NNSA LESSONS LEARNED

AND

RECOMMENDATIONS

FROM REVIEW OF

NASA'S COLUMBIA ACCIDENT INVESTIGATION

BOARD REPORT

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EXECUTIVE SUMMARY

By memorandum dated September 9, 2003, the National Nuclear Security Administration (NNSA) Administrator assigned Brigadier General Haeckel to assemble a team to review the Columbia Accident Investigation Board (CAIB) Report and identify lessons learned from the National Aeronautic and Space Administration's (NASA) experience that might be relevant to NNSA. Lessons learned are defined as, "A good work practice or innovative approach that is captured and shared to promote repeat application. A lesson learned may also be an adverse work practice or experience that is captured and shared to avoid recurrence."[1]

NNSA Site Offices and contractors are also conducting reviews of the CAIB Report for lessons learned applicable to their operations, although some have not fully completed their reviews. The team recommends that Site Offices and contractors submit to the Administrator their Lessons Learned reports and establish an enterprise-wide team to examine the collective findings, integrate the results, and develop additional perspective on complex-wide recommendations for action.

The primary focus of the team's review was Defense Programs (NA-10) and the Office of Nuclear Non-Proliferation (NA-20), their relationship with the Service Center, other Headquarter offices, the eight Site Offices, and on how the conclusions of the CAIB might provide insight to improve the management culture, organization, and technical capability of the NNSA. All reference to the NNSA organization within this report excludes Naval Reactors (NA-30) because of their already established and recognized strong safety program.

The team divided into three sub-teams (Management and Safety Culture Improvement (CI), Corporate Organization Improvement (OI) and Technical Capability (TC)) and developed ten lessons learned themes, as follows:

- Oversimplification of technical information could mislead decision-making.
- Proving operations are safe instead of unsafe.
- Management must guard against being conditioned by success.
- Willingness to accept criticism and diversity of views is essential.
- Effective centralized and de-centralized operations require an independent, robust safety and technical requirements management capability.
- Assuring safety requires a careful balance of organizational efficiency, redundancy and oversight.
- Effective communications along with clear roles and responsibilities are essential to a successful organization.
- Workforce reductions, outsourcing, and loss of organizational prestige for safety professionals can cause an erosion of technical capability.

[1] DOE-STD-7501-99

- Technical capability to track known problems and manage them to resolution is essential.
- Technical training program attributes must support potential high consequence operations.

From the outset of the team's review of the CAIB Report, the similarity of problems and challenges for NNSA and NASA were evident. Both organizations have a proud tradition of managing potential high consequence operations while achieving scientific and technical excellence, both organizations were built on the Cold War rivalry with the former Soviet Union, and both experienced similar uncertainties in their missions with the collapse of the Soviet Union. The political underpinning of NASA's Human Space Flight Program (U.S.-Soviet space competition) was lost, with no equally strong political objective to replace it. Similarly, NNSA's core mission, nuclear weapons design and production, experienced a comparable change in national priority. Both NASA and NNSA have subsequently pursued similar paths, namely downsizing personnel, consolidating operations, and relying more and more on contractors.

NNSA exhibits technical capability and organizational problems similar to those identified by the NASA CAIB. Chief among them is the merging of authority of Program Managers – who must be sensitive to costs and schedules – and "owners" of technical requirements and waiver capabilities – who are more sensitive to safety and technical rigor. When these authorities are merged, it creates a potential conflict of interest. Creating an Office of Chief Engineer is recommended with sufficient authority and responsibility to develop, maintain and oversee ES&H policies and standards, and to monitor the health of NNSA's technical staffing.

Also, NNSA should elevate the management and oversight of operational and infrastructure issues within Defense Programs and provide adequate resources by creating an organization that reports directly to the Deputy Administrator. This could be accomplished in one of several ways; however, whatever method is chosen, the team believes that Defense Programs needs additional resources to carry out its safety responsibilities. Related to the needed additional resources for safety within Headquarters, clear guidance must be provided to Site Office Managers with respect to delegated safety authorities from Headquarters.

The erosion of ES&H technical capability is another serious issue within NNSA. As the organizational transition progresses (e.g., stand-up of Service Center in Albuquerque), it is not clear whether or not the Site Offices have sufficient ES&H support. Effective management of this transition is necessary to define near-term (1-2 years) expectations of Service Center technical capabilities. Also, an integrated NNSA staffing study is necessary to validate current staffing plans. These studies should drive adequate staffing levels at Site Offices while also addressing Service Center staffing to meet peak demands and specific technical assistance for both Headquarters and Site Offices.

The technical capability of key decision makers (e.g., Site Office Managers) involved in potentially high-consequence operations is a crucial element of continued safe operations.

Rigorous technical training programs, succession planning to allow for technical growth, and/or technical education backgrounds are needed. Likewise, the provisions for adequate resources and the establishment of priorities for encouraging and emphasizing technical growth within ES&H staff, including career progression, are essential to the development and maintenance of the technical capability necessary to establish a robust safety culture.

The team is concerned that the abrupt reductions in contractor oversight and Headquarters review of Site Offices have left NNSA vulnerable to failure, especially until Line Oversight/Contractor Assurance System (LO/CAS) processes have been proven effective. Until the NNSA oversight model is defined and LO/CAS is fully implemented, NNSA should reinstate on-site reviews of Site Office oversight systems.

The majority of the NNSA CAIB Lessons Learned Review Team believes NNSA has an adequate concern for safety for potential high consequence programs (nuclear facility operations and nuclear weapons design and production) including adequate systems to ensure that operations are proven safe prior to initiation or deployment. However, the team also concludes NNSA (excluding Naval Reactors) must do more than only exhibit concern about safety. Rather, NNSA needs to aggressively encourage a diversity of views, accept and act upon feedback, avoid oversimplification of technical information, and establish free and open communication between all levels of the organization. A formal minority opinion process must be in place and routinely used. Additionally, NNSA management must be vigilant in guarding against the organization being conditioned by past successes. As the CAIB Report states, "Organizations that deal with high-risk operations must always have a healthy fear of failure – operations must be proved safe, rather than the other way around."

The CAIB Report states, "Leaders create culture. It is their responsibility to change it." The ability to judge the status or effectiveness of safety culture as an attitude within the NNSA is critical towards charting improvement. To this end, the entire team recommends that NNSA bring in outside expertise to provide an independent assessment of NNSA's safety practices and culture, and then to assist NNSA in developing a safety culture statement, steps, and metrics to bring about the necessary changes to improve NNSA's safety culture. Additionally, an NNSA Senior Safety Council is needed to better guide NNSA and to provide long-term consistency and continuity of safety policies, standards, and practices.

Recommendations from each sub-team's review are summarized in Section 3.4. and relevant details are in Appendix 2. Recommendations annotated in bold indicate those the team recommends "must" be implemented by NNSA management or an alternative approach must be found to address the underlying problem or lesson learned. Those that are not bolded "should" be implemented as management considers appropriate. The team advises that the NNSA Leadership Coalition and the Management Council carefully consider all recommendations and communicate the cultural and organizational lessons learned to all NNSA organizations.

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1.0 INTRODUCTION

By memorandum dated September 9, 2003, the NNSA Administrator assigned Brigadier General Haeckel to review the lessons learned from the space shuttle Columbia Accident Review Board (CAIB). The CAIB identifies NASA's history, culture, and organization as key elements in the failure to identify and evaluate critical safety issues. The CAIB Report discusses the attributes of an organization that could more safely and reliably operate within the inherent risks of the space shuttle. Likewise, the NNSA CAIB Lessons Learned Review Team has determined there are lessons that can be learned and applied to NNSA (Appendix 2). Specifically, the team addressed the CAIB Report with respect to the following questions.

1. Is NNSA's management and safety culture appropriate for an organization managing high technology, high-risk activities?

2. Are there issues raised by the CAIB Report that should be considered as we implement NNSA's new organizational model?

3. Will the re-engineered NNSA provide for the necessary technical capability for properly executing NNSA's safety management and regulatory responsibilities?

4. What changes would you recommend that NNSA adopt in light of the lessons learned by NASA?

This review takes advantage of the seven-month investigation performed by the CAIB and enables NNSA to evaluate NASA's lessons learned and to arrive at recommendations that will improve the acceptance and management of risk by NNSA. The team did not conduct a formal accident investigation nor did the team conduct a formal assessment of NNSA management practices. Instead, the team compared the CAIB findings against the organizational experiences of the team members in NNSA.

The NASA CAIB Report cited the Naval Reactors (NA-30) program as an example of a program focused on safety. The primary focus of this NNSA review was Defense Programs (NA-10) and the Office of Nuclear Non-Proliferation (NA-20) and their relationship with the Service Center, other Headquarter offices and the eight Site Offices. Operations related to NNSA's relationship with the Department of Defense (DoD) as a designer and supplier of weaponized nuclear explosives was not thoroughly examined. A review of safety methods/culture in Naval Reactors (NA-30) and our relationship with DoD may deserve follow-on action in order to improve the NNSA safety culture.

The team conducted its review in an open manner, allowing and, in some cases, promoting outside participation. The team was encouraged to share concerns and views openly and to voice minority opinions (Appendix 3).

2.0 REVIEW TEAM

The initial team was assembled from technical resources within Headquarters and the Service Center. By early October, the team also included representatives of Site Offices that were performing similar reviews at their site and by the team's decision to include representation from Pantex, a national laboratory, and another production site. Several other sites also contributed to this report through assignment of site staff to the team. Overall, the team was selected from across the weapons complex for their diverse views and technical backgrounds.

Three sub-teams were assigned with evaluating the areas of (1) management and safety culture improvement, (2) corporate organization improvement, and (3) technical capability. Each group was to determine if and how the CAIB lessons learned applied to NNSA, and propose recommendations.

2.1 Composition of Team

The composition of the team is as follows:

Team Chair
BGen. Ronald Haeckel, NA-10

Support Members
Ron Bentley, NA-13
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Ray Corey, NNSA Service Center
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Tom Rotella, NA-41
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Cdr. Bob Brese, NA-10
Mike Thompson, NA-117
Jeff Kimball, NNSA Service Center
Steve Lawrence, NSO

2.2 Conduct of Review

The first meeting was held September 17, 2003, to establish who, what, when, and how to manage the review. The team developed a review methodology and "roadmap" for proceeding at subsequent meetings. Sub-team leaders met among themselves and with their sub-team members preparing presentations and elements of the report for the Team Chair. Over the course of October, November, and December, the team met seven times.

During those meetings, sub-teams conducted formal presentations to the whole team for the purpose of sharing ideas and gaining further insight. The team's initial impressions were presented to Ambassador Brooks in October and preliminary conclusions were shared with the Leadership Coalition in early December. A draft report was then made available to the Leadership Coalition and Management Council for their review January 22-27, culminating in a Leadership Coalition meeting. A NNSA Safety Summit was held February 4, and lessons learned and recommendations from this report were presented.

The following sections are the evaluations and conclusions of the review.

3.0 SUB-TEAM EVALUATIONS

3.1 Management and Safety Culture Improvement (CI)

In answer to the question, *"Is NNSA's management and safety culture appropriate for an organization managing high technology, high-risk activities?"* The NNSA CAIB Lessons Learned Team reviewed the NASA CAIB Report and extracted 28 major attributes or safety themes. Of these 28 attributes, 14 were related to safety and management culture. These 14 attributes (plus two additional that were added later) were rolled up into four major themes:

1. Oversimplification of technical information could mislead decision-making.
2. Proving operations are safe instead of unsafe.
3. Management must guard against being conditioned by success.
4. Willingness to accept criticism and diversity of views is essential.

The CAIB Report focused on NASA's potential high-consequence activities related to human space exploration. The NNSA CAIB Lessons Learned Team also focused its efforts on potential high consequence activities internal of NNSA, namely the operation of nuclear facilities at NNSA sites and the nuclear weapons production program. We did not examine our relationship with the DoD where the NNSA functions as a partner in designing and supplying weaponized nuclear explosives to the U.S. military.

There are striking similarities between NASA and NNSA. Both organizations were built on the Cold War rivalry with the former Soviet Union and both experienced similar uncertainties in their missions with the collapse of the Soviet Union. The CAIB Report states,[2] "The end of the Cold War in the late 1980s meant that the most important political underpinning of NASA's Human Space Flight Program – U.S.-Soviet space competition – was lost, with no equally strong political objective to replace it." NNSA's core mission, nuclear weapons design and production, experienced a similar loss of national priority and both organizations have pursued similar paths in dealing with this loss, namely downsizing personnel, consolidating operations, and relying more and more on contractors. Both organizations have a proud tradition of scientific and technical

[2] CAIB Report, page 99

excellence. This led NASA to view itself as a "perfect place."[3] This in turn led to NASA managers "[losing] their ability to accept criticism, leading them to reject the recommendations of many boards and blue-ribbon panels."[4] A parallel to NASA's "perfect place" culture within NNSA would be the nuclear weapons design laboratories, commonly referred to as the Nation's "crown jewels." Also, like NASA, DOE has been criticized for years by Congress, GAO, the IG and others (e.g., the June 1999 report by the Special Investigative Panel of the President's Foreign Intelligence Advisory Board, the March 1999 report by the Commission on Maintaining United States Nuclear Weapons Expertise, and the March 1997 "120 Day Study" by the Institute for Defense Analysis) for its reluctance to adopt change recommended by outside organizations. In fact, it was this very criticism, in part, that led Congress to create NNSA as a semi-autonomous agency within DOE.

The majority of the NNSA CAIB Lessons Learned Review Team believes NNSA has an adequate concern for safety (see Appendix 3 for Minority Opinion) for potential high consequence programs (nuclear facility operations and nuclear weapons design and production) including adequate systems to ensure that operations are proven safe prior to initiation or deployment. The team concludes that NNSA (excluding Naval Reactors) must do more than only care about safety. Safety must be one of the organization's core values. NNSA needs to actively encourage a diversity of views, accept outside criticism, and avoid oversimplification of technical information. Additionally, NNSA management must take steps to ensure that the organization does not fall into the trap of being conditioned by past successes. As the CAIB Report states, "Organizations that deal with high-risk operations must always have a healthy fear of failure – operations must be proved safe, rather than the other way around."[5]

DOE and NNSA have invested many resources in Integrated Safety Management (ISM). The team believes that ISM could serve as a model of a system that has demonstrated its value and that has survived multiple changes of leadership in DOE and NNSA. It is our belief that robust implementation of ISM could lead NNSA and its contractors to a stronger safety culture. ISM is a key enabler of safe operations through the use of effective work planning, hazards identification, the development and implementation of work controls, performance of work within those controls, and feedback for improvement. However, without robust and active support by NNSA senior management, ISM will not lead to an enduring NNSA safety culture, nor is ISM specifically designed to improve an organization's safety culture.

The team examined other organizations' efforts to build a robust safety culture. These included DuPont, the Forum for Nuclear Cooperation in Asia, DOE's INEEL site, and the book Developing an Effective Safety Culture: A Leadership Approach by James Roughton and James Mecurio. Any final NNSA safety culture policy statement must be agreed upon by all the major NNSA organizational elements through the NNSA Leadership Coalition. This could include insights from Naval Reactors. A culture

[3] CAIB Report, page 102
[4] Ibid.
[5] CAIB Report, page 190.

change cannot take place without the buy-in and active leadership of top management. This review team concurs with the statement in the CAIB Report, "Leaders create culture. It is their responsibility to change it."[6] NNSA senior managers must develop, own, and establish clear expectations for safety being an organizational value that is part of mission accomplishment. An attitude or value is intangible. However, an intangible attitude or value should lead to tangible manifestations that can act as indicators of that value.[7] It is important to be able to judge the status or effectiveness of safety culture as an attitude within the NNSA. To this end, the team recommends that NNSA consider bringing in outside expertise to give the NNSA Administrator an independent assessment of NNSA's safety practices and culture, and then to assist NNSA in developing a safety culture statement with steps to implement it, and metrics to bring about the necessary changes to improve NNSA's safety culture. The team proposes the following attributes as a first cut at establishing an NNSA safety culture statement and identifying indicators by which to gauge success.

- Visible corporate commitment to safety.
- Individual commitment to safety.
- Concern for your co-worker's safety.
- Visible accountability (rewards and punishments).
- Rigorous self-assessments and outside views/evaluations.
- Track performance using metrics and indicators by top NNSA management, including a robust lessons learned process.
- Adopt the attitude that good safety is good business.
- Develop a baseline of NNSA's safety performance.
- A stated safety value such as "no one gets hurt on the job."
- Trust, openness, and valuing diversity of opinions.
- Support open communication.
- Worker Involvement.
- Competent Staff.
- Healthy tension is good.

3.2 Corporate Organization Improvement (OI)

In answer to the question, *"Are there issues raised by the CAIB Report that should be considered as we implement NNSA's new organizational model?"* the team identified three major organizational lessons learned.

1. Effective centralized and de-centralized operations require an independent, robust safety and technical requirements management capability.
2. Assuring safety requires a careful balance of organizational efficiency, redundancy and oversight.
3. Effective communications along with clear roles and responsibilities are essential to a successful organization

[6] CAIB Report, Section 8.6, pg. 203
[7] IAEA, Safety Series, "Safety Culture," 1991

Unlike NASA, many of the NNSA's technical requirements are grounded in laws and regulations. However, like NASA, the NNSA does not have a central organizational authority responsible for protecting the fundamental technical requirements for our site operations that have evolved as a result of over 50 years of research and experience. As the NNSA strives for greater operational and fiscal efficiency, those fundamental requirements and specifications that have protected the complex and the public for many years may be threatened by the lack of an organizational structure designed to protect them.

The CAIB concluded that the loss of a truly independent, robust capability to protect the system's fundamental requirements and specifications inevitably compromised those requirements and, therefore, increased risk. In particular, the CAIB found that the organization responsible for program accomplishment decided on its own how much safety and engineering oversight was needed. The CAIB concluded that the separation of authority of program managers – who, by nature, must be sensitive to costs and schedules – and "owners" of technical requirements and waiver capabilities – who, by nature, are more sensitive to safety and technical rigor – are crucial. Within the NNSA, safety is the responsibility of line management, not an independent safety organization. These responsibilities are detailed in various letters of delegation and the NNSA Safety Management Functions, Responsibilities and Authorities Manual (FRAM), October 15, 2003.

The ability to operate in a centralized manner or a de-centralized manner, as appropriate, is the hallmark of a high-reliability organization. However, the CAIB Report concluded that complex organizational structures such as NASA that mix centralized and de-centralized functions or split functions into centralized and de-centralized pieces can hinder effective operations and result in severe consequences.

The team reached two key conclusions (and related recommendations) related to these elements of the CAIB Report:

First, while NNSA should retain its management philosophy of holding line managers accountable for safety, the team felt strongly that a central technical authority responsible to the NNSA Administrator is needed to assure the technical adequacy of ES&H standards and to enforce those standards, when necessary, across the entire nuclear weapons complex. NNSA has optimized its organization for de-centralized decision-making on risk acceptance but the team identified various concerns with respect to oversight of this de-centralized decision-making process. Specifically: NNSA's technical requirements management process is fragmented between individual sites and Headquarters. Headquarters is not currently providing sufficient guidance to de-centralized decision-making authorities, in part because the implementation of Line Oversight/Contractor Assurance System and the review and approval of Site Office FRAMS are not complete. Additionally, NNSA's new oversight model relies on rigorous self-assessments by Site Offices that have not yet been fully demonstrated.

NNSA should establish the position of Chief Engineer in lieu of an ES&H Advisor. The Chief Engineer would be responsible for developing, maintaining and overseeing corporate technical environment, safety and health (ES&H) policies and standards, including reviewing and approving any waivers to those policies or standards. The Chief Engineer would also be empowered to veto or shut down any operation deemed unsafe, until resolved to the Chief Engineer's or NNSA Administrator's satisfaction. While the Chief Engineer would be outside the formal chain of line responsibility, this official would provide advice to line officers regarding the impact of major programmatic and budget decisions on operational safety. The Chief Engineer would also be responsible for monitoring the health of NNSA's ES&H technical staffing. Additionally, restructuring the role of NNSA's ES&H Advisor would provide technical staffs a place in Headquarters to communicate minority opinions that have been overlooked or rejected in other parts of the organization. The Chief Engineer should only have a small staff with unfettered access to all NNSA sites and facilities to permit additional independent identification of safety issues that need to be resolved.

Second, Defense Programs is not currently organized or staffed to effectively carry out the safety responsibilities allocated to it in the NNSA FRAM. As the Lead Program Secretarial Officer for ES&H for most operations, the Deputy Administrator for Defense Programs must integrate program and operational issues. As currently organized, this integration regularly occurs at least one level below the Deputy Administrator, reducing the level of management attention those operations and infrastructure issues should receive. Headquarters program managers also wear two hats-- program development and operational oversight-- potentially creating conflicts of interest. Without appropriate checks and balances, the team is concerned that the conflict of roles increases the natural tendency to favor program objectives over operational (safety and security) and infrastructure issues.

To provide the appropriate checks and balances, NNSA should elevate the management and oversight of operational and infrastructure issues within Defense Programs. This can be accomplished in at least one of two ways. One involves creating an organization that reports directly to the Deputy Administrator for Defense Programs and has an equal voice to the program organizations on operational and infrastructure issues. This new organization would be responsible for managing funding required for these purposes, and developing appropriate business systems necessary to regularly review the operational safety status of the Site Offices. Another would be to create a staff organization reporting to the Deputy Administrator that would review program office decisions regarding safety and infrastructure funding and regularly review the operational safety status of Site Offices. In either case, the team believes that Defense Programs needs additional resources and safety needs to be elevated in the organization to carry out its safety responsibilities.

The CAIB concluded that NASA's organizational structure changes designed to improve efficiency undermined the redundancy essential to successfully operating a high-risk enterprise. NASA's contractual arrangements, organizational structure and downsizing undermined the adequacy of federal oversight of the contractor and resulted in the

transfer of too much authority for safety to the contractor. The team concluded that, for NNSA, redundancy and the level of oversight should be proportional to the potential consequences (i.e., higher consequence = more redundancy). No hazardous facility or operation that presents a potential high consequence to the public and/or co-located workers should be without redundancy in oversight processes. However, the team concluded that NNSA has not yet implemented an oversight model with the appropriate level of redundancy in its oversight processes, nor has it established sufficient "push-back" mechanisms to assure safe operation of potential high consequence operations.

The team is concerned that the abrupt reductions in NNSA oversight of the contractor and Headquarters review of Site Offices have left NNSA vulnerable to failure, especially until LO/CAS processes have been proven effective.

NNSA contractors conduct numerous potentially high-consequence operations across its complex that should involve Federal staff oversight. Quality control and Federally imposed safety hold points are used to check contractor progress and status of safety systems and processes in the NNSA. Our existing requirements typically include safety hold points to ensure hazards have been properly analyzed, controls established, and implemented. The lifting of some of these Federal controls, if not carefully evaluated, may, in essence, transfer too much safety authority to the contractor. The team believes it is critical that NNSA management allow enough time to objectively measure how well oversight programs are being implemented and stabilize the oversight model itself. During early stages of implementation, increased Federal oversight might well be necessary to ensure that the right programs are in place and being implemented.

The team recommends that NNSA should institute interim line management oversight practices to address self-assessment and external review of all federal and M&O contractor operations until LO/CAS is fully implemented.

Finally, the CAIB concluded that NASA's complex and often hierarchal organizational structure diffused and confused responsibility, essentially leaving no one person accountable. Coupled with NASA's culture that lent greater technical credence to communications originated from higher in the organization, the organizational structure often stifled or blocked communications.

The team concluded that NNSA Senior Management must provide clear guidance on Site Office FRAMs, including the expectation that each site will have sufficient operational details to adequately describe the key ES&H approval and oversight implementing processes and procedures being relied upon to ensure safe operations. Headquarters must establish a process to assure that the Site Offices are functioning as described in the FRAM. Finally, the new NNSA organizational structure and individual managed staffing plans must be reevaluated to ensure sufficient technical and administrative resources are available for the FRAM framework to succeed.

Clear guidance should be provided by organizations delegating safety responsibilities. This is particularly true for Headquarters and the safety management responsibilities

delegated to Site Office Managers in the NNSA FRAM. Similarly, NNSA should review management decision processes and, where necessary, document and/or improve such processes.

3.3 Technical Capability (TC)

In answer to the question, "*Will the re-engineered NNSA provide for the necessary technical capability for properly executing NNSA's safety management and regulatory responsibilities?*" the team identified three lessons learned.

1. Workforce reductions, outsourcing, and loss of organizational prestige for safety professionals can cause an erosion of technical capability.
2. Technical capability to track known problems and manage them to resolution is essential.
3. Technical training program attributes must support potential high consequence operations.

The CAIB concluded that NASA (1) became dependent on contractors for technical support, (2) contract monitoring requirements increased, and (3) as engineers were placed in management roles, their positions were subsequently staffed by less experienced engineers. Years of workforce reductions and outsourcing culled NASA's layers of experience and hands-on systems knowledge that once provided a capacity for safety oversight. Safety and Mission Assurance personnel were eliminated, careers in safety lost organization prestige, and the respective program manager decided how much safety and engineering oversight was needed.

Similarly, the erosion of ES&H technical capability may be a serious issue within NNSA. As the organizational transition progresses (e.g., stand up of Service Center in Albuquerque), it is not clear whether or not the Site Offices have sufficient ES&H support. Consolidation of personnel into the Service Center has already resulted in a large loss of ES&H nuclear safety expertise. Over 50% of nuclear safety experts within the ES&H department have taken other positions or declined the directed re-assignment. It is not clear whether the Site Offices have sufficient ES&H staff, and the planned ES&H staffing of the Service Center has not been defined during the downsizing transition. A working meeting between the Service Center and their customers (Site Offices and HQ) is needed to map out near-term (1-2 years) expectations of Service Center technical capabilities. Also, an integrated NNSA staffing study (similar in nature and level of detail to those prepared in 1995 and 1998) is needed to validate the current staffing plans. In determining these resource requirements, training and career development for technical personnel must be a key component.

Second, NASA has a number of systems for reporting and capturing information with potential safety significance. However, information captured in those systems was not consistently analyzed, tracked, trended, or acted upon to resolve underlying causes. For NASA, this was a root cause in both the Challenger and Columbia accidents. NNSA (like NASA) has access to a wide variety of information management systems, including

access to local issue tracking and management systems of the contractor. Other examples include:

- NNSA Lessons Learned System
- ORPS (Occurrence Reporting and Processing System)
- SIMS (Safety Issues Management System) for DNFSB related commitments
- CATS (Corrective Action Tracking System) for OA findings/corrective actions
- SFI (Significant Finding Investigations) for weapon related issues
- GIDEP (Government-Industry Data Exchange Program)
- CAIRS (Computer Accident/Incident Reporting System)

NNSA, like NASA, needs to capture, analyze and share safety information, but has limited capability to do so in some areas. NNSA must consider establishing an analysis/trending function for complex-wide issues at either HQ or the Service Center to be periodically reviewed by NNSA senior leadership.

Finally, NASA did not have a recurring training program, was not aggressive in training, and did not institutionalize lessons learned into training. Similar to NASA, NNSA requires a cadre of technically trained people to properly perform its mission. This includes key senior management positions (e.g., Site Office Managers) whose responsibilities include safety of nuclear and other hazardous facilities and operations. Formal qualification and experience requirements, training, and/or compensatory measures must be identified for those individuals within NNSA. The Technical Qualification Program (TQP) is an important and available tool within DOE that has not been particularly well utilized or managed within NNSA. The NNSA TQP must be re-baselined and revitalized for technical staff.

3.4 Recommendations

In answer to the question, *"What changes would you recommend that NNSA adopt in light of the lessons learned by NASA?"* the CAIB NNSA Review Team compiled a list of recommendations. These recommendations are linked to (e.g., CI-1.1) the individual Lessons Learned Forms where the detail and background can be found (Appendix 2).

Recommendations annotated in bold indicate those that the team recommends "must" be implemented or an alternative approach must be found to address the underlying problem or lesson learned. Instances in which sub-teams identified similar issues and offered recommendations for their resolution are cross-referenced by sub-team (CI, OI, TC).

GENERAL RECOMMENDATIONS

1. Site Offices and contractors should also submit their Lessons Learned reports from the CAIB review applicable to their operations to the Administrator. The NNSA should then establish an enterprise-wide team to examine the collective findings, integrate the results, and develop complex-wide (Site generic and enterprise-wide) recommendations for action.

2. Naval Reactors has an established and recognized safety program. Operations related to NNSA's relationship with the Department of Defense as a designer and supplier of weaponized nuclear explosives were not thoroughly examined. A review of safety methods/culture in NA-30 and our relationship with DoD may deserve follow-on action in order to improve the NNSA safety culture.

MANAGEMENT AND SAFETY CULTURE IMPROVEMENT RECOMMENDATIONS

CI-1.1 Re-evaluate decision-maker qualifications and technical development for key decision-makers. All key NNSA managers involved in potential high consequence operations should have technical educational backgrounds or complete a rigorous technical training program for eligibility for these positions. Encourage continued technical growth of key NNSA decision-makers. (See also OI-3.2 and TC-3.3)

CI-1.2 Consider minimum term appointments (5 years) for key decision making positions, such as Site Office Managers.

CI-1.3 Change the safety behavior of NNSA in meetings in order to encourage diverse viewpoints. (See also CI-4.2)

CI-2.1 Establish consistent safety expectations in strategic and operational plans.

CI-3.1 Reinforce expectations (e.g. safely accomplishing NNSA's mission by development and implementation of a NNSA Safety Culture) through individual and contractor performance standards.

CI-4.1 NNSA senior management should communicate the cultural and organizational lessons learned for NNSA from the NASA CAIB Report.

CI-4.2 Change the safety behavior of NNSA to be more open to alternate views and minority opinions. Develop and implement Site specific and key organizational (Service Center, NN, DP) procedures on differing professional opinions. Develop and implement a formal standardized minority opinion disposition process such as that used by the Nuclear Explosives Safety Study group. (See also CI-1.3)

CI-4.3 Develop and publish a safety culture policy statement that clearly defines NNSA's commitment and expectations regarding the role of safety within NNSA. In addition to the vetting process of the Leadership Coalition, NNSA should consider bringing in outside expertise to give the NNSA Administrator independent assistance in development and implementation steps toward improving NNSA's safety culture.

CI-4.4 Establish an NNSA Senior Safety Council that is comprised of experienced safety professionals to guide NNSA and provide long-term consistency and

continuity of safety policies, standards, and practices. Hold periodic (no less than semi-annual) safety forums to discuss, at a minimum, trends, issues, lessons learned and best practices from both internal and external sources.

CORPORATE ORGANIZATION IMPROVEMENT RECOMMENDATIONS

OI-1.1 Establish a Chief Engineer (in lieu of an ES&H Advisor).

OI-1.2 Elevate the management and oversight of operational and infrastructure issues within NA-10 and provide adequate resources by creating an organization that reports directly to the Deputy Administrator.

OI-2.1 Until the NNSA oversight model is defined and LO/CAS is fully implemented and evaluated as effective, NNSA should reinstate on-site reviews of Site Office oversight systems.

OI-2.2 Headquarters, as well as Site Office, managers must routinely conduct self-assessments of their Federal operations.

OI-2.3 Headquarters should routinely review the primary sources of technical information resident in Site Offices (e.g., Facility Representative's periodic reports). (See also TC-2.1)

OI-2.4 The NNSA should further define OA's role in the oversight process through a formal agreement. In particular, clarify OA's role in providing assurance to the Administrator regarding the effectiveness of NNSA's risk acceptance.

OI-3.1 Headquarters must provide clear guidance as necessary to Site Managers with respect to delegated safety authorities (e.g., risk acceptance process and when to request support for accepting risks outside "normal" circumstances).

OI-3.2 NNSA should develop succession planning, development and mentoring programs for risk acceptance officials. (See also CI-1.1 and TC-3.3)

OI-3.3 Laboratory and Production Site Office Manager responsibilities, including oversight responsibilities, must be defined with respect to the balance of safety and program priorities.

TECHNICAL CAPABILITIES IMPROVEMENT RECOMMENDATIONS

TC-1.1 In the very near future, convene a working meeting between the Service Center (emphasis on safety expertise within the ES&H Department) and potential customers (Site Offices, HQ Offices) to map out expectations of the Service Center for the next year or two. (See also TC-1.3)

TC-1.2 Complete an integrated NNSA Staffing Study at a similar level of detail compared to those completed in 1995 and 1998, and use the results of this updated study to validate staffing plans.

TC-1.3 The NNSA Service Center should employ sufficient technical resources, including support service contractors, to fill peak demand in support of Site Office and Headquarters requirements, and to provide specific technical assistance on subjects that do not require a full time employee at any single Site Office. (see also TC-1.1)

TC-1.4 Provide the necessary resources and priority for continued technical growth of ES&H staff throughout their careers through additional academic training, industrial rotations, and detail assignments within NNSA. Develop succession plans for safety and program professionals that recognize their respective equal value to the organization and mission. Provide an NNSA career progression that defines the safety and program positions, and timeframes for professional development that equally values safety and program objectives. Use the Facility Representative (FR) program as a model to develop technical competence of all safety professionals. Consider alternate career paths for technical growth including the Richland technical career path model created in 1998.

TC-1.5 Develop a Safety Professional of the Year Award that recognizes most effective safety improvements, innovation in solutions to safety issues, and contribution to improvements to the NNSA safety culture. In addition, implement the recognition programs for federal employees in safety areas.

TC-2.1 NNSA should re-establish an analysis/trending function for complex-wide issues at either HQ or the Service Center to be periodically reviewed by NNSA senior leadership.

TC-2.2 NNSA should revise the current NNSA voluntary corporate Lessons Learned Program to one of mandatory participation for key NNSA personnel, including the periodic review of past DOE/NNSA accidents and near misses.

TC-3.1 Re-baseline the TQP to ensure that the correct personnel are in the program and establish performance expectations for those personnel in the program.

TC-3.2 Revitalize the TQP. Establish performance metrics that will be reviewed by the Administrator and senior management on a periodic basis.

TC-3.3 Establish a training and qualification program for senior management positions with safety management responsibilities. (See also CI-1.1 and OI-3.2)

4.0 THE ROAD AHEAD

The lessons learned and recommendations from this report are provided for line management's information and action. Bolded recommendations within Section 3.4 should be considered mandatory. The remaining recommendations should be considered opportunities for improvement. An implementation plan to disposition and address these matters is highly recommended, along with the requisite commitment by management to follow through.

As a near-term action, the team recommends that Site Offices and contractors formally submit to the Administrator their Lessons Learned reports from the CAIB review applicable to their operations. The Administrator should consider establishing an enterprise-wide team to examine the collective findings, integrate the results, and develop complex-wide (Site generic and enterprise-wide) recommendations for action.

The team is pleased to have had the opportunity to address the Columbia Accident Investigation and its relevance to NNSA. We stand ready to assist management in these next steps.

APPENDIX 1
CHARGE LETTER

Department of Energy
National Nuclear Security Administration
Washington, DC 20585
September 9, 2003

MEMORANDUM TO: BGen. Ronald Haeckel
Principal Associate Deputy Administrator, Defense Programs

From: Linton Brooks
Administrator

Subject: NNSA Team to Review Lessons Learned from the Space Shuttle Columbia Accident Investigation

On August 26, 2003, NASA's Columbia Accident Investigation Board (CAIB) issued its final report on the recent space shuttle tragedy. The CAIB identified organizational causes as a key element in the failure to identify and evaluate critical safety issues. Given similarities between NNSA's nuclear defense mission and NASA's space mission (highly technical work and reliance on contractors to perform the mission), we are chartering a review of the Columbia accident investigation report to identify lessons learned from the NASA experience that may apply to NNSA.

I want to thank you for agreeing to chair this NNSA team.

In light of the CAIB report, the review team should assess the following questions:

1. Is NNSA's management and safety culture appropriate for an organization managing high technology, high-risk activities?
2. Are there issues raised by the CAIB report that should be considered as we implement NNSA's new organizational model?
3. Will the re-engineered NNSA provide for the necessary technical capability for properly executing NNSA's safety management and regulatory responsibilities?
4. What changes would you recommend that NNSA adopt in light of the lessons learned by NASA?

Please rely on the technical resources within Headquarters and the Service Center to identify team members. I expect that the team will provide me with an initial assessment of the report by the end of this month. A final report by the team should be delivered by the middle of January 2004.

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CAIB ORGANIZATIONAL CAUSE STATEMENT

The organizational causes of this accident are rooted in the Space Shuttle Program's history and culture, including the original compromises that were required to gain approval for the Shuttle Program, subsequent years of resource constraints, fluctuating priorities, schedule pressures, mischaracterizations of the Shuttle as operational rather than developmental, and lack of an agreed national vision. Cultural traits and organizational practices detrimental to safety and reliability were allowed to develop, including: reliance on past success as a substitute for sound engineering practices (such as testing to understand why systems were not performing in accordance with requirements/specifications); organizational barriers which prevented effective communication of critical safely information and stifled professional differences of opinion; lack of integrated management across program elements; and the evolution of an informal chain of command and decision-making processes that operated outside the organization's rules. [Page 177 of CAIB Report]

APPENDIX 2
LESSONS LEARNED FORMS

NNSA CAIB LESSONS LEARNED

Management and Safety Culture Improvement CI-1	Oversimplification Of Technical Information Could Mislead Decision-Making.

NASA LESSON LEARNED STATEMENT

The CAIB Report described "oversimplification of technical information" as one lesson learned. Three specific attributes were identified in the Report that contributed to oversimplification of technical information. Those attributes were:

- Oversimplification of highly complex information in decision-making.
- Making decisions on subjective experience instead of solid data.
- Use of briefings instead of technical papers as the primary method for communication. (CAIB page 181).

RELEVANCE TO NNSA

Oversimplification of technical information is a potentially serious issue within NNSA as well.

Evolution of Technical Decision-Making in DOE/NNSA

Since the mid-70s when the Atomic Energy Commission (AEC) evolved into the Energy Research and Development Administration (ERDA) and subsequently into DOE, much of the Federal technical expertise was lost to make way for budgetary and contractual responsibilities. Also, DOE was put under civil service compensation regulations that resulted in decreases in grade level designations (loss of income) further depleting the technical expert base. Much of the practical experience AEC/ERDA had once possessed left DOE. Furthermore, training for senior management officials shifted from a technical emphasis to management and contractual skills. Throughout the 1970s and 80s the highest priority of the nuclear weapons program was production frequently at the expense of environment, safety and health.

In the late 1980s, the DOE's production mission shifted to balancing production with safety and environmental compliance. Prior to that time, DOE had performed safety analyses only to determine the bounding risk of sites. The basis for proving facilities operations and weapons activities were safe was highly expert-based and utilized past successes. With the evolution of safety requirements in the late 1980s, DOE required a much stronger focus on evaluating the hazardous facilities for a wider variety of hazards, accidents and consequences for the worker, public and environment. In the mid-1990s, worker protection became a more important value to both the DOE and the public.

In the early 1990s, DOE began to work much more aggressively with the public and established a policy of openness to repair years of secrecy associated with highly classified operations (e.g., radiological exposures and experiments). Public involvement in the National Environmental Policy Act (NEPA) process became a fundamental component of how the Department did business. Requirements were expanded significantly through the contracts in the areas of Environment, Safety and Health. Processes such as Environmental Impact Statements issuance, environmental permits, start-up and restart of nuclear facilities and Safety Evaluation Reports for nuclear facilities required more formalized and rigorous processes. Although processes were formalized, decision-makers were not always provided with the necessary technical training, background and competency to ensure high quality technical decisions. In

the past, many of those technical decisions had been the responsibility of the contractors. Several of those major decisions were shifted to DOE to accept the risk.

Breadth of responsibilities for key decision-makers expanded at the same time public interest in DOE and scrutiny of DOE's decisions increased. The formation and evolution of the Defense Nuclear Facilities Safety Board (DNFSB) has confirmed the loss of competency for both Federal employees and some contractors and the lack of technical bases on a variety of technical topics. Contractor and Federal employees who were accustomed to utilizing expert based decision-making were being challenged for lack of a technical basis and formality in documenting their decisions. Whistleblowers became more prevalent throughout the DOE complex in the mid-1990s. DOE's technical bases on key decisions being made by both Federal and contractor employees were continuously being scrutinized and challenged externally (e.g., design of safety systems for new and existing facilities, disposition of excess plutonium, DOE's safety management system, the safe storage of pits, operability and reliability of vital safety systems).

As more and more information was released about changes in budgets, delays to completion of major projects, and decline of public trust, decisions within NNSA having high consequences to workers, public or environment became the focus of external groups. The recent Columbia shuttle disaster and subsequent review of the CAIB Report combined with a self-assessment indicated many of the same NASA negative organizational attributes in technical decision-making existed within NNSA both in the Federal and contractor organizations.

Causal Analysis

The following discussion describes the behaviors and initiators that cause organizations to oversimplify technical information. These attributes can be found within both the Federal and contractor organizations. Sub-team 1, by performing a simple causal analysis, analyzed what could lead an organization to exhibit these attributes. Several causes were identified and grouped into (1) individual behaviors, (2) organizational behaviors, and (3) external influences beyond the control of the organization.

Individual Behaviors

Individual behaviors can heavily influence decision-making in complex, highly technical environments. Preparers of decisions can be contractors or Federal employees. The preparer of information for a decision ("preparer") may not have the technical expertise necessary due to gaps in education, training or experience. The decision-maker can also share these deficits. This individual ("decision-maker") may be a Federal employee or a contractor. The individual decision-maker or preparer may fear loss of control of a decision if too much technical information is revealed and shared. When a preparer or decision-maker loses control of the decision they may be unable to influence the outcome. Frequently organizations have "professional silos" that allow preparers and decision-makers to more easily control outcomes. These silos may be created falsely with technical jargon and acronyms to reduce the decision-maker's ability to understand and evaluate all of the alternatives and consequences. Individual domination can often overshadow effective decision-making for technical organizations.

If a high degree of learning or training is required to make certain decisions, the preparer and the decision-maker without that degree of learning or training may avoid the technical details to save on time and analysis. A decision-maker may not want to take on the effort to learn about the technical aspects of the decision when he/she is near the "end of their career paths." Conflict adverse decision-makers and preparers commonly take the path of least resistance. Sometimes, the individual preparer or decision-maker may not have enough resources in the organization dedicated to evaluate and prepare decisions. Analysis may be reduced to meet deadlines or rushed decisions made due to time constraints.

NNSA should re-evaluate decision-maker qualifications and technical development. Consider minimum term appointments (5 years) for key decision-making positions such as site office managers (CI-1.2). Minimum term appointments help to enhance accountability and competency while retaining greater institutional memory. For non-technical decision-making positions, require strong technical advisors as a compensatory measure with minimal technical training for the non-technical decision-maker. The adequacy of decision-making should be linked to performance and incentives. Encourage continued technical growth of key DOE decision-makers. Require certain performance based technical courses for key decision-makers (e.g., site office managers) every two years in topics such as Nuclear Safety, readiness and environmental compliance. Link the completion of the technical competency being enhanced to performance and incentives. Require conflict resolution skills for key decision-makers. NNSA would need to evaluate what training could most effectively improve skill sets including how to work with diverse opinions and how to solicit out of the box thinking. Performance metrics would be tied to the quality of decision-preparation and decision-making. Incentives and performance would be linked to providing diversity in options and resolving conflicts. Provide training to decision-makers on how to provide effective feedback (CI-1.1).

The decision-maker/preparer may be predisposed to keep the original outcome of a decision, even in the face of changing or new data, if the initial decision is viewed favorably from his/her perspective. A decision-maker or preparer may fear discussions about technical content since it may provide others with information about what is not known indicating a potential lack competency on the part of the preparer/decision-maker. A preparer or a decision-maker may not be held accountable for their decision or results of making the decision. Lack of accountability in decision-making will lead to shortening of time and analysis used for decision-making and no improvement in the decision-making process. This lack of accountability can be due to compensation issues, competition within the organization, or reliability issues.

Trust between the preparer and decision-maker will affect what information is prepared, shared, and how the decision-maker interacts with the preparer. Information may be lost due to lack of trust. A preparer may have an unusual alternative, but based upon past experience would hesitate to present this information. A decision-maker may not support the technical expert after other alternatives were found with the decision, resulting in reduction of trust.

The decision-maker may lack conflict resolution skills that invite differing opinions and allow alternatives to be explored and evaluated. If a decision-maker has limited background on a subject matter, the decision may be postponed or delayed until that individual can be educated to a level of comfort to proceed. These delays may impact the program involved, which in itself influences the decision-maker and preparer's behaviors. Availability of the key people who have knowledge basis for the decision may defer a decision also. When the decision is delayed with subsequent program impacts, the operation/activity may continue without the appropriate level of approval.

For the broad suite of technical activities and competencies that exist in the DOE complex, NNSA's senior decision-makers need broad technical experience. For a new or less-experienced decision-maker, this breadth of information and experience needed may be overwhelming and not easily developed and mastered. Senior positions in DOE rarely have managers who reside in the same position for more than 5 years. Loss of the institutional memory can significantly influence technical decision-making. Some key NNSA managers also do not have the educational backgrounds necessary to make technical decisions. NNSA should consider requiring all key senior management positions involved in potential high consequence operations be filled by managers with technical educational backgrounds.

Many decision-makers in DOE cut short the necessary analysis to meet deadlines that severely restrict tough, complex, technical decision-making. All issues whether administrative, contractual, or technical are treated with roughly the same amount of time, leading to "incomplete" information and analysis on the technically complex set. These time-dependent decision-makers tend to accept information by verbal communications or e-mail rather than technical position papers and technical reports. Many managers operate in an environment of "synthesized information" which leads to incomplete communication from the preparer and lack of key information being conveyed.

Organizational Behaviors

Organizational behavior can affect the amount of information used in highly complex technical decisions. The organization may have "norms" that restrict learning and encourage managers to be primarily administrators rather than technical leaders. These types of organizational norms that restrict learning commonly exist in highly political organizations such as DOE. Organizations such as DOE that are heavily influenced by outside organizations frequently operate in a risk adverse and blame free culture. In organizations of this type, little accountability exists to ensure decision-makers and preparers have obtained the necessary information for key technical decisions.

DOE, along with its contractors, has a heavy political orientation due to outside influences. As a result, contractors may prepare information for the "political" aspect of a DOE decision-maker but assume that the technical decision-making resides within their own organization. Political organizations such as DOE can exhibit disruption and distrust due to these external influences. Senior DOE decision-makers may choose conflict avoidance as an organizational norm since the primary contractors have been viewed as more competent. Many organizations with oversimplified decision-making lack a risk/reward structure that encourages risk and innovative thinking. Organizational norms can also impact decision-makers into managing instead of leading. Managers focus on accomplishing tasks rather than the quality of task.

As NNSA has transitioned into a new structure, some authorities have been delegated down. These delegations seem to indicate, to some decision-makers that technical leadership can also be delegated down instead of in an upward or lateral direction. As a result, technical decision-makers move further from maintaining their technical competency leaving those responsibilities to subordinates. If roles and responsibilities are unclear within an organization, ambiguous command/delegation may mask information since the decision-maker's role is unclear. In contrast, if a decision-maker is so high in the organization, extensive amount of time and effort will be spent educating the decision-maker. The amount of orientation and education depends on how distant the individual in the organization is from the decision and how technical competency has been maintained.

Organizational norms may place a higher value on positive information coming forward than negative information in complex decisions. As a result, preparers may limit options to only those facts viewed positively by the organizational norms, severely restricting information to the decision-makers. Finally, organizational norms may heavily influence how information is conveyed for technical decision-making by requiring synthesis of issues and e-mail usage over technical presentations and reports. Frequently the synthesis process results in shortened information "bytes" that lack information about the impact of consequences, key assumptions, or breadth of options considered.

The conduct of meetings within an organization is another important element of the atmosphere afforded preparers and decision-makers. To implement a change for how meetings are conducted, it is suggested that the following techniques be applied at senior level management meetings that managers can flow-down to the sites and respective organizations (CI-1.3). It is also recommend that outside-experts be utilized to provide feedback on improving the conduct of meetings. Participants can be surveyed to evaluate effectiveness following initial implementation.

- Balance the number of individuals involved in key decisions relative to its importance, consequences and timeliness. Develop a graded approach to decision-making. NNSA needs to ensure we don't overanalyze situations and that critical decisions are made in a timely manner.
- Encourage individual brainstorming for diversity of ideas that avoids the concept of "group think". This means NNSA needs to be aware and receptive to not only internal but external input.
- Occasionally use outside experts to expand the options set for decisions. Bring in people who may not be as familiar with the decision but think "differently" (e.g., engineer versus scientist differences) with consideration of balancing timeliness, importance and consequences.
- Avoid the mindset of consensus. Treat total consensus as a possible gap and force other alternatives to be discussed.
- Encourage differing professional opinions both in preparation and decision-making. Demonstrate positive reinforcement for individuals who bring forward their differing professional opinions. Request contractors to include minority opinions on key recommendations to NNSA for topics such as nuclear safety and nuclear explosives safety.
- Appoint a "devil's advocate" role in key technical decisions. This is an individual who does not agree with the proposed alternative and provides suggestions on a different approach.
- Encourage the use of technical information in decision-making. Do not leave out the information that may have necessary details, but use a graded approach relative to risk and consequences. Bring forward key assumptions and worst-case scenarios in decision-making.
- Document key decision and their technical basis. Include alternatives that were not selected and the basis as to why those options were not selected.

External Factors

External factors such as extensive oversight and demanding customers frequently limit the time that decision-makers can spend on tough decisions. NNSA has both of these external factors. Furthermore, both are beyond the control of the organization. Reductions in budgets or staffing can result in increased workload with less time to focus on more difficult and complex decisions.

CONCLUSIONS (Desired Behaviors)

After reviewing these undesired behaviors, sub-team 1 noticed that many of those behaviors occur either within NNSA and its contractors or in pockets of the organizations. The sub-team then identified which behaviors NNSA should focus on to improve safety culture.

Key behaviors deemed important to the *preparer* of complex decisions:

- Requiring technical competence on the part of preparers of decisions along with emphasizing and maintaining that competency.
- Expanding decision preparation to teams with a diversity of ideas and alternatives. Include minority opinions from the contractor for NNSA decision-makers. Also include key recommendations for potential high consequence decisions.
- Ensuring preparers are familiar with conflict resolution and willing to take on controversial topics.
- Rewarding decision preparers for diversity of alternatives and options.
- Ensuring accountability with the preparers of decisions.
- Building and enhancing trust between preparers and decision-makers through positive feedback on the diversity of preparation and options.

Key behaviors deemed necessary to the *decision-makers*:

- Requiring technically competent decision-makers with emphasis on maintaining competency.
- Expanding decision making to input from individuals with a diversity of ideas and alternatives.
- Ensuring decision-makers can resolve conflict and are willing to take on controversial topics.
- Rewarding decision-makers for comprehensiveness and risk taking.
- Ensuring accountability with the decision-makers.
- Leading organizations instead of managing them to ensure decisions have quality and are not just treated as a task for completion.
- Making sure the decision-maker is at the appropriate level of the organization dependent upon the degree of risk and knowledge of the decision being reviewed.

Positive behaviors for the *organization*:

- Rewarding the technically inquisitive organization.
- Valuing negative information as well as positive.
- Ensuring clear roles and responsibilities are defined for decision-makers.
- Promoting an atmosphere of trust between preparers and decision-makers.

RECOMMENDATIONS

Listed below are specific Recommendations for both individual behavior and organizational behavior of NNSA.

CI-1.1 Re-evaluate decision-maker qualifications and technical development for key decision-makers. All key NNSA managers involved in potential high consequence operations should have technical educational backgrounds or complete a rigorous technical training program for eligibility for these positions. Encourage continued technical growth of key NNSA decision-makers. (See also OI-3.2 and TC-3.3)

CI-1.2 Consider minimum term appointments (5 years) for key decision making positions, such as Site Office Managers.

CI-1.3 Change the safety behavior of NNSA in meetings in order to encourage diverse viewpoints. (See also CI-4.2)

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Sub-Team Leader: _____

Date: 2/5/04

NNSA CAIB LESSONS LEARNED

Management and Safety Culture Improvement CI-2	Proving Operations are Safe instead of Unsafe

NASA CAIB LESSONS LEARNED STATEMENTS

"Organizations that deal with high risk operations must always have a healthy fear of failure--operations must be proved safe, rather than the other way around. NASA inverted this burden of proof."[1]

"Safety and Mission Assurance personnel have been eliminated, careers in safety have lost organizational prestige, and the Program now decides on its own how much safety and engineering oversight it needs."[2]

"NASA's safety culture has become reactive, complacent, and dominated by unjustified optimism. Organizations that successfully deal with potential high consequence technologies create and sustain a disciplined safety system capable of identifying, analyzing, and controlling hazards throughout a technology's lifecycle.[3]

"When managers in the Shuttle Program denied the team's request for imagery, the Debris Assessment Team was put in the untenable position of having to prove that a safety-of flight issue existed without the very images that would permit such a determination. This is precisely the opposite of how an effective safety culture would act."[4]

"Organizations with strong safety cultures generally acknowledge that a leader's best response to unanimous consent is to play devil's advocate and encourage an exhaustive debate. Mission Management Team leaders failed to seek out such minority opinions. Imagine the difference if any Shuttle manager had simply asked, "Prove to me that *Columbia* has not been harmed."[5]

"NASA failed to convey the urgency of engineering concerns up the management chain. Program managers created huge barriers against dissenting opinions based on stating preconceived conclusions based on subjective knowledge and experience, rather than on solid data. Organizations with a strong safety culture generally acknowledge that a leader's best response to unanimous consent is to play devil's advocate and encourage and exhaustive debate."[6]

RELEVANCE TO NNSA

Although higher risk nuclear operations are required to be proved safe with an acceptable level of risk, NNSA is not consistently applying this concept in middle and lower risk operations. Recognizing that a graded approach and the level of formality applied to any operation must be balanced with level of risk to the worker and the public, the concept of proving operations are safe needs to be imbedded into the NNSA safety culture.

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[1] CAIB Report, page 190
[2] CAIB Report, page 181
[3] CAIB Report, page 180
[4] CAIB Report, page 190
[5] CAIB Report, page 192
[6] CAIB Report, page 192

Proving Operations are Safe instead of Unsafe

Since the invention of the atomic bomb, the DOE, National Laboratories, and production plants have always depended on technical expertise and knowledge to address safety. This expert-based culture has been embedded in the DOE and contractor organizations for the last fifty to sixty years. As a result, the approach to safety has relied heavily on the attitude that "this is the way we have always done it," "we have never had a problem before," and "it was invented here." These themes are characteristic of a culture that relies on expert judgment and does not support a process-based model for proving that it is safe.

Over the past ten to fifteen years, the DOE has struggled with implementing and overseeing safety within its organization. One of the major issues DOE has struggled with has been the level of and methods of oversight for its safety programs and M&O contractors. Multiple layers of oversight were identified and employed under Secretary of Energy Watkins' administration. The Office of Nuclear Safety, Office of Environment, Health and Safety, each Principle Secretarial Office (Program Office), Operations Offices, and Area Offices had multiple and redundant oversight responsibilities to review and assess the M&O contractors. In addition, the Environmental Management Office was formed with a fenced budget to deal with environmental problems. Then in the early 90's, the Price Anderson Act Amendments were promulgated that allowed EH-10 to become an enforcement arm of DOE through legislative authority, and finally, the nuclear rule making through 10 CFR 830, Part B, moved Safety Analysis Reports, Technical Safety Requirements, and Unresolved Safety Question processes into legal rather than simply contractual space. Outside the ES&H community, this trend was seen as heavy-handed, as checkers-checking-checkers, and as mindless compliance. Also, the term "paper safety" was coined to imply that increased formality meant doing a lot of expensive, bureaucratic, non-value added work that did not improve safety. These negative attitudes towards safety continue and are evident within NNSA.

With respect to safety culture, NNSA and M&O contractors have made significant progress in implementing Integrated Safety Management (ISM) together with implementing the nuclear safety rules into their potential high consequence operations and processes over the last several years. The concept of conducting a formal safety analysis to determine the hazards associated with the work, applying appropriate controls, and conducting feedback for improvement to assure that the process is repeatable and reliable is a sound approach in proving that an operation is safe with an acceptable level of risk. The cultural challenge facing the NNSA will be to prove an operation is safe rather than depending upon past experience and expert knowledge.

One of the examples of NASA's cultural breakdown was the Debris Assessment Team's effort to obtain additional imagery of *Columbia*. The ability to prove that an operation is safe depends on proper analysis of information. If the information is not available, then a conclusive analysis and recommendation cannot be made. In this specific example, assessing the images would have given the Debris Assessment Team the ability to prove that a flight-safety issue existed. Although this analysis could have potentially saved the shuttle on re-entry, the effect of foam pieces separating and hitting the shuttle on take-off was a phenomenon that had occurred in previous take-offs and was not adequately analyzed and proven to be a safe operation. Not taking the time to do this analysis in a thorough and complete manner to assure that this was proven to be safe, created an expectation that additional information was not beneficial to solving the problem.

The CAIB Report proposed that taking a "devil's advocate" approach encourages exhaustive debate. Taking the approach to prove that it is safe rather than to prove that it is unsafe places the responsibility and accountability on the decision maker to assure that proper analysis and evaluation have been conducted to consider all hazards and possible failure mechanisms.

NNSA has made significant progress in proving nuclear weapons operations are safe. In past years, the weapon experts from the national laboratories used expert knowledge and judgment to design assembly and disassembly processes for nuclear weapons. Although their knowledge and expertise was based on extensive research and testing, the level of formality and application of this knowledge was not documented or reviewed in a consistent manner. The "Seamless Safety for the 21st Century" (SS-21) initiative in the mid-nineties, provided the framework for a process that identified the hazards and controls, and the level of formality and review necessary to prove operations were safe. Also, the national laboratories have been much more focused on understanding the weapon response to various hazard scenarios. In the past, the Nuclear Explosive Safety Study (NESS) was the authorization basis and approval mechanism for authorizing and conducting operations. With the SS-21 process in place, and the ISM approach to weapon operations, a major role change of the NESS took place. The NESS is now an additional review, above and beyond the normal reviews for any nuclear operation, to provide an independent means for the low probability/high consequence nature of nuclear weapon operations. This provides the decision-maker the additional understanding and confidence needed in approving the operation.

Also, the significance and importance of the foam hitting the shuttle wing was minimized and dismissed as a possible failure mechanism. The CAIB Report stated "organizations committed to effective communication seek avenues through which unidentified concerns and dissent insights can be raised, so that weak signals are not lost in the background noise." NNSA can learn from NASA experience. The concern with NASA just focusing on potential high consequence operations and not considering the foam problem and how it lead to a catastrophic failure, indicates that a systematic approach should be applied to consider these kinds of scenarios and their potential impact on the higher risk operations. For NNSA, ISM defines the work scope and evaluates hazards. The message to NNSA is that even for hazards perceived as minor in potential high consequence operations, the scope must be adequately defined to make sure that these minor hazards do not turn into a major safety issue.

As a means of follow-up, NNSA senior management should communicate the cultural and organizational lessons learned from the NASA CAIB Report for NNSA and should publish an NNSA safety culture/policy that clearly defines NNSA's commitment and expectations with regard to the role of safety (CI-2.1).

CONCLUSIONS

Proving that operations are safe for potential high consequence operations may be slowly becoming part of the NNSA culture. However, much needs to be done to further reinforce and practice this concept rather than requiring operations to be proven unsafe before action is taken. Even though NNSA is consistent in its approach proving potential high consequence operations are safe, a deliberate effort must be made to consider the appropriate scope of hazards to assure that what is considered a minor or insignificant issue does not lead to a major problem. NNSA needs to define the appropriate levels of formality as applied to lower risk operations (such as, industrial operations and worker safety) to ensure that the concept of proving operations are safe is integrated into the process, "To change behavior we need to change attitudes and perceptions. Changing attitudes is HARD – we need first to change thinking."[7]

[7] Nuclear Safety Culture - FNCA

RECOMMENDATIONS

The following are recommendations for NNSA to develop an expectation for proving operations are safe instead of unsafe and increasing the prestige of safety as a career.

CI-2.1 Establish consistent safety expectations in strategic and operational plans.

REFERENCES:

1. CAIB Report, pages 180, 181, 190 and 192
2. Nuclear Safety Culture – FNCA
3. DNFSB Recommendation 98-2, 2000-2
4. Lesson Learned, Fatality from Inadvertent CO2 Discharge at INEEL

Sub-team Leader: _____

Date: 2/5/04

NNSA CAIB LESSONS LEARNED

Management and Safety Culture Improvement CI-3	Management Must Guard Against Being Conditioned By Success.

NNSA LESSON LEARNED STATEMENT

"Even after it was clear from the launch videos that foam had struck the Orbiter in a manner never before seen, Space Shuttle Program Managers were not unduly alarmed. They could not imagine why anyone would want a photo of something that could be fixed after landing. More importantly, learned attitudes about foam strikes diminished the management's wariness of their danger. The Shuttle Program turned 'the experience of failure into the memory of success.' Managers also failed to develop simple contingency plans for a re-entry emergency. They were convinced that without a study nothing could be done about such an emergency. The intellectual curiosity and skepticism that a solid safety culture requires was almost entirely absent. Shuttle managers did not embrace safety-conscious attitudes. Instead, their attitudes were shaped and reinforced by an organization that, in this instance, was incapable of stepping back and gauging its biases. Bureaucracy and process trumped thoroughness and reason."[1]

RELEVANCE TO NNSA

NNSA manages nuclear and non-nuclear facilities operations, including nuclear weapons surveillance and disassembly. This occurs at eight diverse sites, with over 60 Category II and III nuclear facilities, and about 300 safety systems within these facilities. Failure of these safety systems could result in a variety of potential accidents, some with direct public consequences. These consequences are comparable to the NASA issue related to failure of the space shuttle, with the understanding that some of our operations are categorically more hazardous than NASA's.

Based on reviewed information, the phenomena NASA described as "conditioned by success" is a potentially serious issue within NNSA. This can be further described as a failure to apply the appropriate rigor (whether it be managerial, oversight, or technical) to processes because of perceived successes in past operations. Sub-team 1 was able to cite several examples where this condition exists and where rigor varies between higher risk and lower risk activities, between sites, and within sites. Sub-team 1 evaluated whether "conditioned by success" is a problem for the re-engineered NNSA.

Sub-team 1 determined the attribute "conditioned by success" envelopes several other attributes presented in the NASA report:

- "Perfect Place" culture.
- Using previous successes as a justification for accepting increases in risks.[2]
- Assessments based on experience instead of engineering hazard analysis.[3]
- New information weighed only against past experience.[4]

Historically, DOE (or its predecessor agencies) has accomplished many feats. The production plants were designed and built in record time; the Laboratories completed design of nuclear weapons; the plants produced the appropriate materials, nuclear and non-nuclear, for weapon assembly; the Nevada Test Site

[1] CAIB Report, page 181
[2] CAIB Report, page 196
[3] CAIB Report, page 200
[4] CAIB Report, page 200

performed underground testing; weapons were deployed to the end-user; and subsequently the U.S. was credited with winning the Cold War. Overall, it was a time of few requirements and minimal federal oversight.

The 1980's brought about many changes for DOE, including the Federal Bureau of Investigation raid on the Rocky Flats plant. Admiral James Watkins, Retired, U.S. Navy, was brought in because the DOE complex was in need of change. The "Tiger Teams" were deployed to assess the sites' compliance against existing requirements. In the late 1980's, the Defense Nuclear Facilities Safety Board was chartered by Congress to watch over DOE's nuclear facilities.

In the 1990's, more public laws and requirements, new information, heightened public awareness yielded additional work in environmental impact statements, chronic beryllium disease testing and compensation, Emergency Planning Community Right to Know efforts, etc.

In the 21st century, requirements like 10 CFR 830, *Nuclear Safety Management* were promulgated to codify DOE compliance with the nuclear safety requirements.

Sub-team 1 developed the following observation: Higher risk nuclear operations require more rigorous assessment (gradual movement from expert-based to performance-based, authorization basis development, NESS, readiness reviews) while lower risk operations do not require as rigorous assessment. For example, for lower risk operations a documented safety analysis is not required; a job hazard analysis may be performed. Each site has their own procedure for performing job hazard analyses. Although this is the concept of graded approach, consistency and rigor varies within NNSA. This results in a fragmented safety culture where a tendency for complacency exists. This is evidenced to the extreme by fatalities, personnel injuries, and property loss as reported in ORPS reports, and Type A or B Investigations.

Specific examples of "rigor varies" from site to site are:

- Processes for and quality of hazard evaluation/analysis vary. Safety analysis reports/safety evaluation reports quality varies from site to site as well. (See OI-2.1, OI-2.3, OI-3.1)
- Status of ISM program implementation varies site to site, as well as DOE program to program. EM-HQ has placed an emphasis on annual site verifications of ISM. No similar push seems to exist in NNSA. (See OI-2.1, OI-2.2, OI-2.3, OI-3.1)
- Moving from the paper (i.e. safety analysis report) to implementing controls varies (SRSO fully implemented; PXSO implementations will take a couple of more years). (See OI-2.2, OI-2.3, OI-3.1)
- Consistency in the flow down of requirements to subcontractors varies. Some NNSA sites have tailored their standards to their site through the DOE Work Smart Standards process while others use S/RIDs. (See CI-2.1, OI-2.1, OI-2.3)
- Safety evaluation reports are signed at different levels at different sites. (See OI-3.1, OI-3.2)
- Some safety evaluation reports contain independent DOE calculations and others do not. (See OI-3.1)
- Some NNSA site managers are held accountable for "programs" in performance appraisals and others are not. (See OI-3.3)
- Training assessments are not performed per the DOE Order (DNFSB letters received on this subject). (See OI-2.1, OI-2.3, TC-2.1)
- Lightning protection implementation varies (DNFSB letters received on this subject).
- Personnel qualifications percentages vary site to site (Technical Qualification Program, Facility Representatives, and Subject Matter Experts). (See OI-2.3, TC-1.4, TC-2.1)

- Technical Qualifications Program "qual cards" vary by site (LSO has re-written theirs; the Service Center will re-evaluate after employment becomes steady-state after personnel reassignments). (See CI-1.1, OI-2.3, OI-3.2, TC-3.3)

Examples of "rigor varies" from within sites are:

- Facilities on the same site may approach utilization of evaluation guidelines for the public and the worker differently (Reference DOE-STD-3009). (See OI-3.2)
- Pu-238 and Pu-239 operations were treated similarly in certain cases (analysis and subsequent handling/ storage) per the recent LANL Type B Report when they should not have been. (See OI-3.2)

Many publications exist in the nuclear community regarding safety culture. The International Atomic Energy Agency issued a *Safety Series Report* on "Safety Culture." This report was prepared by the International Nuclear Safety Advisory Group (No. 75-INSAG-4, 1991). Additionally, INPO has issued a preliminary report entitled "Principles for a Strong Nuclear Safety Culture (Preliminary)," November 2003. Both of these documents stress important attributes of a solid safety culture such as management commitment, questioning attitudes, appropriate rigor, avoiding complacency, and periodic assessment. The *Limits of Safety* by Scott D. Sagan describes two differing perspectives on safety with hazardous technologies: the high reliability theory and the normal accidents theory.

The following is excerpted from a table in the book:

High Reliability Theory:

- Accidents can be prevented through good organizational design and management.
- Safety is the priority organizational objective.
- Redundancy enhances safety: duplication and overlap can make "a reliable system out of unreliable parts."
- Decentralized decision-making is needed to permit prompt and flexible field-level responses to surprises.
- A "culture of reliability" will enhance safety by encouraging uniform and appropriate responses by field-level operators.
- Continuous operations, training, and simulations can create and maintain high reliability operations.
- Trial and error learning from accidents can be effective, and can be supplemented by anticipation and simulations.

Normal Accidents Theory:

- Accidents are inevitable in complex and tightly coupled systems.
- Safety is one of a number competing objectives.
- Redundancy often causes accidents: it increases interactive complexity and opaqueness, and encourages risk-taking.
- Organizational contradiction: decentralization is needed for complexity, but centralization is needed for tightly coupled systems.
- A military model of intense discipline, socialization, and isolation is incompatible with democratic values.
- Organizations cannot train for unimagined, highly dangerous, or politically unpalatable operations.
- Denial of responsibility, faulty reporting, and reconstruction of history cripples learning efforts.

CONCLUSIONS

NNSA has not consistently achieved a uniform safety culture. NNSA should try and emulate applicable characteristics of a high reliability organization as described in the book. Namely:

- Good organizational design and management;
- Safety as a priority organizational objective;
- Redundancy enhances safety;
- Decentralized decision-making ;
- A "culture of reliability"; and
- Continuous operations, training, and simulations.

Sub-team 1 concluded that NNSA has been conditioned by success and a fragmented safety culture exists. See CI-2.1 for the recommendation to establish consistent expectations (including safety) through strategic and operational plans, flowing down from the top. The sub-team reached this conclusion through sub-team meetings, conference calls, and discussions, based on the collective experiences of the individual sub-team members and through discussion of other high-level, Departmental instances. When the larger team meetings occurred, other team members provided additional anecdotal evidence.

RECOMMENDATION

NNSA should strive to be more of a high reliability organization. To address the observation that consistency and rigor vary within NNSA and that a fragmented safety culture seems to exist, the sub-group arrived at the following recommendation:

CI-3.1 Reinforce expectations (e.g., safely accomplishing NNSA's mission by development and implementation of a NNSA Safety Culture) through individual and contractor performance standards.

REFERENCES:

1. CAIB Report, pages 179, 181, 196, 200
2. *Safety Series: Safety Culture.* A report by the International Nuclear Safety Advisory Group, Safety Series No. 75-INSAG-4, International Atomic Energy Agency, Vienna, 1991
3. "Principles for a Strong Nuclear Safety Culture (Preliminary)", INPO, November 2003
4. Sagan, Scott D., *The Limits of Safety, Organizations, Accidents, and Nuclear Weapons,* 1993

Sub-team Leader: _____

Date: 2/5/04

NNSA CAIB LESSONS LEARNED

Management and Safety Culture Improvement CI-4	Willingness to Accept Criticism and Diversity of Views is Essential.

NNSA LESSON LEARNED STATEMENT

The NASA Columbia Accident Investigation Board Report identified problems in the areas of: acceptance to new information; willingness to listen to outside expertise; intellectual curiosity and skepticism; lack of openness in communication and trust; and lack of encouragement in debate and diverse opinions.

RELEVANCE TO NNSA

A survey conducted by the NNSA CAIB Lessons Learned cultural issues sub-team indicates that NNSA also has substantial weaknesses in these same areas. This is often referred to as "shooting the messenger".

The NASA CAIB Report described several attributes of management not accepting or listening to criticisms of their programs. These attributes may be technical, cultural, or organizational. Five cultural factors were cited as causes for "bottling the bad news." They are as follow:

- Leadership shuns bad news because it is perceived as personal criticism.
- A highly political work environment is dominated by tenure, loyalty, power and status instead of performance.
- A rigid hierarchical organizational structure exists instead of a more flat, open structure.
- A pattern of placating those who bring bad news exists instead of taking real action.
- No reward system exists that provides direct or indirect rewards for people who highlight bad news.

NNSA needs to demonstrate an unambiguous visible strategic commitment to safety that includes giving safety a corporate identity and clearly establishing safety as an essential element to mission success by (1) establishing an NNSA Senior Safety Council that is comprised of experienced safety professionals to guide NNSA and provide long-term consistency and continuity; and (2) revising NNSA and Site Office strategic plans to specifically include a safety initiative (CI-4.1, CI-4.3 and CI-4.4).

One reason for resisting bad news was that management has positive intentions but often only selective perception. Because it is harder to see one thing when management looks for and wants to see another, any feedback to the contrary may not get past the individual's "perceptual filter". Participative managers may avoid conflict in order to gain greater acceptance with their employees who have a noticeable need to be liked. This management style takes precedence over holding individuals accountable. Frequently these managers are concerned about fear of failure. A participative manager may get feedback that his/her subordinates are not being held accountable, so the implied solution is raise the performance bar. However, this runs against the comfortable avoidance of interpersonal conflict and rejection. Conversely, a more dominant manager may feel the need to control a decision and make decisions quickly with little modification and with limited participation. This type of manager frequently does not exhibit strengths in building participative decision-making, leaving criticisms and alternatives behind.

Creating a culture in which executives are willing to hear the bad news involves building trust within an organization. Frequently managers are unable to discern the differences between feedback and criticism. Feedback is an emotionally neutral engineering term. It refers to outcome information that is fed back into a process to indicate whether that process is operating within designed parameters. For example, the sensor in a thermostat provides feedback whether the room temperature is below, at or above the target. Performance feedback when appropriately delivered, relates perceived outcomes to an intended target. Feedback is objective and specific and describes observable behaviors and effects.

Conversely, criticism is often emotionally laden, subjective and/or general. The recipient has much more difficulty identifying a changeable behavior. Criticism (non-objective and/or non-specific feedback) will tend to trigger more defensive tendencies thus strengthening the resistance to change. Change challenges individuals at almost all levels of an organization and if not managed properly, leads to distrust. Individuals fear a loss of control, both personally and professionally, that change or the acceptance of new ideas can bring. Uncertainty coupled with demonstrated lack of support, questionable management commitment and poor lines of communication over time, will result in individuals who are uninvolved and believe their input is neither valued nor really wanted. Organizations work better and can contribute more when having a direct connection to, and knowledge of, what we influence and what influences us. Without the "connection", intellectual curiosity suffers, as does healthy skepticism.

NNSA CAIB cultural issues sub-team conducted a survey to determine if there were parallels to many of the problems that NASA had. The team focused on why these problems existed and identified recommendations that should bring about permanent change. The sub-team focused on human behaviors that could be shown to contribute to the NASA problem and potentially NNSA's. The team identified the practice of shooting the messenger as a critical weakness in the NNSA safety culture. Examples include briefings to senior NNSA management where individuals are criticized for "bringing forth bad news". The practice of shooting the messenger can take several forms ranging from simply ignoring the messenger and the message, or ostracizing the messenger and suppressing the issues, to reprimanding and removing the messenger.

Examples of employees being reassigned due to bringing up too many issues about a major contractor or a Laboratory have occurred. While some reprisal actions may be subtle, the end result is the same -- safety professionals remain silent either out of fear or frustration of being ignored. These examples have also occurred in the NNSA Facility Representative (FR) program. Access to facilities' information has been denied and or phone calls are used to discredit and/or dissuade a particular FR from raising issues. Others examples of not accepting feedback is the Department's interactions with the Defense Nuclear Facilities Safety Board and other oversight bodies. Feedback from the Board is not universally welcome by the organization or individuals; it is instead viewed negatively as criticism.

CONCLUSION

Sub-team 1 concluded that NNSA should change the safety behavior of NNSA to be more open to alternate views and minority opinions (CI-4.2). NNSA needs to develop and implement Site specific and key organizational (Service Center, NN, DP) procedures on differing professional opinions. One example within NNSA is that process currently used by the Nuclear Explosives Safety Study group. Further, NNSA needs to establish a climate of healthy professional discourse by developing and implementing the mechanisms and opportunities that support and encourage free flowing discussion and innovation. As an example, hold periodic (no less than semi-annual) safety forums to discuss, as a minimum, trends, issues, lessons learned and best practices from both internal and external sources.

Finally, change the management -employee relationship and communication patterns to encourage individual imitative, growth, involvement, and a sense of identity to include implementing a program requiring safety staff to periodically brief senior management on status and concerns relating to their area of responsibility (see CI-2.2).

RECOMMENDATIONS

Listed below are specific recommendations for both individuals and the organization of NNSA. Suggested improvements within contractor organizations may need to be evaluated by that organization or feedback from the respective DOE office that provides the interface, if applicable.

CI-4.1 NNSA senior management should communicate the cultural and organizational lessons learned for NNSA from the NASA CAIB Report.

CI-4.2 Change the safety behavior of NNSA to be more open to alternate views and minority opinions. Develop and implement Site specific and key organizational (Service Center, NN, NA) procedures on differing professional opinions. Develop and implement a formal standardized minority opinion disposition process such as that used by the Nuclear Explosives Safety Study group. (See also CI-1.3)

CI-4.3 Develop and publish a safety culture policy statement that clearly defines NNSA's commitment and expectations regarding the role of safety within NNSA. In addition to the vetting process of the Leadership Coalition, NNSA should consider bringing in outside expertise to give the NNSA Administrator independent assistance in development and implementation steps toward improving NNSA's safety culture.

CI-4.4 Establish an NNSA Senior Safety Council that is comprised of experienced safety professionals to guide NNSA and provide long-term consistency and continuity of safety policies, standards, and practices. Hold periodic (no less than semi-annual) safety forums to discuss, as a minimum, trends, issues, lessons learned and best practices from both internal and external sources.

REFERENCES:

1. CAIB Report, pages 180, 181, 190, 192.
2. Virgin, B., *Shooting the messenger is a Result of Bad Leadership*, Seattle-Post Intelligencer, March 6, 2003.
3. Brenner, Rick, *Never Ever Kill The Messenger*, Chaco Canyon Consulting.
4. Anderson, Cheri, *Don't Shoot the Messenger*.
5. Daughtry, T., and G. Casselman, *Raising the Executive Performance Bar Why We Shoot the Messenger*.

Sub-team Leader: _____

Date: 2/18/04

NNSA CAIB LESSONS LEARNED

Organizational Issues OI-1	Effective Centralized and De-centralized Operations Require an Independent, Robust Safety and Technical Requirements Management Capability

NASA LESSONS LEARNED STATEMENT

NASA's Columbia Accident Investigation Board (CAIB) found that the loss of a truly independent, robust capability to protect the system's fundamental requirements and specifications inevitably compromised those requirements and therefore increased risk. In particular, the CAIB found that the organization responsible for program accomplishment decided on its own how much safety and engineering oversight was needed. The Board concluded that the separation of authority of Program Managers – who, by nature, must be sensitive to cost and schedule – and "owners" of technical requirements and waiver capabilities – who, by nature, are more sensitive to safety and technical rigor – is crucial.

Additionally, the CAIB concluded that the ability to operate in a centralized manner when appropriate, and to operate in a decentralized manner when appropriate, is the hallmark of a high-reliability organization. However, complex organizational structures such as NASA's that mix centralized and de-centralized functions or split functions into centralized and de-centralized pieces can hinder effective operations and result in disasters. The Board determined that NASA failed to operate effectively in both centralized and de-centralized modes based on the roles, responsibilities, authorities and relationships that developed over time. As a result, organizational complexity created artificial barriers to effective communications throughout the organization. Assigning individuals to multiple, and in some instances, competing places in the organization, complicated the problem.

RELEVANCE TO NNSA

Based on these two CAIB observations, sub-team 2 raised questions regarding how these issues relate to the NNSA and attempted to reach consensus conclusions and recommendations regarding both:

1. Should NNSA adopt the CAIB's strong recommendation to NASA to separate program and safety funding and authority?

Sub-team 2 discussed the question of whether there are areas within NNSA in which technical and funding authority should be separated, and if so, what they are and why? NNSA and NASA have adopted different safety responsibility philosophies: within NNSA, safety is the responsibility of line management, not an independent safety organization. These responsibilities are detailed in various letters of delegation and the NNSA Safety Management Functions, Responsibilities and Authorities Manual (FRAM).

Sub-team 2 observed that because NNSA Program Managers are responsible for assuring safety is adequately funded within their own programs, it raises the issue that NNSA may be prioritizing achieving program goals over safety as the CAIB found at NASA. The CAIB expressed significant concern about NASA's organizational structure that permitted program managers to determine how much safety to fund. With pressure to meet challenging launch schedules, NASA managers under-funded safety to ensure programmatic requirements necessary to meet the schedule were fully funded. Sub-team 2 questioned whether NNSA program organizations, focused on mission accomplishments and the budgets needed to

support them, allocate sufficient resources for operational and longer-term safety and infrastructure considerations.

Moreover, "safety versus program" tradeoffs in NNSA are routinely made two or three levels in the organization below the Administrator. Assistant Deputy Administrators are responsible to the Deputy Administrator for assuring that Program Managers adequately fund safety within programs under their cognizance. Sub-team 2 discussed numerous examples of situations in which safety or infrastructure did not receive the management attention or the resources it required, the most public of which was the creation of a Facilities and Infrastructure Revitalization Program outside of Defense Programs.

Sub-team 2 agreed that line management should continue to be responsible for balancing safety and program funding. However, Sub-team 2 concluded that, although Program Managers are concerned about ensuring safety, raising the visibility of tradeoffs between safety and program funding, particularly within Defense Programs (NA-10), should improve safety-related fiscal decision-making within NNSA. Raising the visibility of these important trade-offs would also serve as assurance to outside agencies and organizations that safety was factored into decision-making by all layers of NNSA management, both at the sites and at Headquarters.

Sub-team 2 also raised concerns about NNSA's ability to assure itself at Headquarters that the right set of technical requirements is established both corporately and on a site-by-site basis. Unlike NASA, many of the NNSA's technical requirements are grounded in laws and regulations. However, like NASA, NNSA does not have a central organizational authority responsible for protecting the fundamental technical requirements that have evolved as a result of over 50 years of research and experience. Based on the NASA experience, sub-team 2 is concerned that as the NNSA strives for greater operational and fiscal efficiency, those fundamental requirements and specifications which have protected the complex and the public for many years may be threatened by the lack of an organizational structure designed to defend them.

The government is liable, by statute, to the public for the safety, surety and efficacy of the nuclear weapons inventory and complex. Sub-team 2 felt strongly that there needed to be a central technical authority responsible to the NNSA Administrator for assuring the technical adequacy of design and production standards and to enforce those standards, when necessary, across the entire nuclear weapons complex. Sub-team 2 concluded that this capability does not exist today within NNSA and that this is a significant organizational deficiency requiring resolution.

2. Given the importance of being able to operate successfully in both centralized and de-centralized modes, does NNSA's new organizational model support what should be centralized/de-centralized today?

For the most part, sub-team 2 answered this question in the affirmative. NNSA's new organizational model depends heavily on de-centralized decision making by Site Office Managers. As NNSA's risk acceptance officials, the primary responsibility of Site Office Managers is operational (safety and security) decision-making. NNSA has chosen to de-centralize the majority of daily operational decision-making to the Site Office Managers and given them the authority and resources to accomplish their mission. Site Office Managers have multiple, but not necessarily redundant, sources of technical information: Authorization Basis professionals, Facility Representatives and Subject Matter Experts. In particular, Facility Representatives provide routine, independent operational oversight of potential high consequence contractor operations.

NNSA has chosen to centralize program management. As a result, Site Office Managers must rely on program organizations for operational and safety system funding. As a compensation mechanism, NNSA

has built operational lines of communication to connect Site Office Managers directly to the NNSA Administrator, providing these officials with immediate access to top management when conflicts exist between centralized program management and de-centralized operational decision-making. In NNSA's new organizational model, Site Office Managers report directly to the front office (NA-1/2), providing a "pushback" mechanism when disagreements arise between a Site Office Manager and a Program Manager. While this compensation mechanism is important, sub-team 2 still believes organizational changes should be made to assure proper balance between operational and programmatic considerations in funding decisions.

While sub-team 2 members generally agreed that NNSA is appropriately centralized and de-centralized, sub-team 2 raised questions about how Headquarters can be assured that de-centralized decision-making is being made appropriately. NNSA is developing a management philosophy based on telling Site Offices and contractors ***what*** needs to be done, but not defining exactly ***how*** to accomplish assigned tasks within existing statutory, regulatory, contractual and policy authorities. The question arises as to how these de-centralized decisions are made and how consistent the process is from site to site.

Sub-team 2 conceded that, at present, Headquarters has limited insight into how key safety decisions are being made on a site by site basis, such as approvals of authorization basis documents, but disagreed on whether or how much Headquarters needs to know. Yet, if Headquarters is in the line management chain and responsible for safety, the sub-team agreed that Headquarters must be assured that these decisions are being made within appropriate bounds, and therefore, guidance should clearly delineate thresholds beyond which the Site Office's will require Headquarter approval.

While there are diverse viewpoints regarding how much information Headquarters needs, the sub-team generally concluded that it is appropriate for Site Office Managers to make decisions without consultation as long as Headquarters has provided sufficient guidance and resources, and adequate controls are in place to assure safety is maintained.

The CAIB concluded that in order to assure safety in de-centralized decision-making, it is essential that mature processes exist that anchor rules, procedures, and routines for de-centralized activities/decisions. Sub-team 2 did not have the resources to fully evaluate the status of DOE and NNSA directives, orders, and policies, that if implemented, would ensure that adequate processes are in place to assure safety in de-centralized decision-making and proposes. This question should be further considered as part of the process of developing the NNSA's Line Oversight/Contractor Assurance System (LO/CAS) policy and approval of Site Office FRAMs.

On balance, the sub-team concluded that NNSA does not currently have the proper management processes in place to assure that de-centralized decision-making is properly executed, in part because the implementation of LO/CAS is far from complete. For example, although NNSA's new oversight model relies on rigorous self-assessments by Site Offices, results from reviews over the past 18 months (NNSA Headquarters Site Office reviews and recent Quality Assurance reviews) indicate that most NNSA Site Offices do not have mature oversight programs in place, or that rigorous self-assessment is being performed. In addition, sub-team 2 is concerned that Headquarters does not have management systems in place to regularly review Site Office performance on their safety oversight functions and their ability to conduct critical self-assessments.

Regardless of the processes in place, it is also essential for Headquarters to ensure consistent application of the processes across the weapons complex. Sub-team 2 agreed that, at present, NNSA does not have the necessary mechanisms in place to ensure consistency in de-centralized decision-making and agreed that the establishment of a central technical authority was a key to overcoming this deficiency. Subteam members agreed that regular external reviews of each Site Office are also needed to help assure consistent

application of decision processes within NNSA, the lessons of which should be shared with Headquarters line officials and other Site Office Managers.

A related question the sub-team discussed was: what assurance does Headquarters have that Site Office Managers are appropriately interpreting Headquarters guidance? The DOE Office of Independent Oversight and Performance Assurance (OA) provides the Administrator with independent information regarding site office and contractor management systems and performance. However, OA only has the resources to review NNSA facilities once every two years and does not have direct authority to shutdown an operation. One solution proposed by the sub-team is the creation of a central technical authority capable of issuing and approving interpretations of guidance and initiating changes to deficient guidance documents, policies and regulations. However, the sub-team agreed more should be done. Until LO/CAS is fully implemented, the sub-team recommends that NNSA reinstitute annual reviews of each NNSA Site Office to help better communicate Headquarters expectations and to provide assurance to Headquarters line officials that the sites are appropriately accepting risk.

Sub-team 2 was also concerned about how Headquarters officials can be assured that Site Office Managers, as NNSA's risk acceptance officials, are asking the right questions and have the right information necessary to accept risk. Sub-team 2 agreed that having the right processes in place and sufficient guidance promulgated with central technical authority available for interpretation, that there would be times that a decision point might fall outside of the established norms, and that Headquarters must feel comfortable that Site Office Managers and their staffs would ask the right questions and ensure they were answered adequately before proceeding with a decision. In addition to regular reviews, the sub-team concluded that a key to feeling comfortable that Site Office Managers and their staffs are asking the right questions is their technical qualifications, experience and ability to identify the issues needing resolution. Sub-team 2 concluded that NNSA should strengthen training and development programs to assure proper qualification of technical decision makers and risk acceptance officials.

CONCLUSIONS

Sub-team 2 reached two key conclusions (and related recommendations) about the organizational structure of the NNSA based on its review of the CAIB Report:

First, while NNSA should retain its management philosophy of holding line managers accountable for safety, the sub-team felt strongly that a central technical authority responsible to the NNSA Administrator is needed to assure the technical adequacy of design and production standards and to enforce those standards, when necessary, across the entire nuclear weapons complex. NNSA has optimized its organization for de-centralized decision-making on risk acceptance but the sub-team identified various concerns with respect to oversight of these de-centralized decision-making processes. Specifically: NNSA's technical requirements management process is fragmented between individual sites and Headquarters. Headquarters is not currently providing sufficient guidance to de-centralized decision-making authorities, in part because the implementation of LO/CAS and the review and approval of Site Office FRAMS are not complete. Additionally, NNSA's new oversight model relies on rigorous self-assessments by Site Offices that have not yet been fully demonstrated.

Therefore, NNSA should establish a Chief Engineer in lieu of an ES&H Advisor that would be responsible for developing, maintaining and overseeing corporate ES&H policies and standards, including reviewing and approving any waivers to those policies or standards, including veto power. The Chief Engineer should also be responsible for monitoring the health of NNSA's technical staffing. Strengthening the role of NNSA's senior technical advisor would provide technical staffs a place in Headquarters to communicate minority opinions that have been overlooked or rejected in other parts of the organization. While this technical official would have a small staff, he or she must have unfettered

access to all NNSA sites and facilities identifying safety issues that need to be resolved. Additional responsibilities might include the following:

- Monitoring implementation of NNSA's LO/CAS policy.
- Concurring on exemptions from Federal regulations and startups of new CAT I/II facilities, and restarts of Cat I/II Facilities, as appropriate.
- Monitoring budget formulation to ensure a balance between safety and operations and programmatic issues.
- Addressing technical issues and safety problems identified by the M&O Contractors, NNSA, or stakeholders.
- Liaising with the Defense Nuclear Facilities Safety Board and DOE's Office of Environment Safety and Health.

Second, Defense Programs is not currently organized or staffed to effectively carry out the safety responsibilities allocated to it in the NNSA FRAM. As the Lead Program Secretarial Officer for ES&H, the Deputy Administrator for Defense Programs must integrate program and operational issues. As currently organized, this integration regularly occurs at least one level below the Deputy, reducing the level of management attention those operations and infrastructure issues should receive. Headquarters program managers also wear two hats, program development and operational oversight, potentially creating conflicts of interest. Without appropriate checks and balances, the sub-team is concerned that the conflict of roles increases the natural tendency to favor program objectives over operational (safety and security) and infrastructure issues.

To provide the appropriate checks and balances, NNSA should elevate the management and oversight of operational and infrastructure issues within Defense Programs. This can be accomplished in at least two ways. One involves creating an organization that reports directly to the Deputy Administrator and has an equal voice to the program organizations on operational and infrastructure issues. This new organization would be responsible for managing funding required for these purposes, and developing appropriate business systems necessary to regularly review the operational safety status of the Site Offices. Another would be to create a staff organization reporting to the Deputy Administrator that would review program office decisions regarding safety and infrastructure funding and regularly review the operational safety status of Site Offices. In either case, the sub-team believes that Defense Programs needs additional resources and safety needs to be elevated in the organization to carry out its safety responsibilities.

RECOMMENDATIONS

OI-1.1 Establish a Chief Engineer (in lieu of an ES&H Advisor).

OI-1.2 Elevate the management and oversight of operational and infrastructure issues within NA-10 and provide adequate resources by creating an organization that reports directly to the Deputy Administrator.

REFERENCES

1. CAIB Report, Chapter 7
2. NNSA Safety Management Functions, Responsibilities and Authorities Manual (FRAM)
3. Existing NNSA and "NNSA of the Future" Organizational Alignment Documents

Sub-team Leader: Robert W. Ad[illegible], Jr.

Date: Feb 4, 2004

NNSA CAIB REVIEW LESSONS LEARNED

Organizational Issues OI-2	Assuring safety requires a careful balance of organizational efficiency redundancy and oversight.

NASA LESSONS LEARNED STATEMENT

The Columbia Accident Investigation Board (CAIB) found that efforts to improve efficiency of NASA's organizational structure undermined the redundancy essential to successfully operating a high-risk enterprise.

The CAIB also concluded that NASA's contractual arrangements, organizational structure and downsizing undermined the adequacy of Federal oversight of the contractor and resulted in the transfer of too much authority for safety to the contractor. The oversight previously in place was essential to successfully operating a potential high consequence enterprise.

RELEVANCE TO NNSA

Organizational Efficiency

In any closely coupled organization, such as NASA and NNSA, redundancy and oversight should be proportional to risk (i.e., the higher the potential consequence, the more redundancy and oversight is required). Within the NNSA, it is a common belief that a hazardous facility or operation that presents a potential risk to the public and/or co-located workers should have redundancy in oversight processes. For clarification, the assurance programs conducted by the contractor to self-assess and monitor their own performance and safety is not considered as oversight in the context of this discussion.

NNSA Site Office Managers have multiple, but not necessarily redundant, sources of technical information: Authorization Basis professionals, Facility Representatives and Subject Matter Experts. In particular, Facility Representatives provide routine, independent, operational oversight of potential high consequence contractor operations. The DOE Office of Independent Oversight and Performance Assurance (OA) provides the Administrator with independent information regarding Site Office and contractor management systems and performance; however, OA serves more of an audit function, rather than assurance function, and does not have direct authority to shutdown an operation.

Sub-team 2 raised several questions regarding the balance of organizational efficiency versus redundancy and oversight. In particular, the sub-team was concerned about NNSA's plan to eliminate portions of its existing oversight and redundancy before the safety assurance processes of the "NNSA of the Future" were fully in place and evaluated as effective. Many of the questions below have not been fully answered and should be further discussed by NNSA management.

Existing NNSA safety assurance systems, including oversight processes and organizational redundancy, have evolved from over 50 years of operational experience. Within the Naval Reactors program, the rationale for each evolutionary change has been documented to ensure that future decision-makers would understand the context of that evolution and have historical data at their disposal as they made additional organizational and process changes. Unlike Naval Reactors, it is not clear that the rest of NNSA can support its decisions about what organizational structures or procedures are needed to ensure the redundancies and independence necessary to support a highly complex, potential high consequence

operational environment. As a result, NNSA cannot answer the follow-on question about whether or not it currently has, or will have in the "NNSA of the Future," the right amount of redundancy for potential high consequence operations. To the sub-team and to many outside organizations, this appears to be a classic example of relying on past success as assurance of success in the future.

Prior to the decision that all on-site reviews would be performed by OA, NNSA's Headquarters organization was conducting reviews of Site Offices to assure performance. Results from these reviews indicate that some NNSA Site Offices do not have mature oversight programs in place, including self-assessment mechanisms. The results of recent Quality Assurance reviews of four NNSA Site Offices reinforce these findings.

The NNSA is in the process of implementing LO/CAS at NNSA facilities (Site Offices and M&O Contractors). While the new LO/CAS oversight model has not been fully developed, much less implemented, the process is intended to include occasional reviews that will be conducted by the DOE OA. In the past, reviews by OA have typically been heavily weighted towards oversight of the M&O Contractor. NNSA line management does not control and has limited influence over OA's review elements.

The CAIB found that NASA's integrated hazard analysis was inadequate. Although hazard analysis tools were available, they were applied inconsistently and decision-making was often subjective. Complicating the problem, hazard analysis had been delegated to the contractor, who was not required to conduct integrated hazard analysis, only system-level analysis. The contractor's analytical products were inadequate for NASA to conduct integrated risk analysis. As a whole, NASA's reporting and tracking systems were fundamentally flawed: they were cumbersome, uncoordinated and the data they held were incomplete and different work centers used the databases differently. As a result, NASA's reporting and tracking systems were ineffective in helping to understand and manage the risks associated with the Space Shuttle Program.

Like NASA, NNSA has developed numerous reporting and tracking systems, but also like NASA, little corporate-wide analysis and/or trending is possible without extensive human effort. Without knowledge of the trend of NNSA's safety assurance system, managers may not be able to take corrective action in sufficient time to prevent a significant failure.

Finally, does NNSA have effective "push-back" mechanisms at each level of the organization and are minority opinions appropriately evaluated? Sub-team 2 believes much of this problem can be corrected through the implementation of the recommendations found in the previous section concerning replacing the ES&H Advisor to the NNSA Administrator with a Chief Engineer and elevating the level of safety versus program decision-making within Defense Programs.

Contractor Authority

The CAIB determined that NASA's Space Flight Operations Contract was intended to streamline and modernize NASA's cumbersome contracting practices, thereby freeing the agency to focus on research and development. A single contract would, in principle, provide "oversight" on production, safety, and mission assurance, as well as cost management, while NASA maintained "insight" into safety and quality assurance through reviews and metrics. However, combined with personnel cuts these mid-1990s transformations rendered NASA's already problematic safety system simultaneously weaker and more complex. Additionally, the NASA consolidated contract involved substantial transfers of safety responsibility from the government to the private sector; rollbacks of tens of thousands of Government Mandated Inspection Points; and vast reductions in NASA's in-house safety-related technical expertise.

Similarly, at NNSA, as a result of downsizing and re-engineering, many experienced engineers are changing jobs or are retiring. LO/CAS, once implemented, will by design, permit NNSA to be more dependent on its contractors and reduce certain aspects of Federal oversight. Headquarters oversight has already been supplanted with OA assessments.

The NNSA Administrator cannot delegate his responsibility for safety; however, authority for certain activities supporting his management of safety can be delegated. Certain of these may be appropriate to delegate to the contractor. However, delegations of safety authority to the contractor assumes these delegations are legal and that the delegate or contractor has the capability, including competence and resources, to effectively execute those safety management authorities.

NNSA has already reduced its oversight of Site Offices and contractors as part of implementing the "NNSA of the Future." Although NNSA intends to rely heavily upon LO/CAS in the future, the question remains as to whether it is heading along the NASA failure route of shifting from "oversight" to "insight" and whether or not it has already reduced oversight too much. The bases for NNSA's reduction of oversight of non-nuclear operations seem to be grounded in expected future assurance system capability and validity instead of on the existing processes in place.

Sub-team 2 believes NNSA should take into account the Naval Reactors experience at it develops LO/CAS. NR clearly defines the bounds within which their safety assurance program is designed to maintain reactors. Establishing the bounds of safety expectations, identifying the possible points of failure for each operation that could potentially breach those bounds, and identifying the required amount of redundancy or oversight to prevent those breaches are necessary steps along the path of determining which Headquarters inspections and other existing oversight activities may be reduced, and when.

CONCLUSIONS

Redundancy and the level of oversight should be proportional to risk (i.e., the higher the potential consequence, the more redundancy and oversight is required). No hazardous facility or operation that presents a potential risk to the public and/or collocated workers should be without redundancy in oversight processes. However, the sub-team concluded that NNSA has not yet implemented an oversight model with the appropriate level of redundancy in its oversight processes or that it has established sufficient "push-back" mechanisms to assure safe operation of potential high consequence operations.

Sub-team 2 is concerned that the abrupt reductions in oversight and Headquarters review of Site Offices and contractor operations has left NNSA vulnerable to failure, especially until LO/CAS processes have been proven effective. Should NNSA reconsider the decision to stop performing regular Headquarters inspections of Site Office management systems and operations as part of its reengineering activities? Sub-team 2 was unanimous in rephrasing the question, that it is not "if" but "which" Headquarters inspections should be reinstated?

NNSA contractors conduct numerous potential high consequence operations across its complex that should involve Federal staff oversight. Quality control and Federally imposed safety hold points are used to check contractor progress and status of safety systems and processes in the NNSA. Existing NNSA requirements typically include safety hold points to ensure hazards have been properly analyzed, controls established, and controls have been implemented. The lifting of some of these Federal controls, if not carefully evaluated, may, in essence, transfer too much safety authority to the contractor.

Many NNSA operations are more hazardous than NASA operations. NNSA must be cautious to ensure it does not transfer, or potentially transfer, too much safety authority to the contractor for our potential high consequence operations. Contractor assurance systems and Federal line oversight must be measured and

must be commensurate in depth with the risk associated with work conducted in nuclear weapons complex. Sub-team 2 believes it is critical that NNSA management allow enough time to objectively measure how well oversight programs are being implemented, and stabilize the oversight model itself. During early stages of implementation, increased Federal oversight might well be necessary to ensure that the right programs are in place and being implemented.

Along with regular Headquarters oversight, OA provides some level of independent information about Site Office and contractor operations. However, OA is not part of the NNSA organization and there is no formal means by which the two organizations communicate audit and oversight requirements and plans. The existing process leaves OA to identify for itself what activities to review. Sub-team 2 believes that OA's role would be much more beneficial to NNSA, and to DOE as a whole, if OA were tasked with evaluating the "right" activities – those that pose the highest risk to the organization if not conducted safely and in accordance with existing statues, policies and procedures. It is incumbent upon NNSA to clearly identify those activities to OA and to discourage OA evaluation of activities with little safety significance or legal impact.

RECOMMENDATIONS

OI-2.1 Until the NNSA oversight model is defined and LO/CAS is fully implemented and evaluated as effective, NNSA should reinstate on-site reviews of Site Office oversight systems.

OI-2.2 Headquarters as well as Site Office managers must routinely conduct self-assessments of their Federal operations.

OI-2.3 Headquarters should routinely review the primary sources of technical information resident in Site Offices (e.g., Facility Representative's periodic reports). (See also TC-2.1)

OI-2.4 The NNSA should further define OA's role in the oversight process through a formal agreement. In particular, clarify OA's role in providing assurance to the Administrator regarding the effectiveness of NNSA's risk acceptance.

REFERENCES

1. CAIB Report, Chapter 7
2. NNSA Safety Management Functions, Responsibilities and Authorities Manual (FRAM)
3. Existing NNSA and "NNSA of the Future" Organizational Alignment Documents

Sub-team Leader: Robert W. Alderman, Jr.

Date: Feb. 4, 2004

NNSA CAIB REVIEW LESSONS LEARNED

Organizational Issues OI-3	Effective Communications along with Clear Roles and Responsibilities are Essential to a Successful Organization.

NASA LESSONS LEARNED STATEMENT

The Columbia Accident Investigation Board (CAIB) concluded that NASA's complex and often hierarchal organizational structure diffused and confused responsibility, essentially leaving no one person accountable. Coupled with NASA's culture that lent greater technical credence to communications originated from higher in the organization, the organizational structure itself often stifled or blocked communications. Additionally, within NASA's strong, hierarchal organizational structure, as decision-making information worked its way up to senior management it tended to get watered down, primarily by reducing the technical detail, for brevity's sake. This resulted in those who should be held accountable for operational performance not having the information necessary to make good decisions and for all effective purposes delegating accountability down to the supporting staff, or even the contractor who was developing the decision briefing for upper management.

RELEVANCE TO NNSA

Confusion about the decision-making processes within DOE and later, NNSA (two headquarters in particular), and the attenuation of technical information (and the lack of clear accountability) created by redundant management activities were significant concerns in the past. Sub-team 2 observed that the "NNSA of the Future" organizational model eliminates much of the complexity and confusion that previously existed by holding Site Office Managers accountable for the operational safety, security and overall success of their sites.

However, the sub-team believes that Site Offices need greater clarity in the direction received from Headquarters. Sub-team 2 noted that completing the NNSA Safety Management Functions, Responsibilities and Authorities Manual (FRAM) is an important step in providing clarity, but everyone across the enterprise must understand the FRAM and be technically capable and proficient to execute their personal responsibilities. Like LO/CAS, approval and implementation of Site Office FRAMs is incomplete. These safety management processes require additional direction from senior management.

NNSA's new organizational model depends heavily on de-centralized decision making by Site Office Managers. However, as NNSA has shifted away from technical management to contract and budget management, the technical skills and experience of risk acceptance officials varies greatly. Compounding this variability, the NNSA has not established any minimum training or qualifications prior to being assigned duties involving risk acceptance. Like NASA, this potentially leads to decision materials being summarized in a manner understandable by the risk acceptance official and may, in some instances, reduce or eliminate the technical information critical to a proper decision. Compounding this problem, NNSA has assigned some individuals to risk acceptance duties based primarily on management skills rather than technical competence. Although NNSA attempts to compensate for technically weak managers by assigning a strong technical deputy to them, this cannot absolve the risk acceptance official of their responsibilities. This practice potentially places sites managed by less technical managers at a higher risk than may be acceptable.

Sub-team 2 is also concerned about how Headquarters officials can be assured that Site Office Managers are asking the right questions and have the right information necessary to accept risk. Sub-team 2 agreed

that having the right processes in place and sufficient guidance promulgated with central technical authority available for interpretation, there would be times that a decision point might fall outside of the established norms, and that Headquarters must be assured Site Office Managers and their staffs would ask the right questions and ensure they were answered adequately before proceeding with a decision.

As previously discussed, NNSA has not determined the right amount of redundancy and oversight it needs. Contributing to this is the lack of metrics and indicators to provide NNSA managers with information about the adequacy and trend of safety of NNSA's potential high consequence activities. Like NASA, NNSA has developed numerous reporting and tracking systems, but also like NASA, little corporate-wide analysis and/or trending is possible without extensive human effort. Without knowledge of the trend of NNSA's safety assurance system, and a means to communicate those trends, managers may not be able to take corrective action in sufficient time to prevent a significant failure.

Effective communications are a necessity in the successful operations of any organization. Several questions concerning the adequacy and effectiveness of communications within NNSA arose during the sub-team's review of the CAIB Report. With respect to the adequacy of organizational communications channels in the new NNSA model, the sub-team concluded that the dual communications paths of Site Office Managers to Headquarters program authorities as well as directly to the Administrator provided sufficient paths for communications. But, the question remained as to whether there are organizational structure options that will encourage staff to raise, and assure proper evaluation of tough questions about operations. Sub-team 2 believed that technical and safety personnel needed an additional outlet for expressing their concerns and for obtaining technical and career advice. Having a central technical authority at Headquarters could provide this outlet and help prevent a situation where technical and safety personnel at a Site Office were unable to get significant concerns aired by management.

The flip side of this concern is that it is not clear how environment, safety and health (ES&H) information consistently moves within line management from the Site Office Managers to the Principal Deputy/Administrator without bypassing the appropriate Deputy Administrator or vice versa. Also, it is not clear by what safety metrics and other evaluation methods Site Office and Site Office Manager performance will be routinely evaluated. Sub-team 2 concluded that Defense Programs, as the Headquarters ES&H line organization, must establish business systems and metrics to assure that the Deputy Administrator remains properly informed to accept responsibility for the safety of the nuclear weapons complex.

Other related questions remained unanswered by the sub-team and felt to be best answered by asking employees for their opinions about communications within NNSA. One question is whether or not different opinions are sought and valued in NNSA. The second is do employees understand how to get critical communications out of their local channels and to the appropriate decision-makers. Sub-team 2 concurred that answering these questions by seeking the opinions of employees would lead to being able to answer whether there are additional organizational changes that could further enhance communications.

CONCLUSIONS

Sub-team 2 concluded that NNSA Senior Management must provide clear guidance on Site Office FRAMs including the expectation that each site will have sufficient operational details to adequately describe the key ES&H approval and oversight implementing processes and procedures being relied upon to ensure safe operations. Headquarters must establish a process to assure that the Site Offices are functioning as described in the FRAM. Finally, the new NNSA organizational structure and individual managed staffing plans must be reevaluated to ensure sufficient technical and administrative resources are available for the FRAM framework to succeed.

In addition to regular oversight reviews, the sub-team concluded that the primary assurance Headquarters has that Site Office Managers and their staffs are asking the right questions is the technical qualifications, experience and ability of Site Office officials. Sub-team 2 concluded that NNSA should strengthen training and development programs to assure proper qualification of technical decision makers and risk acceptance officials.

Clearly defined roles and responsibilities is an obvious attribute of an effective organization. Since the NNSA FRAM was developed with the NNSA of the Future in mind, the question as to whether the FRAM matches the new organizational model may seem moot. The FRAM also, along with formal letters of delegation, clearly identifies the individuals responsible for assuring safety of NNSA operations. However, in light of the conclusions and recommendations developed by the sub-team, it is important that the FRAM be revisited to ensure its consistency with any additional changes to the NNSA organizational structure as a result of this CAIB Report review.

NNSA Sites Offices must rely on program organizations for operational and safety system funding. At the laboratories, the Site Office Managers view safety as their primary mission, along with security and environmental compliance. They do not view program schedule as one of their top concerns, leaving that to the Program Managers. However, at the production plants, Site Office Managers are evaluated on their program accomplishments along with their ability to maintain safety, security and environmental compliance and conflicts of interest may occur. Sub-team 2 concluded that this difference should be taken into account during the development of the LO/CAS oversight model at each site.

RECOMMENDATIONS

OI-3.1 Headquarters must provide clear guidance as necessary to Site Managers with respect to delegated safety authorities (e.g., risk acceptance process and when to request support for accepting risks outside "normal" circumstances).

OI-3.2 NNSA should develop succession planning, development and mentoring programs for risk acceptance officials. (See also CI-1.1 and TC-3.3)

OI-3.3 Laboratory and Production Site Office Manager responsibilities, including oversight responsibilities, must be defined with respect to the balance of safety and program priorities

REFERENCES

1. CAIB Report, Chapter 6 & 7
2. Existing NNSA and "NNSA of the Future" Organizational Alignment Documents
3. NNSA Functions Matrix

Sub-team Leader: Robert W. Jeffries Jr.

Date: Feb 4, 2004

NNSA CAIB LESSONS LEARNED

Technical Capability: TC-1	Workforce Reductions, Outsourcing, and Loss of Organizational Prestige can cause an Erosion of Technical Capability

NASA CAIB LESSONS LEARNED STATEMENTS

"NASA grew dependent on contractors for technical support, contract monitoring requirements increased, and positions were subsequently staffed by less experienced engineers who were placed in management roles."[1]

"Years of workforce reductions and outsourcing have culled from NASA's workforce the layers of experience and hands-on systems knowledge that once provided a capacity for safety oversight. Safety and Mission Assurance personnel have been eliminated, careers in safety have lost organization prestige, and the Program now decides on its own how much safety and engineering oversight it needs."[2]

RELEVANCE TO NNSA

The proposed NNSA of the Future reduces the number of technical positions. Simultaneous retirements, buyouts, relocation refusals and other factors will likely result in a smaller and less capable cadre of technical personnel. This is all ready evident by the remaining pool of technical talent that resides in the Service Center where a large loss of technical personnel has taken place and over 50% of nuclear safety experts within the ES&H department have taken other positions or declined the directed re-assignment since the initial standup of the Service Center. Site Offices now must be self-reliant in some areas where critical hiring is still taking place. Additionally, the Site Offices will become more reliant on a pool of technical talent maintained by the Service Center and the adequacy of the quantity of available technical expertise is being questioned.

Sub-team 3 has attempted to address this issue by looking at NNSA staffing plans and other relevant data, with some focus on erosion of ES&H technical capability of federal staff within the Office of Defense Programs (DP). DP manages over 60 Category II and III nuclear facilities, and about 300 active safety systems within these facilities. Failure of these active safety systems could result in a variety of potential accidents, some with direct public consequence. These are viewed as comparable to the NASA issue related to failure of the space shuttle. We will attempt to determine whether there has been too large an erosion of ES&H technical capability with respect to federal staff, and if so, what should be done about it.

<u>Existing Information and Assumptions Within NNSA:</u>

The following is a list of NNSA information that was reviewed to address this issue.

- NNSA managed staffing plans including plans for the Office of Defense Programs (NA-10), NNSA Site Offices, and the NNSA Service Center.
- NNSA Service Center, Service Level Agreements (some are draft).
- 1995 and 1998 Office of Defense Programs (DP) Staffing Studies.
- NNSA Functions, Responsibilities and Authority Manual.
- NNSA Matrix of Functions used in part to develop NNSA Staffing Plans.

[1] CAIB Report, page 179
[2] CAIB Report, page 181

The evaluation of this diverse set of information could take many forms. For example, Table 1 compiles some data for the NNSA Site Offices, showing the number of nuclear facilities, the number of safety systems for these facilities, and staffing measures such as number of authorization basis staff, facility representatives, safety system oversight staff, and total ES&H staff. Review of both the 1995 and 1998 DP staffing studies indicated that overall staffing would decrease roughly consistent with current overall staffing trends. However, neither staffing study anticipated the DP budget increases that have taken place in the past several years. The above could imply that there is a disconnect between the overall level of work and the federal staffing needed to oversee this work. Linking this to safety oversight implies that the amount of work for each federal safety position may have increased since 1995.

Based on the material reviewed we have identified the following key observations, findings, and performance gaps.

Key Observations, Findings and Performance Gaps:

- The NNSA Managed Staffing Plans (HQ excluded) identified the elimination of approximately 40 ES&H staff, or about a 14% reduction.
- Some of the Site Office Managed Staffing Plans speak to an imposed overall staff ceiling. It is not clear whether this results in too few safety staff or overestimates the anticipated support from the Service Center.
- Comparison between the Site Offices suggests that there may be an imbalance of how they will execute safety responsibilities. Sites with fewer nuclear facilities and safety systems have higher overall staffing compared to sites with many nuclear facilities and safety systems. Some sites have high hazard non-nuclear work whereas others do not. It is not clear whether this imbalance reflects actual work expectations or is an artifact of how these offices were staffed in the past.
- It is not clear whether Site Offices with higher staffing levels and a higher number of nuclear facilities and safety systems have themselves been adequately staffed. This cannot be determined from review of functions alone.
- Site Office expectations of support from the Service Center are not well defined. Service Level Agreements between the Site Offices and the Service Center discuss the types of services required, but they do not provide sufficient information to quantify the needed staffing or subject expertise. Some Site Offices have identified large blocks of support (QA support, safety system oversight, DNFSB recommendations and actions) from the Service Center.
- Site Offices and the Service Center seem to agree that the Service Center may not be capable of providing the quantity of services required by the Site Offices. Some Site Offices are concerned whether the Service Center will have appropriate historical and operation specific knowledge. It is not clear whether this is a subjective feeling or an actual problem and, if it is an actual problem, whether the magnitude of this apparent problem has been determined
- The Service Center, Office of Technical Support, ES&H Department plans on reducing staffing by 44% (from 77 to 43), with only about half of their overall staff capable of addressing nuclear safety issues (about 21 FTEs). There is no data to suggest that this staffing target was based on objective assessment of expected work, and it is not clear that sufficient resources will be available to support peak demands from potential customers.
- Forced physical consolidation of personnel into the Service Center has already resulted in a large loss of ES&H nuclear safety subject expertise. Within the above noted ES&H Department 13 out of 21 nuclear safety related positions are vacant or are positions where

the person has declined the directed reassignment. More important than the loss of expertise may be the loss of direct NNSA experience in dealing with nuclear safety issues.

- Review of functions assigned to NA-1, NA-3.6, NA-10, and NA-50 suggest that they will also need support from the Service Center. It appears that the level of crosscutting support that has been supplied in the recent past (1 to 3 years) may be under-estimated. Examples of this include development and review of policy and directives, addressing DNFSB recommendations and crosscutting issues, and ESAAB review. While one could also argue that having this support physically located with NA-1 or NA-10 is also desirable, the immediate issue is whether the Service Center can meet these needs.

As NNSA has re-engineered and downsized, Site Office and the Service Center have developed managed staffing plans to identify the minimum skill sets required to accomplish the mission. A symbiotic relationship must exist between the Site Offices and the Service Center regarding the inventory and balance of technical capability. Site Offices and the Service Center develop annual service level agreements between each other, but it is not clear that an overall service capability assessment has been made.

Loss of Prestige of Safety as a Career

The prestige and status of safety professionals at NASA was not on par with the program management for the shuttle. This contributed to the lack of attention on the part of management to listen and address the safety concerns in an appropriate manner. The CAIB Report stated, "They were separated from the decision-making process by distance and rank."[3] This concern is present in the NNSA and needs to be addressed.

One example of this in DOE (EM) was a fatality from inadvertent carbon dioxide discharge at INEEL. A carbon dioxide fire suppression system, controlled by an AFP-200 analog fire panel, unexpectedly discharged without an evacuation warning alarm when it was disconnected from normal AC power during routine electrical maintenance. The assumption was that this maintenance had been performed before and that the operation was safe. If this issue had been addressed adequately using a process-based approach to define all of the hazards and information available, this accident could have been prevented. Also, the role of the safety professional and their competence was an issue, which supports the concept that safety professionals need to be qualified to maintain their status and position in the organization.

The implementation of Integrated Safety Management (ISM) has shifted the emphasis from expert-based safety to process-based safety. With this approach, a formal process is implemented to define the work scope, identify and analyze the hazards, implement necessary controls, and review the process before work is started. Although ISM relies heavily on expert knowledge, the necessary level of formality is used to document and communicate the process to allow review and scrutiny for the reviewers and decision maker. This process requires unique technical qualifications and skills that have enhanced the prestige and status of the safety professional. ISM has improved the safety culture within NNSA but more needs to be done to acknowledge the process and the important role of the safety professional.

In general within the NNSA, the safety professional is viewed as an individual of limited value to NNSA's mission, and is sometimes seen or perceived as a barrier to conducting work rather than a valued member of the organization in successfully accomplishing the mission. Sub-team 3 recommends that NNSA develop a Safety Professional of the Year Award that recognizes most

[3] CAIB Report, page 192

effective safety improvements, innovation in solutions to safety issues, and contribution to improvements to the NNSA safety culture. In addition, implement the recognition programs for federal employees in safety areas (TC-1.5).

There are a few examples of NNSA improving the status and prestige of safety professionals. Establishing a Facility Representative (FR) program has enhanced the status of the safety professional within NNSA and has elevated the role and status of the FR from the contractor's perspective. The FR must meet a rigorous training and qualification program that requires both written and oral examinations. The FR must be technically competent to oversee and challenge the contractor concerning facilities and operations. Along with the stringent requirements of the position, the FR is compensated with excepted service pay and retention allowances as appropriate. This program has established credibility and prestige with the contractor and within NNSA for safety oversight and implementation.

The other example was the result of the Defense Nuclear Facilities Safety Board (DNFSB), Recommendation 98-2. This recommendation addressed the need to improve effectiveness and status of the Nuclear Explosive Safety Study (NESS) process. The NESS is led by a federal chairperson with members from the national laboratories, production plants, and other experts as required. The chairperson must meet a rigorous training and qualification program that requires written and oral examinations. Also, a perspective chair must serve as a deputy chair to a study being chaired under a fully qualified chair, prior to conducting and chairing their own study. The chairpersons reside in the NNSA Service Center. They are compensated under the excepted service pay schedule. Also, as part of Recommendation 98-2, emeritus status members have been assigned to NESS. This has elevated the overall status and prestige of the NESS and members within the NNSA nuclear weapons complex.

CONCLUSION

Based on reviewed information, the erosion of ES&H technical capability appears to be a serious issue within NNSA. It is not clear whether the Site Offices have sufficient ES&H staff, and the planned ES&H staffing of the Service Center has not been well thought out or defined. The following recommendations are provided to address the above key observations, findings, and performance gaps.

Although some progress has been made in elevating the status and prestige of the safety career within NNSA, more must be done. Even though NNSA has many safety professionals at the Site Offices and Service Center, the ES&H organization that reports directly to the Administrator only has two people that provide the safety policy and guidance for the organization. Also, some of the Site Offices are not yet adequately staffed with the appropriate level of subject matter experts as recommended in DNFSB Recommendation 2000-2. Other safety professionals still operate under the negative umbrella of a poor safety culture. The role of the safety professional and the program manager must be viewed as having equal value and prestige within the organization. The path to success must include the expectation of each individual serving in both the safety and program role to be elevated to the next level. This change in behavior and expectation will start to drive a new safety culture for NNSA to improve program success and safety.

RECOMMENDATIONS

TC-1.1 In the very near future, convene a working meeting between the Service Center (emphasis on safety expertise within the ES&H Department) and potential customers (Site Offices, HQ Offices) to map out expectations of the Service Center for the next year or two. (See also TC-1.3)

Customers (Site & HQ Office representatives) should come prepared with FTE expectations and expertise needed for all aspects of support. This action should explicitly address peak demand needs from the Service Center to ensure that adequate staff planning (expertise and capacity) is accomplished. Use the results to validate, and as needed redefine, staffing targets with focus on Site Offices or Service Center. Update Service Level Agreements to explicitly define FTE needs. Present this information to NA-1, and as needed initiate hiring actions to fill critical staffing gaps.

TC-1.2 Complete an integrated NNSA Staffing Study at a similar level of detail compared to those completed in 1995 and 1998, and use the results of this updated study to validate staffing plans.

While the NNSA Managed Staffing plans are an excellent start, NNSA needs an integrating staffing analysis. In determining resource requirements, the integrated staffing analysis should explicitly ensure that adequate time is allotted for training and career development for technical personnel (including as a minimum all personnel within the Technical Qualification Program).

TC-1.3 The NNSA Service Center should employ sufficient technical resources, including support service contractors, to fill peak demand in support of Site Office and Headquarters requirements, and to provide specific technical assistance on subjects that do not require a full time employee at any single Site Office. (see also TC-1.1)

TC-1.4 Provide the necessary resources and priority for continued technical growth of ES&H staff throughout their careers through additional academic training, industrial rotations, and detail assignments within NNSA. Develop succession plans for safety and program professionals that recognize their respective equal value to the organization and mission. Provide an NNSA career progression that defines the safety and program positions, and timeframes for professional development that equally values safety and program objectives. Use the Facility Representative (FR) program as a model to develop technical competence of all safety professionals. Consider alternate career paths for technical growth including the Richland technical career path model created in 1998.

TC-1.5 Develop a Safety Professional of the Year Award that recognizes most effective safety improvements, innovation in solutions to safety issues, and contribution to improvements to the NNSA safety culture. In addition, implement the recognition programs for federal employees in safety areas.

REFERENCES

- CAIB Report, August 2003

Sub-team Leader: _____

Date: 2/9/04

TABLE - 1

Site	# Cat. II/III Nuc. Facilities (Nucs)	# Safety Systems (SS)	Safety System Oversight Staff[1] (SSO)	Ratio SS/SSO (systems per person)	AB staff	Ratio Nucs/ AB staff	FR staff	Ratio Nucs/ FR Staff	Other SMEs	Total ES&H Staff	Total # Federal FTEs (FY04) target	Ratio ES&H/ Total	Design Cat. II/III Facilities
KCSO	0	0	0	0	0	0	0	0	5	?	50		
LSO[6]	6+3	47	5.7	8	3	2	8+2	0.9	8.3	37	90	0.42	Trit, WMV
LASO	17	86	6.5[2]	13	10	1.7	16	1.1	9	43	103	0.42	CMRR, TA-55, RLW, TA-18
NSO	5[3]	24	3.5	7	4	1.25	4	1.25	12	20	92	0.22	TA18
PSO	19	81	3.5	23/4[4]	6	3.2	6	3.2	15	30	82	0.36	12-44, 12-64, SNM
SSO	5	28	1.98	14	6	0.8	8	0.6	18	32	89	0.36	
SRSO	8[5]	15	1.7	9	1	8/1	2	4/0.5	1	2	20		Trit.
YSO	13	34	6.0	6	5	2.6	9	1.4	8	27	81	0.33	HEUMF, DU, EU

Shaded entries are ratios that could be viewed as outside range.

Footnotes:

1: Sum of FTE fractions as reported to FTCP.

2: LASO estimated that they needed 6.5 FTEs for safety system oversight. The LASO staffing plan only accounts for 2 FTEs and assumes that the Service Center would supply 4.5 FTEs support. Service Center is working with LASO to define SSO program.

3: NSO has 3 DP and 2 EM Cat. II/III nuclear facilities.

4: For PSO two ratios of safety systems to safety system oversight provided, the first based on the total # of safety systems, the second attempting to account for the redundancy in safety systems between Bays and Cells.

5: For SRSO Tritium Operations assumed as one facility

6. For LSO, plus sign indicates DP and EM for facilities or FTEs; vacancies included; note that 5 FRs are dedicated to nuclear facility coverage.

7. This does not include ES&H staff utilized from SRO on an as-needed basis.

NNSA CAIB LESSONS LEARNED

Technical Capability: TC-2	Technical Capability To Track Known Problems And Manage Them To Resolution Is Essential.

NASA CAIB LESSONS LEARNED STATEMENTS

"NASA has an impressive history of scientific discovery, but can learn much from the application of lessons learned..."

"NASA has a broad Lessons Learned Information System that is strictly voluntary for program/project managers and management teams."

"...design engineers and mission assurance personnel use it only on an ad hoc basis, thereby limiting its utility."

"...integrated hazard reports and risk analyses are rarely communicated effectively, nor are the many databases used by Shuttle Program engineers and managers capable of translating operation experiences into effective risk management practices."[1]

Known problems were not tracked managed to resolution. Information suggesting there may be a problem existed but was not acted upon in a timely manner. For example, it was widely known that pieces of foam routinely separated during launch operations. However, the data was not systematically analyzed and evaluated to determine whether the separation of foam represented a significant hazard, which should be mitigated.[2]

RELEVANCE TO NNSA

Like NASA, NNSA has an impressive record of scientific accomplishment. Also like NASA, it has a number of systems for reporting and capturing information with potential safety significance. However, it is not clear that information captured in these systems is consistently analyzed, tracked, trended, and acted upon to resolve underlying causes.

Existing Information and Assumptions Within NNSA:

NNSA has access to a variety of program-wide information management systems that capture and disseminate data with potential safety significance. Examples include:

- NNSA Lessons Learned System;
- ORPS (Occurrence Reporting and Processing System);
- SIMS (Safety Issues Management System) for DNFSB related commitments;
- CATS (Corrective Action Tracking System) for OA findings/corrective actions;
- SFI (Significant Finding Investigations) for weapon related issues; and
- GIDEP (Government-Industry Data Exchange Program);
- CAIRS (Computer Accident/Incident Reporting System).

[1] CAIB Report, page 184
[2] CAIB Report, page 189

In addition, individual sites and contractors also maintain local issue tracking and management systems.

NNSA (NA-10) reviews status of SIMS/ORPS commitments on a monthly basis.

NNSA (NA-10) has processes in place for tracking and follow-up of SFIs.

Key Observations, Findings and Performance Gaps:

There is no comprehensive mechanism within NNSA for looking across systems to look for trends or systemic issues.

DP used to have a group dedicated to analysis of data to look for complex-wide issues and trends. This function no longer exists within NNSA. Ostensibly, this function was transferred to the Office of the Assistant Secretary for Environment, Safety, and Health for all DOE Programs.

HQ personnel having safety oversight responsibilities also have significant other duties (e.g., program management) and therefore have limited time available to conduct data analysis, trending and communication. HQ data analysis tends to be more reactive in nature focusing on events that have already occurred or been identified by outside entities.

Lack of resources dedicated to data analysis, trending, and communication has resulted in NNSA being more reactive (to issues identified by others such as the DNFSB and OA) rather than identifying issues before others do.

CONCLUSION

NNSA appears to be similar to NASA in both its need for capturing, analyzing and sharing safety information and its limited capability to do so.

RECOMMENDATIONS

NNSA has opportunities for improvement as follows:

TC-2.1 NNSA should re-establish an analysis/trending function for complex-wide issues at either HQ or the Service Center to be periodically reviewed by NNSA senior leadership.

TC-2.2 NNSA should revise the current NNSA voluntary corporate Lessons Learned Program to one of mandatory participation for key NNSA personnel, including the periodic review of past DOE/NNSA accidents and near misses.

REFERENCES

- CAIB Report, pages 184, 189

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NNSA CAIB LESSONS LEARNED

Technical Capability: TC-3	Technical Training Program Attributes Must Support Potential high consequence Operations

NASA CAIB LESSONS LEARNED STATEMENT

NASA did not have a recurring training program, was not aggressive in training, and did not institutionalize "lessons learned" approaches to ensure that knowledge gained from both good and bad experiences was retained in the corporate memory.

NASA began a "Strategic Management of Human Capital" initiative to ensure the quality of the future NASA workforce. The goal was to address the various external and internal challenges that NASA faces as it tries to ensure an appropriate mix and depth of skills for future program requirements.

Key personnel in NASA Headquarters routinely rotate into field positions to remain familiar with every aspect of operations, training, maintenance, development and the workforce.

RELEVANCE TO NNSA

NNSA requires a cadre of technically trained people in order to properly perform its mission. The Technical Qualification Program (TQP) is an important tool that NNSA is underutilizing to ensure personnel are technically trained to support its mission. The establishment and continued maintenance of technical expertise through technical qualifications are essential components of high-technology, potential high consequence operations.

Information is available on the status of technical qualifications in NNSA through:

- Federal Technical Capability Panel (FTCP) Quarterly Reports on Technical Qualification
- Managing Corporate Technical Resources in NNSA and Setting Corporate Expectations for the Technical Qualification Program, January 12, 2002, *Technical Resources and Status of the Technical Qualification Program.*

The Technical Qualification Program (TQP) is not well managed. For example:

- The current FTCP Quarterly Report shows 56 NNSA personnel delinquent in qualification. The delinquent number has been between 50-70 for the last two years
- The percentage of NNSA in the TQP who are fully qualified is 67%. The SOE goal is 75%.
- Some personnel in the program are at zero percent qualification even though they have been in the program for over 18 months.
- Re-engineering has resulted in personnel shifts/turnovers. The data being tracked in the TQP may not be accurate.
- There is no known program where key NNSA personnel periodically review major lessons learned (e.g., various Type A and B Accident Investigations, ORPS "near-miss" reports). (see TC-2.2).

Discussion during CAIB Review Team meetings raised a question about what training and qualification requirements should be established for key decision-makers (e.g., Site Office

Managers) whose responsibilities include safety of nuclear and other hazardous facilities and operations. Currently there is no formal technical qualification requirement, succession planning, or training for these positions. The result is some Site Office Managers do not have a technical background and the organization must rely on compensatory measures. The professional development of key decision-makers is discussed in CI-1 with recommendations CI-1.1and CI-1.2.

The CAIB Report gives high credit to Naval Reactors and the SUBSAFE programs for having institutional "lessons learned" programs and for conducting relentless and innovative training. The resident talent and wisdom from NR should be further utilized by NNSA.

CONCLUSION

Based on the team's review of data and through discussions with the review team, the status of training in NNSA is not good. NNSA would benefit by reemphasizing training adopting a more aggressive training posture, and complementing training with professional development activities that are directly linked to succession plans for key decision-makers.

RECOMMENDATIONS

TC-3.1 Re-baseline the TQP to ensure that the correct personnel are in the program and establish performance expectations for those personnel in the program.

TC-3.2 Revitalize the TQP. Establish performance metrics that will be reviewed by the Administrator and senior management on a periodic basis.

TC-3.3 Establish a training and qualification program for senior management positions with safety management responsibilities. (See also CI-1.1 and OI-3.2)

REFERENCES

- CAIB Report, pages 115 and 183
- Federal Technical Capability Panel (FTCP) Quarterly Reports
- "Managing Corporate Technical Resources in NNSA and Setting Corporate Expectations for the Technical Qualification Program," *Technical Resources and Status of the Technical Qualification Program.*

Sub-team Leader: _____

Date: 2/9/04

APPENDIX 3
MINORITY OPINION

A minority opinion process was described to the review team on January 8, 2004 to ensure a process for documenting any significant differences of opinion from the open forum of discussions and the "majority" opinions stated in this report was available. Team members reviewed the report and submitted a combination of comments and a few minority opinions. The result was the adoption of minority opinions into the report in one form or another. For instance, where the report's breadth of scope was too limited, a minority opinion was adopted into the report as fact. Other minority opinions, however, are certain to have been lost in NNSA's culture of consensus. Building a culture of greater accountability both for the decision-maker and the staff preparing decision options will require a conscious adjustment to how the organization approaches staff work and related decisions relative to consensus. The review team did an excellent job wrestling with the many issues from the CAIB, establishing relevant ties to NNSA, and providing definitive recommendations. However, the review team itself may have fallen victim to an area the CAIB identified as a potential pitfall -- identifying and fully addressing different perspectives.

In Section 3.1, Management and Safety Culture, the report states, "The majority of the NNSA CAIB Lessons Learned Review team believes NNSA has an adequate concern for safety for potential high consequence programs (nuclear facility operations and nuclear weapons design and production) including adequate systems to ensure that operations are proven safe prior to initiation or deployment."

Such generalized statements provide little value other than to make people feel good and may actually result in behaviors that suppress the open identification and resolution of known safety problems. In the case above, the statement is not supportable either by text of the report nor, more importantly, by observable fact. It introduces a bias by appearing to indicate that the NNSA CAIB Review team has concluded by discussion that NNSA, through senior management, has and continues to express concerns over safety. This is not supported by action on the part of senior management, either formally or informally.

For those operations that involve nuclear facilities, DOE Rules have mandated compliance on the part of its contractors with strict penalties for non-compliance and primary oversight provided. Our contractors, through issuance of these legal requirements, have themselves undertaken significant actions involving their nuclear operations. However, how well have we really done? We have at least one major contractor who does not have an approved Quality Assurance Plan to comply with a nuclear safety rule (10 CFR 830) promulgated in 1994. This fact, and the duration of non-compliance, cannot be viewed as representing an adequate concern for safety.

Although progress has been made in developing programs and systems to ensure operations are safe versus unsafe, the question remains, how well have we really done? When approval authority for facility authorization and safety basis was delegated to Site Office Managers, did we objectively ensure that these Managers had the capability (mechanisms) and capacity (technical expertise) to accept these delegations? No. These delegations have been in place for many years yet only recently (12-18 months) are the Site Offices staffing up. Initial efforts at Headquarters federal oversight were initiated

but stopped, not because results were positive, but as a result of changing our oversight model. To quote our own report, "the team believes it is critical that NNSA management allow enough time to objectively measure how well oversight programs are being implemented and stabilize the oversight model itself." This does not represent an adequate concern for safety.

Some senior managers may point out that we have put programs in place following Integrated Safety Management (ISM) principles and that this is an adequate concern for safety. But, how well have we really done? Are we really adequately executing ISM? No. Many examples come to mind. Two are provided for brevity. One, a major nuclear project at one of our sites was cancelled in part because the contractor and NNSA did not adequately integrate safety into design. This general issue has plagued many NNSA nuclear projects yet gets very little attention. The second example relates to the recent design of a safety class system at a nuclear facility that not only does not comply with DOE safety class design requirements, but also does not follow the institutional programs in place for such systems at the site in question. This does not represent an adequate concern for safety.

A better litmus test would be to determine the place that safety plays on the part of our senior managers. The team discussions noted that over the past many years, the topic of safety by senior managers at Headquarters has been one of reaction to events that have already occurred rather than a routine proactive discussion of current safety performance. For example, our relationship with the DNFSB is reactive versus proactive. There appears to be a dearth of routine discussions of NNSA safety performance directed by Headquarters senior managers. It may be that senior managers are uninformed of these issues. That is no excuse. Ignorance does not translate into an adequate concern for safety.

Recommendation: Delete sentence and replace with: "In general, the NNSA CAIB Lessons Learned Review team believes NNSA Senior Management has expressed, primarily through a lack of demonstrated participation and actions, an inadequate concern for safety."

Jeffrey Kimball

Gerald Gears