of facilities, schedules and plans for replacing them, and means to mitigate disruptions to ongoing operations that may result from recommended safety improvements, and other considerations.[4]

The Board has followed the guidance provided by the Senate committees during the ensuing 23 years and 57 formal recommendations.

The following three general principles can be extracted from the committee reports:

- The requirement to consider technical and economic feasibility "is not a cost-benefit formula."[5]
- The Board is not required "to make formal findings concerning economic or technical feasibility."[6]
- "The burden of demonstrating that a recommendation is not technically or economically feasible rests with the Secretary."[7]

The first of these principles is a direct consequence of the enabling act requirement that the Board determine a recommendation is "necessary to ensure adequate protection of public health and safety."[8] Hence, recommendations are not to concern safety above and beyond the Atomic Energy Act standard, but rather should look to achieving that standard of adequate protection. The courts have held that, unless required by statute, cost may not be weighed against measures needed to meet the statutory standard.[9]

The second and third principles are interrelated. The language of the statute directs the Board to "consider" technical and economic feasibility, yet Congress was aware that the Board would ultimately have to defer to the Secretary on application of these criteria. This is so because the Secretary is assigned the task of evaluating the Board's recommendations before drafting and providing to the Board an implementation plan. Part of this task involves deciding

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[4] S. REP. No. 100-232, at 26 (1987).
[5] *supra* note 1.
[6] S. REP. No. 100-173, at 28-29 (1987).
[7] *Id.*
[8] *Id.* at 5-7 (discussing the "adequate protection" standard to be used by the Board).
[9] *See* Union of Concerned Scientists v. U.S. Nuclear Regulatory Comm'n, 880 F.2d 552 (D.C. Cir. 1989); Union of Concerned Scientists v. U.S. Nuclear Regulatory Comm'n, 824 F.2d 108 (D.C. Cir. 1987), *reh'g en banc den.* 859 F.2d 237.

the best means to implement the safety objectives set forth in the recommendation. It therefore follows that the ultimate burden of deciding on technical and economic feasibility properly rests with the Secretary.

III. Development of a Recommendation

Before moving to a discussion of the two separate criteria, it is important to explain how the Board decides to issue a recommendation. Prior to the preparation of a recommendation, the Board and its staff will have evaluated the safety implications as well as technical and regulatory issues of concern. This evaluation is comprised of many activities: Board Member and staff visits to affected sites; briefings to the Board by DOE and its contractors; exchanges of formal correspondence; staff-to-staff meetings; reports to the Board submitted under a reporting requirement; and, in some cases, public hearings. By the time a recommendation is considered, DOE will be fully aware of the Board's concerns and will have provided much of the information relied on by the Board to formulate its position. None of the Board's 57 recommendations have been issued without this level of review and analysis.

The Board applies its deep understanding of DOE's nuclear facilities, underlying technologies, programs, standards, and procedures to avoid recommending measures that simply cannot be implemented. The Board has always been pragmatic in its review of alternative means and methods proposed by DOE to meet the intent of a recommendation. In the great majority of cases, DOE has been able to develop an implementation plan suitable to address the safety problems of concern to the Board. However, disagreements have arisen over priorities, risks, and safety criteria. These disagreements were expected by Congress: "Inevitably there will be instances where the Secretary believes the Board has not properly evaluated the data and reached correct conclusions concerning the safety of DOE's facilities."[10] All regulatory and oversight systems involve tension over complex problems. The Board believes that the best approach to satisfying Congressional intent is to be extremely thorough in exploring safety concerns prior to considering whether a recommendation to the Secretary is needed.

IV. Technical Feasibility

Both Senate reports include the same criterion for technical feasibility: is the recommended measure "capable of implementation using generally accepted scientific and engineering principles"?[11] This criterion would apply principally in cases where the Board recommends that DOE take specific physical actions such as installing new equipment, upgrading a safety system, engaging in a test program, and the like, as opposed to setting out a desired result without specifying means. Of its recommendations issued to date, 10 fall into this category.[12] In its other 47 recommendations, the Board is recommending that DOE address

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[10] S. Rep. No. 100-173, at 28-29 (1987).
[11] *supra* note 1; *id.* at 30.
[12] Recommendations 90-1, 90-3, 90-7, 93-5, 95-1, 2000-1, 2004-2, 2010-2, 2012-1, 2012-2.

concerns in its safety framework, including safety management programs dealing with fire protection, quality assurance, confinement ventilation, packaging, and administrative controls.

Assurance of technical feasibility of recommended measures is provided by three factors. First, the Board Members themselves are legally required to be recognized experts in the field of nuclear safety and thus trained in physics, chemistry, nuclear engineering, and mathematics. Second, the Board has recruited and maintains a technical staff holding advanced degrees in nearly every technical discipline applicable to defense nuclear facilities. Outside experts are regularly engaged (as authorized by the Board's enabling legislation) whenever specialized knowledge is required. Third, the corporate knowledge represented by the Board Members and its staff extends into every field of nuclear science and engineering, from theory through to implementation, including construction, operations, and project management. Taken together, these factors enable the Board to assure that prior to issuing a recommendation, the technical measures necessary to address the recommendation are readily available should DOE choose to implement them. Specific examples of recent recommendations are included in Section VI below.

Additional assurance is provided by the fact that the Secretary has not responded to any Board recommendation by arguing that the measures requested by the Board are "technically infeasible." This record gives the Board confidence that it has faithfully followed the guidance of Congress to recommend measures "capable of implementation using generally accepted scientific and engineering principles."

V. Economic Feasibility

Congressional guidance on this criterion can be summarized in these three points:

- The burden of demonstrating that a recommended measure "will be extremely burdensome" to implement rests with the Secretary.[13]
- The Board may compare the cost of alternative approaches and structure its recommendations so as to reflect cost comparisons.
- The Board may consider such factors as the remaining useful life of facilities, schedules and plans for replacing them, and means to mitigate disruptions to ongoing operations that may result from recommended safety improvements, and other considerations.

The reason for the first of these has already been noted: only DOE can estimate with any accuracy the precise cost of implementing Board recommendations. In most recommendations the Board identifies a safety concern and safety objectives, but leaves up to the Secretary what specific actions will be taken. Moreover, the Board lacks the resources, expertise, and information base on which to make financial estimates.

[13] S. REP. NO. 100-173, at 28-29 (1987).

In formulating the specifics of its recommendations and evaluating implementation plans, the Board does take into account such factors as "the remaining useful life of facilities, schedules and plans for replacing them, and means to mitigate disruptions to ongoing operations that may result from recommended safety improvements,"[14] and other considerations. Sometimes, the Board considers safety issues in an old DOE facility that may not be replaced for some years, if ever.[15] A recent example is the Board's consideration of newly-discovered seismic deficiencies which led to Recommendation 2009-2, *Los Alamos National Laboratory Plutonium Facility Seismic Safety.*[16]

> Near-term actions and compensatory measures to reduce significantly the consequences of seismically induced events will likely involve operating the facility with restrictions on material-at-risk, removing inventory from susceptible locations or storing material in robust containers, and reducing the likelihood of a fire following a seismic event by identifying and implementing appropriate safety measures. Consistent with the Board 's Recommendation 2004-2, *Active Confinement Systems*, one long-term strategy that could provide effective mitigation for seismic events involves upgrading the facility's confinement ventilation system to meet seismic performance category 3 criteria. This strategy would allow the confinement ventilation system to reduce reliably the consequences of a seismically induced event by many orders of magnitude to acceptably low values.

When NNSA learned of a significant increase in the estimated ground motion that the Los Alamos Plutonium Facility could experience during an earthquake, the Board carefully considered the subsequent dose consequence to the public following such an event. The Board then purposely crafted Recommendation 2009-2 so as to give the Secretary maximum latitude to choose the most effective remedies. A wide range of economically-feasible remedies were considered by the Board, including reduction of material-at-risk (MAR), changes in facility operations, and facility replacement. Recommendation 2009-2 identified the severity and urgency of the situation and called for an acceptable safety strategy involving both immediate and long term actions to reduce this risk. As noted above, the Board recommended that installation of an active confinement ventilation system be considered as part of an effective long-term strategy for risk-reduction. In short, the Board identified the risk to the public, and further

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[14] *Budget Request for Department of Energy Atomic Energy Defense Activities and Department of Defense Nuclear Forces Program: Hearing Before the Subcomm. on Strategic Forces of the H. Comm. on Armed Services*, 112th Cong. 5-6 (2011) (statement of Dr. Peter S. Winokur, Chairman, Defense Nuclear Facilities Safety Board).

[15] Congress expected this situation to occur: "Under those circumstances, the Board could indicate what technical and engineering improvements would be needed to repair the existing facility so that it could achieve acceptable standards for continued operation, but recommend closing such an old facility and accelerating the planning and construction of a new, replacement facility as a more economic use of federal dollars." S. Rep. No. 100-173, at 28-29 (1987).

[16] Issued October 26, 2009.

identified a wide range of economically-feasible remedies, then left it to the Secretary to select the specific remedial measures and timetable for implementation.

VI. Application of Principles to Recent Recommendations

In 2012 the Board issued two recommendations, both dealing with highly technical problems at defense nuclear facilities. On May 9, 2012, the Board transmitted Recommendation 2012-1, *Savannah River Site Building 235-F Safety*, to the Secretary of Energy. This recommendation dealt with removing plutonium-238 (Pu-238) contamination from an inactive facility. Recommendation 2012-2, *Hanford Tank Farms Flammable Gas Safety Strategy*, sent to the Secretary on September 28, 2012, addressed a serious safety problem at the Hanford Tank Farms. In both cases, the Board was fully informed as to the nature of the safety problem and recommended technically and economically feasible measures that should resolve the issues in a reasonable period of time.

Recommendation 2012-1

Building 235-F at the Savannah River Site no longer has a programmatic mission. It is operated in a surveillance and maintenance mode, is normally unoccupied, and houses several partially deactivated processing lines. With the exception of residual contamination, Building 235-F has been de-inventoried of special nuclear material. This residual contamination constitutes the principal hazard and includes a significant quantity of Pu-238. Pu-238 in this facility is in the form of highly dispersible, fine powder. This form increases the potential dose consequences associated with a release.

The Board first identified the need to remove Pu-238 from Building 235-F in a 2003 letter to the Secretary of Energy: "In particular, Building 235-F was anticipated to be shut down in the near future, but now is planned to be used for long-term storage and related operations...the risk from several hazards ha[s] been accepted rather than eliminated (e.g., combustible inactive cables in KAMS and ... plutonium-238 contamination in Building 235-F)."[17] Later in 2003, the Board filed a special report requested by Congress. The Board stated in regard to this same facility:

> DOE should carry out its plan to remove and characterize plutonium materials currently stored in 235-F. DOE should not plan extended storage of plutonium in 235-F until it has completed implementing the proposals in this report. It may be preferable from safety, cost, and mission perspectives to pursue storage elsewhere at SRS. Options include an enhanced KAMS facility, a new storage facility, or an expanded PDCF.[18]

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[17] Letter from John T. Conway, Chairman, Defense Nuclear Facilities Safety Board, to the Hon. E. Spencer Abraham, Secretary, U.S. Dep't of Energy (June 12, 2003). This letter was based on several years of work by the Board's technical staff in the form of onsite inspections of Building 235-F and review of DOE's documentation of the building's radioactive inventory.

[18] Defense Nuclear Facilities Safety Board, Study of Facilities for Storage of Plutonium and Plutonium Materials at Savannah River Site 2-5 (2003).

The Board reiterated this concern in a second report to Congress in 2005. In that report, the Board stated:

> The Board notes that DOE-SR intends to continue making some structural and equipment upgrades to 235-F. DOE-SR considers these upgrades necessary to provide confinement of plutonium-238 holdup in old processing cells should there be a significant earthquake. The presence of extensive plutonium-238 holdup is one of the most significant hazards in 235-F. The Board believes the first priority for DOE-SR should be to decontaminate the process cells to eliminate this hazard. Any structural or equipment improvements would be warranted only if the effort to decontaminate the plutonium-238 holdup were protracted. The Board will continue to follow this issue in the course of its normal safety oversight for the site.[19]

On a number of occasions from 2005 to 2012, DOE evaluated options and developed plans to remove Pu-238 residual contamination from this facility. However, because these efforts never moved beyond the planning stage, the Board found it necessary to recommend that the Secretary take action to reduce the radiological hazard of this deteriorating facility. By 2012, the Board and its staff had been involved in the technical issues presented for more than a decade. During that period, the Board had the opportunity to review DOE's own plans for Pu-238 decontamination, plans that were never put into effect. The Board became increasingly concerned that ventilation and fire protection systems were continuing to degrade. In addition, the construction of the MOX facility in recent years had placed many additional workers at risk.

Recommendation 2012-1 thus identified the need for DOE to take near-term actions to more effectively prevent a major fire in Building 235-F and 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.

As regards to technical feasibility, the Board recommended near-term actions to reduce the fire hazards in Building 235-F from combustibles and electrical ignition sources. The Board pointed to a September 2011 walkdown of Building 235-F by Board staff that specifically identified a significant quantity of transient and fixed combustibles and unnecessary, non-air gapped electrical equipment. Remedial measures clearly involved generally accepted practices. The recommendation further addressed hazards associated with residual contamination. The Board understood that immobilization and/or removal of the hazardous material involved standard engineering practices.

As regards economic feasibility, the Board considered DOE's previous evaluations and plans to immobilize and/or remove residual Pu-238 contamination. The Board further understood that as an alternative to immobilization/removal of residual contamination,

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[19] Defense Nuclear Facilities Safety Board, Study of Facilities for Storage of Plutonium and Plutonium Materials at Savannah River Site 2-4 (2005).

physical upgrades to fire and ventilation safety systems could also have resulted in adequate protection. However, given the lack of facility mission and remaining life, and the likelihood that immobilization/removal would ultimately be necessary, physical upgrades (other than early warning smoke and fire alarms) were understood to be economically inefficient. Accordingly, Recommendation 2012-1 advised the Secretary to take immediate, low cost actions such as removal of combustibles, de-energization and air-gapping of electrical ignition sources, evaluation of early detection alarm systems, and upgrades to the emergency response plan. The Secretary was further advised to immobilize or remove residual contamination as a long-term measure by whatever method the Secretary found to be most efficient and effective.

On July 10, 2012, the Secretary of Energy accepted the recommendation. In his acceptance letter, the Secretary stated:

> DOE agrees with the Board that action must be taken to reduce the hazards associated with the material at risk that remains as residual contamination within Building 235-F. The Board acknowledged in its letter that DOE has taken action to de-inventory Building 235-F of special nuclear material. DOE has also taken action to remove the transient combustible material within Building 235-F and to limit access. In developing an Implementation Plan, DOE will address all sub-recommendations with the ultimate goal of reducing, to the extent feasible, the radiological hazards from residual contamination and the fire hazards due to excessive combustible materials and electrical ignition sources . . . We look forward to working with the Board as we work to reduce the hazards posed by Building 235-F.[20]

The Board is now reviewing DOE's implementation plan, submitted on December 5, 2012. The plan identifies no areas of the recommendation that, in DOE's view, are technically or economically infeasible.

Recommendation 2012-2

In this recommendation, the Board requested that DOE take a number of specific actions to reduce the accident threat posed by flammable gases in storage tanks at the Hanford Tank Farms. The ventilation systems for the double-shell tanks (DST's) in the Tank Farms are important in preventing and mitigating potential accidents involving the flammable gases generated by the high-level wastes stored in these tanks. The Tank Farms safety analysis shows that many of the tanks contain sufficient quantities of gas trapped in the waste such that flammability limits could be exceeded if the gases were spontaneously released, which is possible under both normal operating and accident conditions. Furthermore, all the double-shell tanks contain wastes that continuously generate flammable gases and would eventually create a flammable atmosphere in the tank without adequate ventilation. Consequently, ventilating the double-shell tanks will prevent hydrogen explosions in the vessel headspace.

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[20] Letter from the Hon. Steven Chu, Secretary, U.S. Dep't of Energy, to Dr. Peter S. Winokur, Chairman, Defense Nuclear Facilities Safety Board (July 10, 2012).

Tank ventilation has been the preferred safety strategy to adequately protect collocated workers and the public for most of the past two decades.

In 2010, DOE approved downgrading the functional classification of the ventilation systems from safety-significant to general service. In lieu of a credited engineered feature, DOE implemented an administrative control to monitor flammable gas conditions in the tanks. However, the Board identified a number of weaknesses with the administrative control, including the need to effectively measure flow rates in the ventilation system. The weaknesses collectively rendered the control inadequate to perform the specified safety function. The Board further noted that other engineered systems providing indications used in determining whether operators need to take corrective action were not classified as safety significant and would not be qualified or maintained by DOE in accordance with their safety function. The Board documented its concerns in a letter to DOE on August 5, 2010.

In response, DOE issued a letter to the Board on February 25, 2011, stating that it would take action to restore the double-shell tank ventilation systems to safety-significant status and upgrade other monitoring systems to safety-significant status. However, DOE did not make meaningful progress in accomplishing these important commitments. The Board therefore issued Recommendation 2012-2 to bring the issue to the attention of the Secretary.

As regards to technical feasibility, the Board considered the nature and severity of the flammable gas hazards in the Hanford DSTs, the reliability of DOE's chosen safety strategy, and DOE's applicable safety requirements. The Board's recommendation considered that active confinement ventilation is the most effective engineering solution used to prevent the build-up of flammable gases in radioactive waste storage vessels. The technical feasibility of the recommendation was self-evident in that the ventilation systems already existed and had been previously credited and relied upon to perform this vital safety function at the Tank Farms.

As regards to the economic feasibility, the Board specifically recommended that DOE use a graded approach and "... determine the necessary attributes of an adequate active ventilation system that can deliver the required flow rates within the time frame necessary to prevent and mitigate the site-specific flammable gas hazards at the Hanford Tank Farms." In this regard, the Board was sensitive to the costs of recommending extensive upgrades to the existing system. The Board's recommendation recognized that the primary considerations involved reliable flow monitoring and assurance of the prescribed flow rates. Consequently, the Board recommended installing safety related flow monitoring in the tank farm ventilation system and restoring safety related maintenance and testing requirements to the installed active ventilation systems to assure that the required flow rates were met.

The Secretary accepted Recommendation 2012-2 in these terms:

> In developing an Implementation Plan (IP), DOE will take the pragmatic and graded approach detailed below to address the sub recommendations that will significantly improve the robustness of flammable gas controls in the near term. DOE is confident

> this is the most expeditious approach to implement a more robust safety control for Double Shell Tank (DST) ventilation monitoring consistent with the intent of Recommendation 2012-2.
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> * * * *
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> DOE is committed to the safe operation of its nuclear facilities consistent with the principles of Integrated Safety Management and the Department's nuclear safety requirements. DOE values the Board's input on how the Department can improve its activities. We look forward to working with the Board and its staff on preparing DOE's IP for Recommendation 2012-2.[21]

From these statements it appears that DOE is confident the recommendation can be implemented using a "pragmatic and graded approach" that will fully satisfy the Board's safety objectives. The plan identifies no areas of the recommendation that, in DOE's view, are technically or economically infeasible.

VII. Conclusion

Over a period of some 23 years, the Board has endeavored to follow the guidance provided by Congress in applying the statutory requirement to consider "technical and economic feasibility." Proof that the Board has succeeded rests in the fact the Secretary has accepted every Board recommendation in whole or in part; partial acceptances have not been based on failure to meet the technical and economic feasibility criteria. The Board will continue in every case to pragmatically search for technically sound and economically feasible solutions to safety concerns at defense nuclear facilities, while being mindful of the ultimate requirement that adequate protection be provided to the public.

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[21] Letter from the Hon. Steven Chu, Secretary, U.S. Dep't of Energy, to Dr. Peter S. Winokur, Chairman, Defense Nuclear Facilities Safety Board (Jan. 7, 2013).