OPERATIONAL FORMALITY FOR CONFINEMENT VENTILATION SYSTEMS: SOME LESSONS

Keynote Address

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by

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Introduction: The Defense Nuclear Facility Safety Board

The Manhattan Project, initiated in the early days of World War II, is generally recognized as the start of the nuclear age. Since then, the Department of Energy (DOE) and its predecessor agencies, the Atomic Energy Commission and the Energy Research and Development Administration, have produced considerable quantities of special nuclear materials and designed, manufactured, tested, and maintained the weapons in the nation's nuclear arsenal. During most of the last fifty years, the nuclear weapons complex operated without independent external oversight. In 1988, Congress, mindful of the accumulating public health and safety issues involving many of the aging defense nuclear facilities, enacted into law the creation of the Defense Nuclear Facilities Safety Board (Board). The five-member Board, composed of "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," was empowered to provide advice and recommendations to the Secretary of Energy to ensure adequate protection of public and worker health and safety at DOE's defense nuclear facilities. The Board became functional in late October 1989, when the charter Board members were sworn in.

The Board is responsible for independent oversight of all activities relating to nuclear safety within DOE's nuclear weapons complex. Today, DOE is actively engaged in the ongoing process of disassembling nuclear weapons, maintaining the remaining weapons in the stockpile in a safe and reliable condition, and conducting research focused on ensuring the continued stewardship of the stockpile. In addition, considerable attention is currently being devoted to safe disposition of fissionable material removed from disassembled weapons and of material remaining in the system following the abrupt cessation of many production activities more than seven years ago. Many of DOE's current activities are associated with cleanup of extensive radioactive contamination resulting from decades of production.

Its enabling statute, 42 USC § 2286, *et seq.*, requires the Board to review and analyze facility and system design, operations, practices, and events, and make recommendations to the Secretary of Energy that are necessary to ensure adequate protection of public health and safety. The Board must consider the technical and economic feasibility of implementing the recommended measures, and the Secretary must report to the President and Congress if implementation of a recommendation is impracticable because of budgetary considerations. If an imminent or severe threat to public health or safety is determined to exist, the Board is required to transmit its recommendations to the President, as well as to the Secretaries of Energy and Defense.

The Board is required by law to review and evaluate the content and implementation of health and safety standards, including DOE's orders, rules, and other safety requirements pertaining to the design, construction, operation, and decommissioning of DOE defense nuclear facilities. The Board must then recommend to the Secretary of Energy any specific measures, such as changes in the content and implementation of those standards, that it believes should be adopted to ensure that the public health and safety are adequately protected. The Board is further required to review the design of new defense nuclear facilities before their construction begins, as well as modifications to older facilities, and to recommend necessary changes. The Board's review and advisory responsibilities continue throughout the full life cycle of facilities, including not only the operational phase – specifically including the formality of operations – but also the shutdown and decommissioning phases.

The Board may conduct investigations, issue subpoenas, hold public hearings, gather information, conduct studies, establish reporting requirements for DOE, and take other actions in furtherance of its review responsibilities. These ancillary functions relate to the accomplishment of the Board's primary function, which is to assist DOE in identifying and correcting health and safety problems at defense nuclear facilities. The Department and its contractors at defense nuclear facilities are required to cooperate fully with the Board.

There are some rough parallels to the Board's oversight role in the commercial nuclear industry, although strictly speaking, the Board has no regulatory authority over DOE. In drawing those parallels, I will borrow heavily from a technical report of the Defense Nuclear Facilities Safety Board, *Operational Formality for Confinement Ventilation Systems at Hazardous Facilities of the U.S. Department of Energy*, DNFSB/TECH-XX, now in publication. I believe many of you know the principal author of that report, Dr. Roger Zavadoski, who is a member of the program committee for this conference.

Operational Formality

In the mid- to late-1970's, nuclear utilities were disappointed in the poor showing in performance-related measures for their nuclear units, such as plant availability, system reliability, and number of unscheduled outages. The industry-wide followup to the accident at Three Mile Island served to focus attention on extensive deficiencies in formality of operations. In particular, weaknesses were frequently identified in conduct of operations, maintenance, configuration management, testing and surveillance, technical oversight, competent personnel and leadership. Some of these had been regulated or reviewed by the Nuclear Regulatory Commission; others had received little attention from either the utilities or the regulators.

As a result of disclosures during this industry-wide introspection, the nuclear utilities formed their own internal oversight group, the Institute of Nuclear Power Operations (INPO), which promised the utilities that they could achieve better availability by responding affirmatively to suggestions provided by the INPO staff as a result of its reviews. Nearly twenty years later, the nuclear industry's experience vividly demonstrates the soundness of that promise.

There is no secret involved in the INPO approach. Quite simply, it consists of substantial strengthening of the formality of facility operations, combined with establishment of challenging goals, critical self-evaluations, and continuing feedback. Today, the approach seems fundamental, but in the post-Three Mile Island period, many utility personnel resisted the changes INPO proposed, voicing their desire to maintain maximum "flexibility" in operations. Eventually, however, INPO prevailed, flexibility generally gave way to formality of operations, and where it did, improved performance ensued.

Today, operation of many hazardous DOE facilities is reminiscent of operations in the commercial nuclear industry twenty years ago. Responsible DOE managers strive to maintain maximum "flexibility" for their operation. Maintaining such flexibility results in precisely the same outcomes as had prevailed in many nuclear utilities prior to their enlightenment: high numbers of Unreviewed Safety Question Determinations (USQD – the formal process for reviewing proposed system changes and previously undisclosed operating conditions to determine their potential impact on safety) and reduced reliability and availability.

A recent review of enriched uranium operations at Oak Ridge identified several ventilation/filtration issues, including inadequacies in: conduct of operations, safety documentation, configuration management, testing and surveillance, and technical oversight. These findings, which closely parallel the complex-wide deficiencies discussed in this report, as well as those disclosed in earlier reviews by the Board and its staff, coupled with DOE's slowness to respond, call for prompt action to avoid potentially serious consequences.

Today, I would like to share with you some realistic expectations for confinement ventilation systems at DOE defense nuclear facilities, compared to real as-found conditions for these systems, including examples derived from direct observations by the Board and its staff over a period of nearly five years. Based on lessons learned from the INPO experience, it is reasonable to postulate that introduction of substantially improved formality of operations in operation of confinement ventilation systems at DOE's hazardous facilities would increase performance and reliability of these important systems.

The Board's formal interest in ventilation/filtration systems began with the consideration of electrical power supplies at the TA-55 facility at Los Alamos National Laboratory (LANL), in the fall of 1993. This inquiry resulted in a public meeting in March of 1994, as a result of which LANL specifically rewrote the applicable diesel operating procedure to ensure starting the standby diesel generator and loading the ventilation systems upon loss of off-site power, until such time as a new, approved Safety Analysis Report became available.

On March 20, 1995 the Board issued its report *Overview of Ventilation Systems at Selected DOE Plutonium Processing and Handling Facilities*, DNFSB/TECH-3 (TECH-3). In its forwarding letter and in later correspondence, the Board imposed two reporting requirements on the Department. DOE's formal response to this exchange of letters took nearly a year. Of 36 actions proposed by DOE in its corrective action plan, nine remain open today. For some items, the path to final resolution is not clear, while for others, closeout is stalled for no apparent reason.

Several related side issues have been raised by the Board's staff. These include: (1) the need for filter test facilities; (2) the need for a Qualified Products List (QPL) test laboratory; (3) filter wetting, and (4) by-pass leakage considerations. In addition, the staff issued a separate report on radiation degradation of B-Plant filters at Hanford in April 1996.

In August 1997, the Board's staff identified the filter wetting issue and the safety related implications at the Rocky Flats Environmental Test Site. At the time, the staff was in the process of reviewing the results of by-pass leakage studies then underway at Rocky Flats, an issue raised more than two years earlier in TECH-3. This issue had been the subject of extensive correspondence, and, at the time, it still had not been resolved. At its root lies the conflict that arises when requirements associated with one safety-related system are permitted to take precedence over those of another safety-related system. Such a situation should not be permitted to occur; elimination of such conflicts is one of the major purposes of a sound configuration management program.

Characteristics of DOE Confinement Ventilation Systems

Although this audience needs little instruction on the subject of air cleaning, I trust you will allow me to review some basic aspects of confinement ventilation, to set the tone for material I intend to present.

Confinement, DOE's preferred method for protecting the public and workers from exposure to hazardous materials, encompasses both the physical structures in which the material resides and the associated ventilation systems. For highly hazardous materials, multiple confinement zones are often employed in series, each zone consisting of a separate structure and ventilation system. By design, air flows from areas with lower hazards to those with greater hazards, thus facilitating access to most areas with minimal risk. Before air is released to the environment, it is filtered to ensure that any residual contamination is well below acceptable, safe levels for public exposure.

For example, a typical three-zone system might comprise a building, a room within the building, and one or more glove boxes within the room, each zone with its own associated ventilation system. Because differential pressures from zone to zone establish the desired air flow direction and volume between zones, activities within one zone can affect those in another. Safe and effective operation of the composite system requires considerable knowledge, thought and care.

Mechanical components, such as ducts, fans, filters, dampers, valves and heating, cooling and de-humidifying units, typically comprise confinement ventilation systems, in addition to appropriate instrumentation and control systems and supporting utilities. The basic premise of system operation involves supplying inlet air at a lower rate than it is exhausted, thus ensuring a negative differential pressure from inlet to outlet (relative to external pressure) to ensure that flow is from areas with the least threatening potential to those with the most. Because of their vulnerability to fire damage, confinement ventilation systems demand special attention to fire protection.

An acceptable confinement system starts with a robust and well-documented design, which implies robustness not only in the physical structures involved, but also in the attributes of defense in depth incorporated in the overall system design. Confinement systems are expected to be thoroughly and explicitly described in applicable safety documents, such as Authorization Bases, Safety Analysis Reports and Technical or Operational Safety Requirements. Typically, the strenuous demands imposed by the need for uninterrupted operation of confinement ventilation systems over extended periods of time – often for years – has led to the exceptionally rugged designs found in many DOE applications today. For example, redundant filter banks and power supplies are commonly found as defense-in-depth features in modern applications.

Operational Formality for Safety Systems

In addition to soundly designed, robust structures and systems, adequate protection of the public and workers depends on development and implementation of programs to ensure proper functioning of the system under reasonable and expected circumstances and required service life. Such programs, under the general rubric of "formality of operations," are discussed in a recent technical report prepared by the Board's staff; they include conduct of operations, configuration management, maintenance and surveillance, testing, and training and qualification. These programs must be carried out by competent, alert, well trained and technically inquisitive individuals backed up by technical support, competent management and adequate funding.

In part, an effective conduct of operations program includes provisions for operational control, staff qualifications, formality of operations, procedures, equipment status, deficiency reporting and feedback. In an effective conduct of operations program, changing the operational status of any piece of equipment in the confinement system should require that only well trained and formally qualified individuals, who are (1) performing work with the proper discipline, (2) well aware of the current system status and its projected new status (including its expected response), and (3) following approved written procedures, be allowed to make changes. Deviations from an expected response should set in motion formal processes for determining what went wrong and potential resolutions and for feeding back that information.

Operation within the safety envelope also requires a strong configuration management program that preserves the integrity of the original design by permitting only suitable replacement parts to be used. The configuration management program should take into consideration the service life of substituted items. An effective configuration management program inevitably becomes more difficult as a facility ages; it also becomes more important that any changes are fully understood before they are implemented as a facility grows older.

A vigorous maintenance program staffed with trained and qualified personnel, who are guided by technically accurate and proven written procedures, with strong, complementary programs in predictive and preventive maintenance, is crucial for reliable performance of any confinement system. Access to a comprehensive record of maintenance history should be readily available and consistently reviewed. An effective maintenance program includes strong critique and feedback provisions, in order to enhance learning from past experience and is integrated into the day-to-day work planning function. This work planning function is expected to incorporate key verification steps, and to integrate the requirements of applicable safety documentation, the conduct of operations program, the maintenance program, resources, support services, configuration management and procurement into planning for safe execution of maintenance activities . A clearly delineated single chain of authority and responsibility, from the facility manager down to workers on the floor, should control all maintenance activities; no maintenance tasks should be performed without the knowledge and approval of the facility manager.

Testing and surveillance programs provide assurance that the system will perform as expected when called upon, and that key parameters and assumptions used in safety analyses remain valid and within acceptable levels. Testing and surveillance must be conducted by trained and qualified personnel in accordance with written procedures that reflect the actual configuration of the system; results should be reviewed routinely by the operations staff to confirm that the mode of operation continues to be appropriate. Special care is required when periodic tests might compromise confinement integrity; for example, filters installed in confinement systems require careful attention when field leak tests and by-pass leakage tests are conducted.

Technical review and oversight are necessary to ensure that boundaries of the safety envelope have not been violated. This element is particularly crucial when operating older equipment. The frequency of assessments of equipment functionality should be increased and be made more proactive when operating with aged equipment in unique configurations or situations. Another element of the technical review program should ensure that in-place programs continue to perform as expected. This review should be constant, ongoing, objective and independent. It should not duplicate internal programmatic reviews that provide feedback to individual programs. Rather it should provide a broader range review of the integrated functioning of all the programs with specific emphasis on shortcomings that impede the safe accomplishment of the facility's mission.

Existing Conditions at DOE Facilities

Let me review some of the existing conditions at DOE defense nuclear facilities.

The experience gained by DOE and its predecessor agencies in building confinement ventilation systems was captured in the Nuclear Air Cleaning Handbook. Since 1976, several unsuccessful attempts at revision of this handbook have been made. The current draft of this guidance has been under review for some time, but it still lacks crucial graphs, drawings and photographs, and is currently stalled for lack of funds, despite general agreement within the air cleaning community that revision is desirable based on more than twenty years since the handbook was last revised, if for no other reason.

Typically, the confinement ventilation systems found on high-hazard material facilities appear to be robust. It is not uncommon to find ventilation systems with all steel filter housings, containing multiple banks of roughing filters upstream from the HEPA filters, and supplied with redundant sources of power.

On the other hand, the weak link of confinement is most often the 15- to 30-mil HEPA filter medium. This filter medium consists of fiber glass and binder formed into a continuous sheet, in a process similar to paper making. The filter medium is made water repellant, but not water proof, prior to incorporation into a filter. Fire protection systems may wet this medium, some times repeatedly, during system tests or responses to real fires, and like paper, the filter medium is subject to deterioration from moisture.

A recent study found that chronological age of filters could not be used alone to determine operating life, since not only age, but also service conditions, dust loading and previous wettings all play roles in limiting usability. One site (Savannah River) limits HEPA filter use to no more than five years from date of manufacture. Reviews by the Board's staff identified some filters that have been in service for more than 20 years. There has been no Department-level attention paid to whether such disparate practices are appropriate.

A review conducted by the Board's staff in anticipation of proposed restart of the enriched uranium facility at the Y-12 Plant, disclosed that the initially proposed Operational Safety Requirements did not contain a single limit for any of the six ventilation systems that were credited in the safety analysis. The review also identified several additional ventilation/filtration issues, including inadequacies in: conduct of operations, safety documentation, configuration management, testing and surveillance, and technical oversight. These findings, which closely parallel the complex-wide deficiencies discussed in this report, as well as those disclosed in earlier reviews by the Board and its staff, coupled with DOE's slowness to respond, call for prompt action to avoid potentially serious consequences.

Based on additional observations, the Board has concluded that, in general, conduct of operations involving confinement systems is weak throughout the defense nuclear complex. Numerous instances have been encountered involving failure to conduct operations in accordance with approved procedures during expected upset conditions. A particularly egregious example of failure to adhere to disciplined conduct of operations occurred during the 1980's at Rocky Flats. As a result of a major fire in 1969, improved roughing filters in the exhaust ducts of most gloveboxes were installed, resulting in substantial pressure drops across those filters when they became loaded, and concomitant reductions in air flow through the gloveboxes. In order to offset this drop in air flow, it became a common practice to either set the filter aside, or puncture the filter medium with a sharp tool (e.g., a screwdriver).

The largest potential threat to the public from a high-hazard material facility is most commonly a fire accident scenario. Since fires often generate large volumes of smoke, they pose a potential threat to effective functioning of the filtration systems because the filters are rapidly loaded with the smoke particles, thus causing a potentially large pressure drop across the filter leading to a breach of confinement. At times during some fire scenarios, it may be necessary to stop flow to the filter systems because their destruction is imminent. Such a decision needs to be carefully evaluated ahead of time, with the resulting strategy clearly captured in procedures and rigorously practiced.

Further, the particulate material deposited on the HEPA filters is easily dispersed, as attested to by its having been borne downstream in the air flow. In the event of breakthrough of the filter in the presence of the heat from a fire, that material is readily lifted by buoyancy into the winds aloft, where it can be further dispersed in potentially serious downwind patterns. This makes some fires potentially more serious than explosions that generally drive much of the particulate matter into surrounding structures rather than elevating it into the prevailing winds.

One example of the importance of formality of operation in the context of the threat from fire is particularly informative. At one plutonium facility at the Rocky Flats Environmental Technology Site (RFETS), neither a strategy for isolating a confinement ventilation system nor an implementing procedure existed, despite the fact that the facility had two major fires in the past. Further, DOE was unaware of what might be found at other facilities. A DOE survey is underway to find out how each facility responds to a fire. Completion is forecast for the Fall of 1998.

There appears to be a lack of clear understanding across the complex regarding how confinement ventilation systems are best operated. For example, DOE has provided no guidance to its contractors regarding the suitability, credibility, or acceptability of a surveillance system that generates many alarms. This is important because frequent, or continuous, alarms generate a natural response among operating personnel that, over time, leads to acceptance of alarm conditions as normal. At RFETS, the Building 371 facility was operating with literally thousands of alarms per month, but no guidance had been provided by DOE as to the acceptability of these conditions. (In contrast, commercial nuclear facilities are expected to operate with "black boards", i.e., nothing in alarm status.).

The purpose of a vigorous configuration management program is to ensure that changes to a system maintain the integrity of design features, safety analyses, and operating procedures; and that such changes are adequately documented. Failure to implement a strong configuration management program inevitably leads to questionable physical changes to affected systems, loss in fidelity of operating procedures, and lapses in procedure compliance. In reviews of confinement ventilation systems at the Waste Isolation Pilot Plant (WIPP), RFETS, and the Savannah River Site (SRS), both the Board's staff and DOE's own internal auditors have observed "C" clamps being used as fasteners for dampers and ductwork on numerous
occasions. On one occasion at RFETS, wire and a piece of wood were fashioned into a louver operator, while in another case, also at RFETS, a piece of wood was wedged into a valve to keep it open.

Allowing hardware problems to remain unrectified or temporary solutions to remain open for extended periods of time without long-term resolutions in sight can obviously also affect the integrity of the configuration management program. At one RFETS facility, rather than resolve a long-term control problem for closing a particular isolation valve, the contractor relied on a louvered damper as a substitute for the faulty valve, based on an assumption that the damper was as leak-tight as the isolation valve would have been, had it been fully functional. Subsequent videotape taken from inside the ductwork showed that the damper was not fully seated. Without adequate configuration management, proper conduct of operations that ensures safety is impossible.

It appears that DOE's expectation for operating confinement ventilation systems is that "if it's within the OSR requirements, it's all right." This is reminiscent of the view held by the commercial nuclear industry prior to the accident at Three Mile Island, a view that focused on taking care of the safety-class equipment and observing the Technical Specification limits, but with considerably reduced focus on less formally prescribed restrictions. A similar mind set, with a slight twist, appears to have taken root at DOE. Over time at DOE's defense nuclear facilities, there has been a general downgrading of confinement ventilation systems from safety-class to safety-significant and, in some cases, simply to commercial standards. In many cases, confinement ventilation systems are interconnected and dynamically linked, as, for example, when they share a common discharge stack. At a number of facilities, faulty distinctions in relative safety significance of different interconnected ventilation systems have been made. This reflects a lack of technical understanding of the dynamic interrelationships among such systems and the resultant potential impact on safety.

Failure to exercise adequate formality of operations can lead to potentially serious radiation exposures. An recent example occurred during activities to deactivate gloveboxes at RFETS. Because the portion of the glovebox they were deactivating was located on the upstream side of design airflow pattern, workers assumed it was clean. Their assumption did not take into account that pressure and flow variations that occur could (and in fact did) distribute radioactive material throughout the glovebox. This oversight caused at least two workers to receive potentially significant uptakes of plutonium. More rigorous adherence to the principles of formal operation might well have precluded this occurrence.

A maintenance program that merely reacts to breakdowns without anticipating them is no maintenance program at all. Yet it is this type of maintenance that is most visible throughout the defense nuclear complex. Predictive and preventive maintenance programs, hallmarks of maintenance programs that are the standards in the nuclear industry, seem to be in their infancy for confinement ventilation systems at DOE defense nuclear facilities. Maintenance history programs, too, appear to be very rudimentary at these facilities. Where they do exist, they appear to address only some major components, and do not provide systematic coverage.

The calibration portion of the maintenance program is essential to ensure that instruments accurately reflect system conditions. Differential pressure gauges are used extensively in confinement ventilation systems. At the Y-12 Plant at Oak Ridge, the calibration programs entirely omitted calibration of these critical items. Further, when the calibration was eventually carried out, it was done with inadequate technical direction. When procedures were ultimately written, they required considerable additional work to make them workable. Specifically, it wasn't always clear where and when key steps were to be independently verified. Rigorous calibration programs, documented in written procedures, are generally not in place for confinement systems in the DOE defense nuclear complex.

Work planning, which integrates the demands of operations, maintenance and the safety envelope with personnel, training, material and time, is something that is in its infancy in the DOE defense nuclear complex, when compared to the commercial nuclear world. DOE's efforts seem piecemeal and without commitment. Good work planning for activities under a sound preventive maintenance program increases the availability of equipment. As a rule, DOE neither tracks nor sets goals for the availability of equipment.

No amount of predictive maintenance, preventative maintenance, or work planning will work unless a trained maintenance force is assigned. At Y-12, review by the Board's staff disclosed that insufficient maintenance resources were committed. As a result of these findings, additional maintenance personnel were assigned to the facility on a full-time basis. But DOE has not analyzed the required manning levels for maintenance programs at other DOE facilities, except at sites where operational readiness reviews have recently been conducted.

Despite the importance of testing of confinement ventilation systems, there is widespread lack of understanding about the purpose and applicability of required testing. The differences between laboratory efficiency tests of a HEPA filter done at a laboratory filter test station and *in situ* leak testing done at a facility are largely unrecognized. Although at one time both tests used the same surrogate aerosol material for test purposes, dioctylphthalate (DOP), thus leading to the misconception that they were equivalent tests, they did not test the same attributes. *In situ* field tests are conducted to demonstrate the leak tightness of the filter seats against the frame, while the laboratory test ensures only that the filter manufacturer produced an acceptable product with a specified removal efficiency.

In a number of cases, DOE field personnel and contractor staff members have proposed elimination of the laboratory test by running only the field test On the other hand, DOE HQ studies have shown that it is cost beneficial to send filters through the laboratory test stations, since by that means faulty filters are eliminated prior to installation, thereby avoiding the much greater cost of disposal of a contaminated filter identified only after installation and use.

Another common misconception is that *in situ* field testing demonstrates filter performance under upset conditions. In fact, incipient failure or severe internal structural degradation of the filter is unlikely to be detected by such tests; field testing merely tests the leak tightness of the filter's fit against the frame. Filters can be severely weakened by aging, wetting, loading, or prolonged exposure to chemical vapors or extremes in temperature, without necessarily failing *in situ* field tests. While some of these effects are understood, most are not, and the effects can act synergistically. Only the Savannah River Site has set an age limit for the use of HEPA filters.

Although confinement ventilation systems are installed in many DOE facilities, DOE has no complex-wide policy governing review and evaluation of safety analyses affecting these systems. Sometimes key assumptions are made in safety analyses which require nonstandard field verification on a periodic basis. For example, acceptable levels of building out-leakage during periods when the ventilation must be turned off would appear to be an appropriate subject for department-wide guidance based on peer-reviewed research. Instead, individual DOE facilities developed more or less *ad hoc* solutions, thus omitting any rigorous, complex-wide review and evaluation by independent subject matter experts. Today, such peer review is even more difficult, since DOE has backed away from its sponsorship of the biannual national nuclear air cleaning conference. There currently is still no standardized method of testing building out-leakage in use for the complex. Things are even more complicated when fire fighting strategies require the isolation of the ventilation systems. A comprehensive evaluation by competent system design and operations personnel is needed to determine solutions that balance potentially conflicting system requirements, while providing an adequate level of safety.

With regard to field testing, the most common deficiency is the lack of a suitable guidance for testing the variety of systems likely to be installed on a given site. A generic field test procedure developed for broad usage has been shown to be inadequate. For example, the accepted industry standard on this subject calls for a visual inspection of the filter installation prior to testing. Such inspections have frequently led to surprises, such as the use of caulking to form a seal between the filter and the frame, a practice that is banned by accepted industry standards. Despite the fact that facility- and system-specific procedures are required by standards, and are badly needed, they are typically found lacking throughout the defense nuclear complex, and have not been demanded by DOE.

Technical oversight of the confinement ventilation area has been lacking within DOE. The technical expertise that does exists, exists almost exclusively in the contractor ranks. The spectrum of ongoing problems from fire fighting strategies to filter wetting to smoke binding of filters to the need for adequate test facilities is indicative of lack of adequate senior management attention to this subject. Past Board exhortations for resolution of identified problems appear to have been passed down to the lowest levels of the organization, where those tasked with the responsibility to respond are given neither resources nor authority to resolve the problems. For example, in October of 1997 the Board brought to DOE's attention a significant challenge to the defense-in-depth concept, the potential problem associated with wetting HEPA filters. DOE does not propose to even have the scope of the problem identified until the end of September of 1998. This apparent inability to provide timely and responsive answers to Board inquiries is disturbing.

Technical oversight appears to be lacking in another area, as well. A DOE guidance document used for estimates of release fraction and respirable fractions during accident scenarios implies that HEPA filters remain efficient for an unreasonably long period of time at 825 °C. Other DOE guidance suggests exposure to a temperature of 750 °F for as little as five minutes can lead to some reduction in efficiency, a much more plausible outcome to exposure to these high temperatures. It appears that the flawed guidance may have been used in some fashion regarding thermal exposure of HEPA filters in recent safety documentation for enriched uranium operations restart at the Y-12 Plant in Oak Ridge. The possibility of its inappropriate use at Y-12 has been reviewed under a USQD, and the matter is still under review at other facilities. One part of the local DOE Field Office response is clear, however. The local Field Office questioned the contractor on the use of such a high temperature. When Field Office personnel were informed by the contractor that the practice was allowed in accordance with a DOE handbook, the cited information was verified as contained in the handbook, but no further evaluation was completed, because there was no resident DOE expertise in this subject area, nor was there knowledge of expertise available elsewhere in the DOE complex. This is clearly an instance where competent, technical oversight may have helped, had it been available.

Steps Toward Adequate Formality of Operation

When consideration is given to the differences in expectations and reality for confinement ventilation systems, it is clear that there are steps that should be taken to avoid problems in the future. These should include:

(1) ensuring that sound, integrated, goal-driven programs, with constant feedback, are developed for confinement ventilation systems and maintained with suitable rigor including, as a minimum: conduct of operations, configuration management, maintenance, testing and surveillance, and technical oversight (guidance in DNFSB-TECH 5, 6, and 15 should be considered);

(2) developing a sound consistent set of requirements and guidance for ventilation systems operation, maintenance, testing and design;

(3) ensuring that these programs, requirements and guidance are consistently applied to existing facilities during operation and modification, and new facility design, through an integrated complex-wide effort;

(4) recruiting and retaining technically competent personnel; and

(5) establishing strong central leadership.

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This address is based on a technical report of the Defense Nuclear Facilities Safety Board, *Operational Formality for Confinement Ventilation Systems at Hazardous Facilities of the U.S. Department of Energy*, DNFSB/TECH-XX, now in publication. The report was prepared for the Board by staff members Roger Zavadoski and Dudley Thompson, with assistance from Steve Krahn, Ron Barton, and Donald Owen.