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Memo

Date: July 3, 2007

To: M. Bebon

From: J. E. Tarpinian

A handwritten signature in black ink that reads "James E. Tarpinian". The signature is written in a cursive style with a prominent "J" and "E".

Subject: *Independent Assessment Report: Facility Safety Management Systems at the Brookhaven National Laboratory, dated June 29, 2007*

Reference: *Memorandum, M. Bebon to J.E. Tarpinian, Subject: "Facility Safety Management System Assessment of Authorization Basis Documentation," March 12, 2007 (ATS #3676.1.1)*

Attached is the report of an independent assessment of the Facilities Management Safety Management System authorization documentation. You commissioned this assessment (referenced memo) to determine the extent of condition of the deficiencies identified in two occurrences with regard to safety basis documentation at BNL facilities. Specifically, the assessment team examined the extent of condition for the issues identified in the occurrences regarding a failure to maintain authorization basis configuration controls for the High Flux Beam Reactor and a failure to consider all hazards in the Documented Safety Analysis for the Waste Management Facility.

In summary, the team found that the conditions that led to the deficiencies do not extend to facility safety management in accelerator or industrial facilities. Also, the team concluded that there is no underlying PAAA deficiency in terms of systematic failures or pervasive extent of conditions that led to the two occurrences. The report does identify areas for improvement and contains recommendations. A corrective action plan should be developed that addresses these recommendations and those actions should be incorporated into the ISM/Safety Improvement Project Plan.

JET/mcb

Attachment: as stated

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**REPORT
INDEPENDENT ASSESSMENT:
FACILITY SAFETY MANAGEMENT SYSTEMS
AT THE
BROOKHAVEN NATIONAL LABORATORY**

JUNE 29, 2007

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**REPORT
INDEPENDENT ASSESSMENT:
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June 29, 2007

EXECUTIVE SUMMARY

Brookhaven National Laboratory (BNL) management commissioned this Facilities Safety Management System assessment of the Laboratory's authorization documentation to determine the extent of condition of the deficiencies identified in two recent occurrences with regard to safety basis documentation at BNL facilities. The charge for this assessment is documented in a March 12, 2007 memorandum from M. Bebon to J. E. Tarpinian; the primary objective was to determine the extent of condition of the deficiencies identified in these recent occurrences. The scope of the assessment included authorization documents for nuclear facilities, radiological facilities, accelerators, and other appropriate BNL facilities.

The assessment was conducted by a review team familiar with nuclear, accelerator, radiological, and other facility safety system requirements, practices and implementation methods. The Team conducted extensive document reviews and interviewed twenty-seven BNL personnel during the period April 18-20, 2007.

The Team examined the extent of two conditions identified in these occurrences:

- (1) failure to maintain controls as agreed upon with the Department of Energy (DOE) to preserve downgraded below HC-3 categorization status (High Flux Beam Reactor [HFBR]), and
- (2) failure to consider all hazards and specify resulting controls in a Documented Safety Analysis (Waste Management Facility [WMF]).

The Team found that these conditions do not extend to facility safety management in accelerator or industrial facilities. However, BNL may wish to further investigate and formalize safety basis documentation and processes for control of conditions (e.g., inventories, facility configuration) in radiological facilities where the facility hazard categorization is based on maintaining these conditions. Other key results of the assessment are summarized as follows:

- No underlying PAAA deficiency in terms of systematic failures or pervasive extent of conditions that led to the two recent occurrences was identified.
- Issues were identified regarding the nuclear safety organization, as follows:
 - Resources applied to nuclear safety functions are not sufficient;
 - Roles, responsibilities, authorities, and accountabilities are not clearly defined; and

- Organizational placement of the Nuclear Safety Officer is not consistent with responsibilities of the position.

Opportunities for improvement were identified in the following areas:

- Formality could be enhanced in facility safety management for facilities that are managed under Facility Use Agreements.
- Internal consistency of Standards-based Management System (SBMS) documentation related to facility safety and consistency of SBMS constructs with applicable DOE guidance, could be improved.

1.0 BACKGROUND AND OBJECTIVES

Brookhaven National Laboratory (BNL) has had two recent issues concerning the adequacy and maintenance of facility authorization basis documentation: one with regard to the Authorization Basis Manual at the High Flux Beam Reactor (ORPS EM--BHSO-BNL-HFBR-2006-0002) and the other with regard to the Documented Safety Analysis for the Waste Management Facility (ORPS SC--BHSO-BNL-BNL-2007-0006). Although these conditions did not pose any hazard or threat to the safety of personnel or the environment, BNL management has determined that they call into question BNL's attention to maintaining configuration control of authorization documents.

Accordingly, BNL has commissioned a Facilities Safety Management System assessment of the Laboratory's authorization documentation to determine the extent of condition of the deficiencies identified in these recent occurrences. The scope of this assessment included authorization documents for nuclear facilities, radiological facilities, accelerators, and other appropriate BNL facilities.

The charge for this assessment is documented in a March 12, 2007 memorandum from M. Bebon to J. E. Tarpinian; objectives set forth are to perform:

- a review of recent relevant reports, management reviews, and SBMS documentation,
- a review of the technical adequacy of relevant safety authorization documents,
- an evaluation of BNL's resource utilization, including qualifications and expertise of personnel, level of effort of program management and oversight, and organizational reporting relationships of personnel who prepare, review, and approve safety documentation, a review of the charter, role, authority, processes and work products of the Nuclear Safety Committee and
- a review of the organizational placement, R2A2, and overall effectiveness of the Nuclear Safety Officer and Nuclear Criticality Officer positions.

Results of the assessment are documented in the form of findings on the effectiveness of the BNL safety management systems in satisfying the requirements of applicable DOE Orders and subordinate implementing constructs (e.g., SBMS).

2.0 SCOPE

This report describes the approach and tasks implemented to conduct a systems-based assessment of the BNL Facility Safety and Facility Operations Management Systems, including the following subordinate SBMS constructs:

Subject Areas

- Accelerator Safety
- Facility Hazard Categorization
- Nuclear/Criticality Safety
- Facility Use Agreements
- Transportation Safety

Programs

- Facility Authorization Basis
- Conduct of Operations

Overall, the assessment provided an evaluation of the effectiveness of these systems in meeting applicable requirements for configuration management and conduct of operations, with a focus on the resource utilization, organizational, and personnel effectiveness evaluations listed in the “Background and Objectives” section above.

Lists of documents reviewed and persons interviewed are provided in Appendices A and B, respectively.

3.0 APPROACH AND TASKS

The overall approach involved assembling a review team familiar with nuclear, accelerator, radiological, and other facility safety system requirements, practices and implementation methods. For this assessment, this team was as follows:

Kyle Turner – McCallum-Turner, Inc., Team Lead
Mark Davis – BNL
Stephen Musolino - BNL
David Renfro – Oak Ridge National Laboratory
Stephen Sohinki – Dade Moeller & Associates
James Tarpinian – BNL, Assessment Manager

Vitae for the team members are provided in Appendix C.

Overall assessment activities were comprised of the following:

- Identify and review key processes and documents
- Conduct initial team meeting via conference call
- Finalize work plan
- Conduct interviews across organizational elements (anticipated to be a total of 3 days)
- Formalize findings, areas for improvement, develop conclusions and recommendations
- Prepare draft assessment report for factual accuracy review and outbrief key personnel
- Respond to factual accuracy comments and prepare final report

In accordance with the graded approach, the Team organized the evaluation according to the hazard categories and associated approaches for facility safety and authorization of operations at BNL facilities, as follows:

- Hazard Category 3 – Waste Management Facility (WMF)
- Former Hazard Category 1 – 3 facilities downgraded by analysis – High Flux Beam Reactor (HFBR), Brookhaven Graphite Research Reactor (BGRR), Controlled Environmental Radiation Facility (CERF)

- Radiological Facilities – e.g., Hot Laundry (650), Hot Machine Shop (462)
- Accelerators – e.g., Relativistic Heavy Ion Collider (RHIC), National Synchrotron Light Source (NSLS), Source Development Lab (SDL), Accelerator Test Facility (ATF)
- Other BNL facilities whose authorization basis is addressed in Facility Use Agreements (FUA)

The assessment was conducted using the criteria and lines of inquiry listed in Appendix D. These evaluation bases reflect both the structure and implementation constructs necessary for systems to meet applicable facility safety requirements.

4.0 RESULTS

Primary results of the evaluation are as follows. Detailed results derived from the evaluation are described in the following subsections; as applicable, these results are categorized by facility type, organizational issues, and comments on facility safety constructs of the BNL SBMS.

4.1 Current and Former Category 1 through 3 Facilities

As part of executing its charter for this evaluation, the Team reviewed documentation and interviewed personnel related to the two facility safety management events identified in Section 1.0, as well those associated with the BNL analysis of the causes of those events. This focus provided the Team with insights into the events themselves as well as providing a more thorough understanding of the conditions the extent of which were the primary focus of the evaluation. In general, the Team's impression is that the causal analysis conducted by BNL provides an accurate identification of the causes of these events.

In the course of completing its mission, the Team did gain several insights into issues that relate to facility safety management at the current and former Category 1 through 3 facilities at BNL; these are provided in the following sections.

4.1.1 Hazard Category 3 Facility (WMF)

WMF management indicated that they were having difficulty receiving priority with regard to preventative maintenance activities at the facility, and that there was a significant backlog of maintenance items. While the Team could not independently verify these assertions, insufficient priority on maintenance items at nuclear facilities has led at other facilities to inefficient workarounds and operational impediments that can lead to loss of configuration control.

4.1.2 Former/downgraded Hazard Category 1-3 Facilities

- Regulatory requirements are clear for Hazard Category 3 facilities and are set forth in 10 CFR 830, Subpart B and associated DOE standards and guides. It is also clear that radiological facilities (inventory below Hazard Category 3) need not have in place the Safety Basis documentation and processes required by 10 CFR 830, Subpart B. However, several BNL facilities have been downgraded to radiological facility status "by analysis," i.e., a demonstration has been made that, while the inventory is above HC 3 levels, there is no credible mechanism for the material to be dispersed such that it presents hazards at the HC-3

consequence threshold. These facilities include HFBR and BGRR, both of which are the responsibility of the Environmental Restoration (ER) Division. Accordingly, for these facilities, certain conditions and/or controls must remain in place to ensure that conditions assumed in the downgrade analysis are maintained. In the sense that these controls are critical to maintaining the facility hazard category, they must be implemented with the same degree of rigor as nuclear safety requirements, even though no 10 CFR 830-like Authorization Basis is required. That situation appears to place these facilities in a regulatory “grey” area.

The Team believes that BNL should carefully identify and put in place formal processes for maintaining those key controls that are necessary to maintain these safe conditions.

4.2 Accelerators

In general the Team found that BNL accelerators have current Safety Analysis Documents (SAD), Approved Safety Envelopes (ASE), and that they have established coherent, effectively implemented processes for maintaining configuration control with respect to these approved safety bases. Specific observations with regard to establishment and maintenance of safety bases at BNL accelerator facilities are as follows:

- The SAD and other Collider-Accelerator Division (C-AD) procedures describe how the C-AD ESHQ Division reviews procedures and work planning to ensure conformance to the authorization basis documents. C-AD personnel described how the USI process (CA OPM 1.10.1 ‘Procedure for Documenting Unreviewed Safety Issues’) is employed to identify, and document safety–basis issues. Several USIs have been appended to the current online version of the SAD.
- FUAs for C-AD buildings contain a link to the authorization documents and list the Facility Operating Safety Approval Documents (Reference FUA Table 4.2.0 Operational Safety Agreements and Other Controls)
- C-AD utilizes the Facility Risk Assessment 3-year review process to evaluate physical aspects of their buildings – this process may help to verify that the physical configuration agrees with the authorization basis documents.
- NSLS management uses an “EMS, FUA, and SAD/ASE checklist for NSLS and SDL Reviews” form during project reviews, experimental reviews, and committee reviews to flag and document potential safety basis document issues and initiate the USI process. Note that the Source Development Lab (SDL) is a facility within the NSLS Department and is subject to the same management systems.
- NSLS performs field verification of Experimental Safety Reviews to ensure that scientific staff and visiting users at NSLS and SDL are conforming to specified configurations and safety requirements.
- NSLS and SDL authorization basis documents are maintained in the NSLS Department controlled document program, which alerts staff to the 5-year review cycle.

- The ATF authorization basis documents have recently been updated and are maintained in the Physics Department as controlled documents in conformance with the Departmental procedures.
- In general the Physics, NSLS and C-AD Departments all have site-specific management systems and ES&H personnel assigned to maintain their authorization basis documents and carry out the operational requirements. All three Departments demonstrated respective proactive programs to maintain their authorization basis documents.

4.3 Other Facilities

Other facilities for which facility safety management systems and practice were examined by the Team include those which are managed under FUAs, including some radiological facilities and other buildings that have been removed from active use. Findings of the Team regarding the role and effectiveness of the FUA process and documents in facility safety management for these facilities are provided below.

- SBMS work planning and other constructs related to configuration management include appropriate vectors that specify reference to FUAs and/or consultation with building managers. For example:

In the Subject Area: Work Planning and Control for Experiments and Operations, addressing facility issues is specified in Experimental Safety Review guidance (Section 1.1) for Steps 1, 5 and 8, as well as Sections 1.3, Notifications to Other Departments/Divisions (Step 2), 1.6 Review of Long-term Experiments (Step 6), and 1.7 Experimental Termination (Step 4).

In the same Subject Area, guidance for planning operations work specifies consultation with requirements of FUAs in Sections 2.3, Screening Work Requests for Work Permit Determination, and 2.4, Categorizing Work Requests and Filling Out Work Permit Sections 1 and 2. Facility concerns are specified as part of the work permit review in Section 2.5, Filling out Work Permit Sections 3 - 5 for Moderate- and High-Hazard Activities.

- SBMS constructs that specify the substance of and process for referencing information in FUAs during work planning and other configuration-control-related activities is not always rigorous. As a result, work planners, for example, would not always find in SBMS comprehensive guidance on how information, requirements, and controls specified in FUAs should be taken into account. Similarly, the scope of consultation with or approval by Facility Managers during planning of work that affects FUAs, is not specified.
- It was indicated that FUAs are updated for major facility changes or BNL-wide requirements changes, however, SBMS does not have a clear requirement for periodic review and updating of FUAs. Although the FUAs for the radiological facilities were generally of recent vintage due to a vigorous campaign led by the BNL FUA champion, the team believes that SBMS could be revised to require updates at a set interval e.g., three years. Interviews and reviews of selected FUAs indicated that they typically identify BNL-level controls and possibly facility-level controls; FUAs are repositories of requirements that originate elsewhere, not drivers of

requirements. The fact that controls were developed for Building 801 was stated to be atypical. Also, while the FUA champion has conducted assessments of FUAs “a couple of times” to review their vintage, there have apparently been no BNL-wide assessments of how accurate the FUAs are (e.g., with respect to building conditions or hazards) or how closely they are being followed in terms of configuration control.

- Documentation indicating the basis for the determination of the level of hazards analysis associated with a facility does not appear to be included in or appended to each applicable FUA. The BNL SBMS *Subject Area: Hazard Analysis* provides a *BNL Hazard Identification Tool* that provides guidance on when a higher level of hazard analysis is required, i.e., when it cannot be determined that “the facility is deemed adequately covered by Laboratory standard hazard control programs that are designed to handle routine hazards,” and “[t]he Facility Use Agreement (FUA) becomes the vehicle for and documentation of the authorization basis.” Guidance on the type of hazard analysis required is provided in Section 2 of the Subject Area. Most facilities have apparently been determined not to warrant facility-specific hazard analyses and instead rely on standard hazard control programs. The concern is that there exists no documentation or record that the Team could find documenting the results of applying the Hazard Identification Tool and justifying the appropriate level of hazard analysis associated with the activities conducted in these facilities.
- Interviews indicated that, other than the Waste Management Facility (WMF), a Nonreactor Nuclear Hazard Category 3 Facility; there are currently no facilities at BNL that exceed the Individual Fissionable Material Mass Limits for Exempt Facilities (set at 45% of the minimum critical mass and calculated by sum of the fractions for all fissile and special actinide isotopes present). For the WMF, there are special TSR limits (Administrative Controls) which apply and additional protocols in place to assure that there are no actual nuclear criticality safety hazards onsite. No facility onsite has or requires the use of a criticality monitoring system, based on the limited inventories available (including the WMF).

Additional formality in facility safety documentation for some facilities (in particular for radiological hazard class buildings where maintenance of inventories and/or configurations are critical to maintaining the facility hazard classification) would enhance the BNL facility safety management posture. For example:

- Facility Use Agreements (FUAs) for four radiological hazard class buildings (356, 463, 650, 801) contain references or links to Facility Authorization Basis documents of various types (e.g., SOPs, SARs, Hazardous Analysis Documents). Additional types of documents exist that may relate to, or directly form a portion of, an authorization basis (e.g., DOE or BNL authorization letters) for individual facilities. However, BNL personnel did not appear to have a clear understanding of precisely which document(s) collectively make up the facility authorization basis for a given facility (primarily the smaller facilities/buildings) and where the control copies of these documents could be found.
- The Team found that BNL personnel are aware of the provision that sealed sources not meeting the requirements as stated in DOE-STD-1027 must be included in facility inventories. Given the characterization of sealed sources at BNL is critical to hazard categorization for some

facilities at BNL, more formal documentation for the analyses used to support hazard categorization may be required to fully support the facility safety management basis at such facilities. Periodic review of these analyses and the condition of the sealed sources themselves is required to provide full assurance that the facility safety status of these facilities is maintained.

- Interviews indicated that the Radiological Control Division (RCD) inventories sealed sources site-wide but that the individual building managers are responsible for tracking and managing individual building radioactive material inventories. FUA's for all facilities categorized as "radiological" (refs. 62, 65-70 and 91-114) on the August 2005 "Facility Hazard Categorization List" (ref. 77) were reviewed for currency of revision, extent and type of hazards listed, controls for those hazards, and links to other risk assessment or control-establishing documents. The team expected to see radioactive material inventory limits for the radiological facilities in order to prevent exceeding the DOE-STD-1027 Hazard Category 3 threshold but none were identified except for Building 801. Note: The team recognizes Building 801 as an excellent example of how an FUA can be used to compile a set of documents that define a facility authorization basis. It appears that the Nuclear Safety Officer annually requests and reviews the radioactive material inventory from those facilities with the potential to exceed the HC-3 threshold and that this review is the control rather than the FUA's. While this practice is viewed to be a good mechanism for management oversight of material inventory control, facility-specific inventory control should be considered as the primary mechanism for real-time maintenance of building inventories.
- A recent BNL Radiological Control Division (RCD) self-evaluation of authorization basis documentation for Building 348, which is categorized as a Radiological Facility, revealed that the FUA Operating Safety Limits (OSL) for the building were exceeded by taking receipt of a new replacement source. While it is commendable that RCD recognized the need to conduct a self-evaluation of its own facilities, this issue highlights a more general (beyond RCD) concern in maintaining a facility to authorization basis limits, due the fact that FUA Operating Safety Limits were exceeded despite the FUA clearly identifying and linking to the following authorization basis document: [*Building 348 Radiation Calibration Facility Annex, Technical Safety Basis and Hazard Analysis*](#). (Note: The Team notes that RCD has acknowledged corrective actions must be designed to address practical (day-to-day) methods of ensuring that Operating Safety Limits are not exceeded.) BNL should share this information as a Lessons Learned, and organizations should evaluate the effectiveness of their own practical methods of ensuring operations are conducted within established limits.

4.4 Organizational Issues

- It appears that Nuclear Safety (NS) support lead for WMF, the NS support lead for ER, and the institutional (Lab-wide) Nuclear Safety Officer (NSO) are the only true NS staff members at BNL. Although the institutional NSO has designated responsibility for NS issues, he also has several other assignments (including onsite nuclear transportation issues), and the other two staff members devote considerably less than full-time to NS activities. The WMF and ER NS support staff members appear to function somewhat independently from each other and from the institutional NSO. The team was unable to determine all of the causes for this situation but

recognized that communications must be improved within the BNL NS organization and between Brookhaven Science Associates (BSA) and with the DOE Brookhaven Site Office (BHSO), especially with regard to document consistency and technical robustness, and resource sharing, back-up, and cross-checking.

- Resources (e.g., number of people, training, experience), with respect to facilities at BNL and current DOE safety policy, are not adequate. All individuals with nuclear safety responsibilities (NSO, WMF and ER nuclear safety leads) are assigned only for a portion of their time. Based on the Team's experience at other DOE facilities with similar nuclear safety basis requirements, these resources are not adequate to accomplish the functional requirements associated with nuclear safety implementation, nor is this level of resource commensurate with the importance of nuclear safety in the BNL safety posture. Also, although initiatives are in progress to provide more formal training and involve NS personnel in system-wide DOE nuclear safety forums, additional experience and training for these individuals is judged to be required to allow the NS practice at BNL to fully function at the level required for its current facilities.
- The NSO position is currently placed relatively low in the BNL organization (three levels below the Deputy Director for Operations (DDO)). The Team believes that this does not provide the NSO with the organizational platform commensurate with the importance of the nuclear safety function in facility safety management at the Laboratory.
- Based on interviews conducted during the evaluation, there is no clear, universally understood institutional mission or implementation basis for the Nuclear Safety Management System. While this is reflected in the communications and personnel resource issues discussed above, additional factors leading to this conclusion are:
 - Requirements for nuclear safety training of persons involved in implementing the nuclear safety management system are not codified (though training is accelerating)
 - Communications within the nuclear safety organization are not as effective as needed, especially in consideration of challenges noted above
 - R2A2s for nuclear safety positions are not clearly defined or understood by Laboratory personnel or by outside entities (e.g., DOE)
- The Nuclear Safety Committee (NSC) provides input primarily through the provision of comments and advice to preparers of authorization basis documents. However, NSC input is typically sought relatively late in the safety basis documentation process (e.g., when draft documents have been prepared), after the overall strategic and technical approaches for nuclear safety analysis have already been determined.

4.5 SBMS Documentation

The Team identified several areas where the SBMS could be enhanced to more effectively describe and/or provide implementation guidance for facility safety management; these are described below.

- The Team questioned most interviewees concerning the extent and frequency of performance assessment activities associated with their areas of responsibility, especially self- and

management assessments of work activities and processes. There appears to be no formal training for those who are asked to conduct self-assessments of their work activities, or those who are conducting management assessments of process-related issues. The Team notes that this is the case with many DOE contractor organizations. Without such training, however, it is difficult to ensure consistency in the approach to performance assessment across disciplines and facilities within the Laboratory, and to have a solid basis for confidence in the results of the assessments.

- DOE O 420.1B 'Facility Safety' requires that a Natural Phenomenon Hazards (NPH) assessment review be performed at least every 10 years. BNL SBMS documents do not identify this requirement. BNL personnel indicated that an NPH assessment review was likely not performed within the last 10 years for several facilities (with the exception of the WM Facility), and they were also not aware of the approach to be employed (e.g., site-wide perspective or facility-specific). While no specific NPH hazard was identified that would challenge the BNL facility safety bases, the lack of a required update per the DOE order could be interpreted as a regulatory non-compliance.

5.0 CONCLUSIONS AND RECOMMENDATIONS

As initially noted in the Results section (Section 4.0), above, a primary conclusion of the assessment is that, taking into account the causal analyses in previous evaluations of the recent occurrences at WMF and HFBR, the identified conditions leading to such events were not found to extend to other organizations or facilities at BNL. Other key results of the assessment are as follows:

- No underlying PAAA deficiency in terms of systematic failures or pervasive extent of conditions that lead to the two recent occurrences was identified.
- Some issues were identified regarding the nuclear safety organization:
 - Resources applied to nuclear safety functions are not sufficient;
 - Roles, responsibilities, authorities and accountabilities are not clearly defined; and
 - Organizational placement of the Nuclear Safety Officer is not consistent with responsibilities of the position.

Opportunities for improvement were identified in the following areas:

- Formality in facility safety management for other facilities that are managed under Facility Use Agreements
- Internal consistency of SBMS documentation related to facility safety and consistency of SBMS constructs with applicable DOE guidance.

Detailed conclusions and recommendations of the Evaluation Team with regard to each of the issues posed in the Objectives for this evaluation are provided below.

Extent of condition of the deficiencies identified in these recent occurrences

Conclusions:

The Team examined the extent of two conditions identified in these occurrences:

- (1) failure to maintain controls as agreed upon with DOE to preserve downgraded below HC-3 categorization status (HFBR), and
- (2) failure to consider all hazards and specify resulting controls in a Documented Safety Analysis (WMF).

The Team found that these conditions do not extend to facility safety management in accelerator or industrial facilities. However, BNL may wish to further investigate and formalize safety basis documentation and processes for control of conditions (e.g., inventories, facility configuration) in radiological facilities where the facility hazard categorization is based on maintaining these conditions. Specific opportunities for improvement in and recommendations for facility safety management are identified below.

Technical adequacy of relevant safety authorization documents

Conclusions:

Based on the document reviews and interviews conducted by the evaluation team, safety authorization documents in place or in progress for accelerator facilities appear to be technically adequate in terms of properly addressing facility operations and hazards. The team notes that this evaluation did not include a detailed compliance level examination of these documents.

As noted elsewhere in this report, the team did identify that the Laboratory should review safety basis documents for radiological facilities to ensure that both the material conditions and analytical bases for determining the hazard category for these facilities reflects actual building configurations and current regulatory requirements.

Recommendations:

BNL should review the existing safety basis documentation for any currently downgraded facilities with regard to its technical and regulatory bases and whether implementation and maintenance of the bases for maintaining the facility hazard category is currently effective. Scope of this review should include:

- Provisions of DOE-STD-1027 for sealed sources or material in Type B shipping containers and lessons learned from other laboratories such as ORNL.
- Inventory tracking practices at the WMF if it applies the inventory exclusions of STD-1027.
- Accuracy of the radioactive material inventories being reported annually to the NSO for radiological facilities to ensure that they remain below the HC-3 threshold.

BNL should consider an internal assessment of processes used to effect configuration control/conduct of operations for facilities for which the authorization basis is addressed in FUA's. Targeted facilities for such an assessment would be selected based on a graded approach, with more focus on the facilities with higher hazards (e.g., radiological facilities, especially those that have been downgraded and/or taken out of routine use). Specifically, this assessment should address those facilities for which inventory control and/or building condition are used as bases for facility safety documentation.

Evaluation of BNL's resource utilization

This component of the Team's charge included qualifications and expertise of personnel, level of effort of program management and oversight, and organizational reporting relationships of personnel who prepare, review, and approve safety documentation, a review of the charter, role, authority, processes and work products of the Nuclear Safety Committee.

Conclusions:

Based on the team's review of facility safety system documentation and interviews with individuals responsible for maintenance and implementation of these systems, those constructs of the facility safety management system devoted to nuclear safety management do not have the level of visibility and management attention appropriate for nuclear systems and facilities. Similarly, the level of personnel resources devoted to nuclear safety activities is not commensurate with the importance of these functions or the associated work load. The Team's sense of this issue is that nuclear safety has been organizationally de-emphasized as BNL nuclear facilities have moved from active operation to decommissioning status, though the role of nuclear safety systems in managing BNL's risks remains the same. Partially as a result, roles, responsibilities, authorities and accountabilities (R2A2) and training for nuclear safety positions are not afforded an appropriate level of attention and formality.

The Nuclear Safety Committee is consistently viewed as providing value to the overall nuclear safety function. The Committee's effectiveness can be enhanced via inclusion of additional nuclear safety expertise and by involving it early in the safety basis documentation process.

Recommendations:

Applicable SBMS constructs should be reviewed to ensure that R2A2s for nuclear safety positions are consistently and clearly defined; additional formal guidance on these R2A2s should be provided to individuals assigned to these positions.

BNL should develop an estimate of the actual resource requirements for nuclear safety functions (e.g., via benchmarking with other laboratories) and should secure additional personnel resources, as required to:

- Accomplish 10CFR830 Subpart B program development and maintenance,
- Execute the program including facility and project support,
- Effectively interface with BNL management and DOE,
- Periodically assess program effectiveness, and

- Stay abreast of emerging requirements and expectations for the program.

This assessment should take into account the planned disposition of facilities with nuclear status and the associated variations in nuclear safety demands over time.

Based on this assessment, adequate resources, in terms of personnel with dedicated NS assignments should be assigned and organizationally placed so that they can effectively perform the associated day-to-day NS functions, including the following considerations:

- Staff assigned to NS positions need to be focused on their NS duties and have other collateral duties reassigned as necessary.
- NS staff should be assigned to operating organizations with clearly defined NS support responsibilities and authorities to assist HC-3 or downgraded former HC-1/2/3 facility managers or serve institutional roles.
- NS staff should be cross-trained and should to be able to consult with each other, check each others' work, and provide back-up.
- BNL NS staff should maintain active participation with EFCOG working groups and other member companies to share lessons learned with respect to nuclear safety issues.

NSC expertise should be expanded to include individual(s) with specific experience and expertise in dealing with current and evolving nuclear safety policies and practices in the DOE system.

BNL should consider involving the NSC earlier in the process of developing authorization basis documents, so that the Committee's input to defining regulatory and technical approach to safety basis documentation can be obtained. The charter of the NSC in early activities should be focused on assisting in establishing an early consolidated Laboratory position on the most appropriate technical approach to AB and other nuclear safety issues that are specifically tailored to the hazards presented, especially for facilities that are in poorly defined regulatory space.

Organizational placement, R2A2, and overall effectiveness of the Nuclear Safety Officer and Nuclear Criticality Officer positions

Conclusions:

The effectiveness of the NSO position is hampered by both its relatively low placement in the BNL organization (three levels below the Deputy Director for Operations), and by insufficiently effective communications within the nuclear safety organization. See also the Conclusion above regarding R2A2s.

Because of the minimal nature of criticality concerns at BNL facilities, the NCO position requires minimal functionality; organizational placement, R2A2, and effectiveness of this position are consistent with requirements for it.

Recommendation:

The Team believes that, in order to emphasize the importance of maintaining excellence in performance with respect to nuclear safety issues, BNL should elevate the NSO position in the organization to report to the Deputy Director for Operations, as was formerly the case, so long as there are nuclear facility issues that justify having such a position at BNL.

SBMS Issues

In the process of investigating the issues posed in the Objectives for this evaluation, the Team identified several areas where SBMS documents, requirements and processes could be upgraded to enhance facility safety management at BNL; conclusions and recommendations with regard to SBMS are provided below.

Conclusion:

There appears to be no formal training for those who are asked to conduct self-assessments of their work activities, or those who are conducting management assessments of process-related issues. The Team notes that this is the case with many DOE contractor organizations.

Recommendation:

The Team recommends that BNL institute such a training program for the supervisors and managers who are responsible for or participate in assessment activities. Other successful training programs for such activities, either at INPO or other organizations within and outside the DOE Complex, could be benchmarked to identify training modules that could be adapted for BNL's use. BNL could also implement a mentoring program in which individuals who have developed expertise in conducting such assessments work with those that are less experienced with this type of activity.

Conclusion:

It appears that all of the requirements specified in the DOE O 420.1B 'Facility Safety' have not been clearly captured in BNL SBMS requirements, and it does not appear that BNL has the authorization basis documents clearly defined for each facility.

Recommendation:

Consider institutionalizing the requirement (e.g., through appropriate modifications of the SBMS constructs for NS) for ten year re-evaluation of natural hazards, including evaluation of current status. Also, consider performing a complete review cross-walk matrix of DOE O 420.1B 'Facility Safety' (and other orders as determined necessary) and BNL SBMS documents to ensure all requirements are appropriately captured. Finally, consider developing a program to clearly define and centralize control of documents that make up the authorization basis for each facility (utilizing a risk-based graded approach).

Conclusion:

SBMS constructs implementing facility safety requirements are not always internally consistent, consistent with facility safety practices, or consistent with terminology of relevant DOE requirements.

Recommendation:

BNL should conduct an internal review of facility safety constructs within SBMS to ensure that the various components are consistent in terminology and that, where applicable, terminology and requirements are consistent with current versions of applicable DOE guidance.

APPENDIX A
Documents Reviewed

BNL SBMS Subject Area, *Nuclear/Criticality Safety, 1. Nuclear Safety*, effective date March 17, 2005.

Occurrence Report EM-BHSO-BNL-HFBR-2005-0001, “Violation of High Flux Beam Reactor Safety Evaluation Report,” Final, December 16, 2005.

BNL SBMS Program Description, *Facility Authorization Basis*, effective date December 30, 2005.

Occurrence Report SC-BHSO-BNL-BNL-2006-0003, “PISA Declaration on Corrosion of Building 865 Stacks,” Final, March 3, 2006.

Independent Oversight Report IO 05-20, Work Observation by Senior Management: (Assistant Laboratory Director for Environment, Safety, Health & quality Directorate and DOE-BHSO Area Manager), “Brookhaven Target Processing Lab Operations,” March 15, 2006.

Letter, M. Bebon (BSA) to M. Holland (SC-DOE), Subject: “Unreviewed Safety Question Program Assessment,” dated April 26, 2006.

Independent Oversight Report IO 06-01, Work Observation by Senior Management: (Deputy Director for Operations), “Back-up Diesel Generator Maintenance Testing, Buildings 801 and 802,” April 28, 2006.

Independent Oversight Report IO 06-04, Phase 1 – Work Observation by Senior Management, “Accelerator Test Facility – Shutdown Condition,” August 30, 2006.

BNL SBMS Committee Handbook – Nuclear Safety Committee, effective date June 2006.

E-mail communication, C. Sohn (PNL) to J. Tarpinian (BSA), Subject: “Nuclear Safety Considerations,” dated June 29, 2006.

E-mail communication, C. Sohn (PNL) to J. Tarpinian (BSA), Subject: “Nuclear Safety Questionnaire,” dated September 5, 2006.

E-mail communication, J. Tarpinian (BSA) to M. Bebon and S. Coleman (BSA), Subject: FW: Nuclear Safety Issues: Meeting with Carol Sohn,” dated October 3, 2006.

Letter, M. Holland (SC-DOE) to M. Bebon (BSA), Subject: “Brookhaven National Laboratory (BNL) Brookhaven Medical Research Reactor (BMRR) Request for Amendment to the Facility Safety Basis,” dated October 24, 2006.

Memo, D. Rocco (BSA) to C. Schaefer (BSA), Subject: “Factual Accuracy Determinations on Draft Sealed Source/Hazard Categorization Surveillance,” dated October 26, 2006.

Occurrence Report EM-BHSO-BNL-BNL-2006-0016, “Contamination Found Outside the BGRR Radiologically Controlled Area (RCA),” Final, November 14, 2006.

Letter, R. Rimando (SC-DOE) to L. Hill (BSA), Subject: “Violation of Approved Safety Evaluation Report (SER) for High Flux Beam Reactor (HFBR) at Brookhaven National Laboratory (BNL),” dated November 27, 2006.

Memorandum, R. Rimando (SC-DOE) to C. Anderson (SC-DOE), Subject: “Information Regarding Violation of Approved Safety Evaluation Report (SER) for High Flux Beam Reactor (HFBR) at Brookhaven National Laboratory (BNL),” dated November 27, 2006.

Occurrence Report EM-BHSO-BNL-HFBR-2006-0001, “HFBR air Conditioning Water Pump Seal Leak,” Final, Rev. 1, November 28, 2006.

E-mail communication, G. Shepherd (BSA) to J. Tarpinian (BSA), Subject: “FW: ATS 3373 Additional Condition Document,” dated November 29, 2006.

S.H. Moss (BNL), HFBR Authorization Basis Documents Timeline, December 1, 2006.

Report, Assessment of the HFBR Configuration Management Issue, Brookhaven National Laboratory, January 2007.

Letter, M. Holland (SC-DOE) to S. Aronson (BSA), Subject: “Change in Nuclear Safety Requirements for Brookhaven National Laboratory,” dated January 12, 2007.

Memorandum, Frank McCoy (Washington Group International) to Mike Bebon (BNL), Subject: “Report of an Independent Evaluation of Safety Implications and Resolution Activities Regarding the High Flux Beam Reactor Safety Evaluation Report Configuration Control Failure Reported December 16, 2005 (Draft),” dated January 19, 2007.

Independent Audit and Oversight Report IO 06-10, “Integrated Safety Management-Facility Operations, Conduct of Operations Action Follow-up, Phase 1,” February 6, 2007.

Occurrence Report EM-BHSO-BNL-HFBR-2006-0002, “Failure to Maintain Configuration Control of DOE-SER specified Authorization Basis Manual Documents,” Latest update, February 8, 2007.

E-mail communication, G. Shepherd (BSA) to T. Kneitel (BHSO), Subject: “Update Status for TCAP CAP,” dated February 21, 2007.

E-mail communication, G. Goode (BSA) to C. Dimino (BSA), Subject: “FW: WMF DSA Review,” dated February 28, 2007.

Internal Audit and Oversight Report IO 07-01, “Integrated Safety Management-Facility Operations, Conduct of Operations Corrective Action Follow-up, Phase 2, Central Steam Facility (CSF),” March 1, 2007.

Internal Audit and Oversight Report IO 07-02, “Integrated Safety Management-Facility Operations, Conduct of Operations Corrective Action Follow-up, Phase 2, Central Chilled Water Facility (CCWF),” March 28, 2007.

Letter, M. Holland (SC-DOE) to M. Bebon (BSA), Subject: “Brookhaven National Laboratory (BNL) Waste Management Facility (WMF) Documented Safety Analysis (DSA) and Technical Safety Requirements Review (TSR), dated March 5, 2007.

E-mail communication, G. Shepherd (BSA) to J. Tarpinian (BSA), Subject: “RE: Change in Nuclear Safety Requirements for BNL,” dated March 5, 2007.

E-mail communication, G. Goode (BSA) to D. Rocco, M. Clancy, J. Tarpinian, Subject: “FW: draft PISA/USQD/Safety Letter,” dated March 6, 2007.

E-mail communication, J. Armstrong (SC-DOE) to R. Desmarais (SC-DOE), Subject: “FW: A Dozen Things,” dated March 8, 2007.

E-mail communication, D. Rocco (BSA) to G. Goode, M. Bebon, J. Tarpinian, M. Clancy, G. Shepherd (BSA), Subject: “RE: WMF Evaluation of Safety and Letter,” dated March 8, 2007.

E-mail communication, M. Clancy (BSA) to G. Shepherd (BSA), Subject: “Brookhaven National Laboratory,” (attachment: Temporary SOP “Control of On-Site Radioactive Material with Radionuclide Quantities of Nuclear Facility Category 3 or Greater), dated March 8, 2007.

Memorandum, M. Bebon (BNL) to J.E. Tarpinian (BNL), Subject: “Facility Safety Management System Assessment of Authorization Basis Documentation,” dated March 12, 2007.

Occurrence Report SC-BHSO-BNL-BNL-2007-0006, “PISA and USQ for DOE Review of Waste Management Facility Documented Safety Analysis and Potentially Unanalyzed Hazards,” Latest Update, March 15, 2007.

Letter, M. Bebon (BSA) to M. Holland (SC-DOE), Subject: “Action Plan for Recovery – WMF DSA,” dated March 20, 2007.

Internal Audit and Oversight Office Report IO 07-03, “Integrated Safety Management-Facility Operations, Conduct of Operations Corrective Action Follow-up, Phase 2, Waste Management Facility (WMF),” April 9, 2007.

BNL SBMS Subject Area, *Facility Use Agreements*, effective date July 16, 2004.

BNL SBMS Subject Area, *Accelerator Safety*, effective date February 9, 2006.

BNL SBMS Subject Area, *Facility Hazard Categorization*, effective date January 13, 2006.

BNL SBMS Subject Area, *Hazard Analysis*, effective date March 15, 2001.

BNL SBMS Subject Area, *Nuclear/Criticality Safety*, effective date March 17, 2005.

C-A Operations Procedures Manual 1.10.1 *Procedure for Documenting Unreviewed Safety Issues*, Rev.2, effective date March 23, 2005.

C-A Department *Safety Assessment Document*, Linac, Tandem Van De Graaff, Booster, AGS, RHIC, Transfer Lines, Experimental Areas, Rev. 2, August 2004.

Accelerator Safety Envelope for RHIC, Revision: January 16, 2006.

Accelerator Safety Envelope for NASA Space Radiation Laboratory, Dated August 13, 2004.

Accelerator Safety Envelope for Tandem Van de Graaff and Tandem to Booster Transfer Line, Dated August 13, 2004.

Accelerator Safety Envelope for AGS , Booster and LINAC, Revision: August 13, 2004.

Letter, M. Holland (SC-DOE) to M. Bebon (BSA), Subject: "Revision to Relativistic Heavy Ion Collider Accelerator Safety Envelop", dated April 5, 2006.

Safety Assessment Document for the National Synchrotron Light Source, dated August 14, 2006.

Safety Assessment Document for the DUV-FEL, dated October 1, 2004.

Accelerator Safety Envelope for National Synchrotron Light Source and associated revision log, Dated February 2, 2006.

Accelerator Safety Envelope for DUV-FEL and associated revision log, Dated October 1, 2004.

Safety Assessment Document for the Accelerator Test Facility, dated October 1, 2004.

Accelerator Safety Envelope for the Accelerator Test Facility, Dated October 31, 2004.

Accelerator Facility Safety Implementation Guide for DOE O 420.2B, *Safety Of Accelerator Facilities*, dated July 23, 2004.

DOE O 420.2B, *Safety Of Accelerator Facilities*, dated July 1, 2005.

BNL SBMS Subject Area, *Accelerator Safety*, effective date February 9, 2006.

Facility Use Agreement for Building 1005: RHIC Ring, effective date January 2007.

Facility Use Agreement for Building 801: Isotope Research and Processing Laboratory, effective date August 2006.

BW 015 Rev-1, B-801 Radiological Inventory Control, effective date February 9, 2007.

BW 010 Rev-A, B-801 Operating Safety Limits, effective date February 12, 2007.

Facility Use Agreement for Building 356: Solid State Gamma-Ray Irradiation Facility, effective date August 2001.

Facility Use Agreement for Building 650: Hot Laundry, effective date April 2004.

Facility Use Agreement for Building 463: Biology Department, effective date November 2005.

Facility Use Agreement for Building 479: Central Fabrication Services Division Machine/Sheetmetal/Welding Shops, effective date May 2005.

Facility Use Agreement for Building 462, effective date July 2004.

Facility Use Agreement for Building 491 Brookhaven Medical Research Reactor, effective date November 2006.

Letter, M. Holland (SC-DOE) to S. Aronson (BSA), Subject: “Brookhaven National Laboratory Triennial Transportation Safety Assessment (TCAP) Report”, September 25, 2006 with enclosed report dated September 22, 2006.

Letter, M. Holland (SC-DOE) to S. Aronson (BSA), Subject: “Brookhaven National Laboratory Triennial Transportation Safety Assessment (TCAP) Report”, November 15, 2006.

Letter, S. Aronson (BSA) to M. Holland (SC-DOE), Subject: “Change in Nuclear Safety Requirements to Brookhaven National Laboratory”, March 14, 2007.

Slides recording “Facilitated [BNL] Discussion on Nuclear Safety and Related Issues”, April 3, 2007.

E-mail communication, D. Rocco (BSA) to F. Petschauer (BSA), et al, Subject: “Draft Recommendations on Nuc Safety Program”, dated April 17, 2007.

White paper, “Gerry Shepherd’s Basic Strategic Objectives for BNL Nuclear Safety Program Re-engineering Strategic Plan,” undated.

BNL Facility Hazard Categorization List, link in SBMS from Facility Hazard Categorization subject area, August 2005.

BNL SBMS Management System Description: *Facility Operations*, effective date August 30, 2005.

BNL SBMS Management System Description: *Hazardous Material Transportation Safety*, effective date July 15, 2002.

BNL SBMS Program Description: *Hazardous Material Transportation Manual*, effective date July 31, 2001.

Management System Description: *Facility Safety*, effective date July 15, 2002.

BNL SBMS Committee Handbook – Laboratory Environment, Safety and Health Committee, effective date January 2007.

BNL SBMS Committee Handbook – Transportation Safety Working Group, effective date July 2004.

Organization chart for Safety and Health Services Division, October 2, 2006.

Organization chart for Safety Engineering Group, December 2005.

E-mail communication, D. Rocco (BSA) to M. Clancy and G. Goode (BSA), Subject: “nuc facility items/status”, dated April 17, 2007.

Evaluation of the Safety of the Situation [of the Waste Management Facility DSA PISA], undated draft provided by D. Rocco (BSA).

E-mail communication, D. Rocco (BSA) to M. Davis (BSA), Subject: “Pu-Be sources”, April 19, 2007.

WMD-USQD-2005-01 R1, “*Encapsulate 18 Plutonium-Beryllium Sources at the WMF*”, March 14, 2005.

Letter, M. Holland (SC-DOE) to M. Bebon (BSA), Subject: “Authorization to Start Removal of Building 490 Plutonium-Beryllium Sources”, March 14, 2005.

– 114 FUAs for 902, 555, 560, 906, 480, 526, 703, 815, 830, 701-715, 750, 650A, 670, 802, 810-811, 535, 490, 801, 197, 510, 820B, 832, 348, 473.

BNL SBMS Program Description, *Price-Anderson Amendments Act Compliance Validation and Noncompliance Reporting*, effective date 3/12/07.

DOE O 433.1A, *Maintenance Management Program for DOE Nuclear Facilities*, 2/13/07.

SBMS, *Brookhaven National Laboratory Committee Membership*, last modified 2/27/07.

BNL *Unreviewed Safety Issue Flow Chart*, 1/2006.

BNL *Unreviewed Safety Issue Checklist*, effective date 2/9/06.

SBMS BNL Management Description, *Integrated Assessment Program*, effective date 6/20/06.

10 CFR 830, Subpart B.

DOE STD 1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*, 12/92.

DOE G 424.1-1A, *Implementation Guide for Use in Addressing Unresolved Safety Question Requirements*, 7/24/06.

Draft Memorandum, J.E. Tarpinian to Distribution, BNL Nuclear Safety Officer Review of Authorization Basis Documents, 6/21/2006.

DOE Memorandum, Martha Krebs to Cherri Langenfeld, *Categorization of Building 463, Controlled Environment Radiation Facility*, at Brookhaven National Laboratory, 10/27/95.

DOE Letter, Michael D. Holland to Michael H. Brooks, *Controlled Environment Radiation Facility (CERF), Building 463, Basis for Interim Operation*, 6/2/95.

DOE Memorandum, Martha Krebs to Cherri Langenfeld, *Review of Basis for Interim Operation (BIO) and Preliminary Hazards Analysis (PHA) for Building 463, Controlled Environment Radiation Facility of Brookhaven National Laboratory (BNL)*, 5/26/95.

APPENDIX B
List of Interviewees

Individuals interviewed as part of this assessment are listed below.

1. Michael Bebon, Deputy Director of Operations
2. James Tarpinian, Assistant Laboratory Director for Environment, Safety, Health, and Quality
3. Barbara Royce, Building Manager Program Manager, Facilities & Operations Directorate
4. Raymond Costa, EHST&Q Manager, Facilities & Operations Directorate
5. George Goode, Manager, Environmental and Waste Management Services Division (EWMSD)
6. Michael Clancy, Deputy Manager, Waste Programs, EWMSD
7. Diane Rocco, Waste Management Operations Manager, WM Facility Nuclear Criticality and Safety Officer, EWMSD
8. Steven Coleman, Integrated Safety Management Project Manager
9. Les Hill, Director of Environmental Restoration Projects (ERP)
10. Fred Petschauer, General Manager, D&D Support Group, ERP
11. Tom Daniels, D&D Operations Manager, ERP
12. Charles Schaefer, Manager, Radiological Control Division (RCD)
13. Kris Dahms, Isotopes and Special Materials Group Leader, RCD
14. Robert Desmarais, Director, Operations Management Division, DOE Brookhaven Site Office (BHSO)
15. Peter Kelley, Facility Representative, Operations Management Division, BHSO
16. Jason Armstrong, Sr. Health Physics Specialist, Operations Management Division, BHSO
17. Steven Hoey, Environment, Safety, and Health Coordinator, Center for Functional Nanomaterials
18. Michael Zarcone, Michael J. Zarcone, Manager, ESSH&T Programs, Physics Department
19. Steven Moss, Authorization Basis Engineer for the Environmental Restoration Projects Directorate, and Laboratory Criticality Safety Officer

20. Gerard Shepherd, BNL Nuclear Safety Officer, Safety & Health Services Division
21. Andrew Ackerman, Manager of ESH&Q, National Synchrotron Light Source (NSLS)
22. Robert Casey ESH Manager, NSLS-II
23. Nicholas Gmur, ESH Coordinator, NSLS-II
24. Ed Lessard, Associate Chair for ESSHQ Collider-Accelerator Department (CAD)
25. Ray Karol, Head, ESSHQ Division, CAD
26. Bill Gunther, Nuclear Safety Committee Chair, and Special Assistant to the Associate Laboratory Director of Life Sciences
27. Douglas Ports, Manager, Integrated Planning, Policy and Strategic Planning Office

APPENDIX C
Vitae of Assessment Team Members

MARK DAVIS
Brookhaven National Laboratory

EDUCATION/CERTIFICATION: West Virginia University, Bachelors of Science, Petroleum Engineering (1983); Dowling College, Master of Business Administration (1988); Project Management Professional (PMP) Certification (2002); BNL ORPS Categorizer (2005-present)

EXPERIENCE:

Project Engineer – Environmental Compliance, Brookhaven National Laboratory (BNL): 2000–present. Responsible for Lab-wide implementation of the NEPA, NHPA, and TSCA regulations. Self-Assessment Program Coordinator for EWMS Division, Prepared Environmental Assessment for construction/operation of National Synchrotron Light Source-II, Chair of Accelerator Readiness Review (ARR) Team for commissioning of the Source Development Lab, ARR Team member for: commissioning & operations of Ebcocyclotron (2003–2006), commissioning of the NASA Space Radiation Laboratory (2002–2003), commissioning of the Relativistic Heavy Ion Collider (RHIC) (2000).

HFBR Operations Manager, Reactor Division: 1997-2000. Responsible for direct oversight of the Operations Section in maintaining safe and efficient operation of the High Flux Beam Reactor at BNL. Approved and directed installation of facility system design changes, and managed multiple facility upgrade projects.. Member of Review of Operations Committee.

HFBR Assistant Operations Manager, BNL Reactor Division: 1994-1997. Planned, scheduled, and coordinated all plant maintenance and operating modes. Responsibilities included investigative oversight, root cause analysis, development and evaluation of special test procedures.

Work Controls Group Leader, BNL Reactor Division: 1991-1994.. Established priority, plant conditions, post work testing, permit requirements, and technical specifications of facility corrective maintenance activities. Participant on US DOE Argonne National Laboratory West Investigative Team for the Experimental Breeder Reactor II Technical Specification Violation - Dec. 1993. Co-Author of technical paper *Program For Improved Facility Management; From Concept through Implementation*, and presented paper at the 5th Asian Symposium on Research Reactors in Taejeon Korea, April 1996.

Reactor Supervisor, BNL Reactor Division: 1986-1991. Certified Shift Supervisor of High Flux Beam Reactor.

Staff Engineer, Isotopes & Special Nuclear Materials Group, BNL: 1984-1986. Involved interaction with scientific, administrative and engineering personnel in the management, control, and accountability of nuclear materials. Responsibilities included implementation of U.S. DOE, DOT and NRC regulations, coordination of reactor fuel reprocessing shipments with city, state and federal agencies.

STEPHEN MUSOLINO
Brookhaven National Laboratory

Dr. Stephen Musolino is a Health Physicist and member of scientific staff in the Nonproliferation and National Security Department at the Brookhaven National Laboratory. During his 28 years at BNL, Dr. Musolino has worked on radiological and industrial safety projects throughout the Laboratory, such as the Alternating Gradient Synchrotron and National Synchrotron Light Source. He was the Assistant to the RHIC Project Director for ES&H during the \$600M construction of the Relativistic Heavy Ion Collider and was the ES&H Manager for the Brookhaven Graphical Research Reactor Decommissioning Project. He received his M.S. in Nuclear Engineering from the Polytechnic Institute of New York, and Ph.D. in Health Physics from the Georgia Institute of Technology. Dr. Musolino is certified in Comprehensive Practice by the American Board of Health Physics.

DAVID G. RENFRO
Research Reactors Division
Oak Ridge National Laboratory

Mr. Renfro is an experienced technical and management reviewer, auditor, and assessor and has over thirty years experience in managing and technically contributing to safety analyses of U.S. Department of Energy (DOE) facilities and commercial nuclear power plants. He has been responsible for effective relationships with regulatory and oversight authorities, including DOE, Defense Nuclear Facilities Safety Board, Nuclear Regulatory Commission, and Advisory Committee on Reactor Safeguards. He has an active U.S. DOE Q-clearance. Selected recent experience is as follows:

ORNL Research Reactors Division Cold Neutron Source Safety Basis Engineer (2005 to present)

- Led preparation of High Flux Isotope Reactor Cold Neutron Source Documented Safety Analyses including coordinating or preparing all chapters except hazard and accident analyses
- Led review and approval of HFIR CNS DSA by interfacing with internal, independent, and DOE reviews
- Served as member of Management Self-Assessment team for restart of HFIR with CNS
- Represented company on the nation-wide Energy Facility Contractors Group (EFCOG) Safety Analysis Working Group Steering Committee (1993-present) and Safety Basis Subgroup

ORNL Nuclear and Facility Safety Services Group Leader (2003 to 2005)

- Led staff of twenty engineers to maintain programs and provide support services for ORNL in facility safety, fire protection engineering, nuclear criticality safety, and construction safety
- Maintained the Nuclear and Facility Safety portion of the ORNL Standards Based Management System
- Evaluated all proposals for the Basic Ordering Agreement procurement for services to Nuclear and Facility Safety and recommended awardees
- Served as final approver for all ORNL safety basis documents, USQDs, and fire protection analyses and assessments
- Chaired ORNL authorization basis independent review board and ORNL accelerator safety

independent review committee

- Served as ORNL subject matter expert for system engineering
- Chaired EFCOG Safety Analysis Working Group Steering Committee (2004 to 2005); vice-chair (2003)

ORNL Facility Safety Team Leader (2003)

- In addition to continuing to serve as facility safety engineer, supervised team of six other engineers to develop and maintain facility safety bases for ORNL nuclear and accelerator facilities
- Served as ORNL technical point of contact for interaction with Nuclear Regulatory Commission inspection team reporting to Congress on feasibility of external regulation of nuclear safety

STEPHEN M. SOHINKI, J.D. Dade Moeller & Associates

EDUCATION/CERTIFICATION: J.D., Georgetown University Law Center, 1974; B.A., Political Science (*summa cum laude*, Phi Beta Kappa), University of Pittsburgh, 1971; Bar Admissions: United States Supreme Court - 1978, District of Columbia – 1989, New Jersey - 1974

EXPERIENCE: Currently with Dade Moeller & Associates, Mr. Sohinki has been a member of the Senior Executive Service for the past 17 years and has more than 30 years of experience in the field of nuclear energy (civilian and military uses). During his service with the U.S. Department of Energy (DOE), he managed major national security programs associated with the analysis of alternatives for the nuclear weapons complex of the future, the development of a new supply of tritium to support the nuclear weapons stockpile, and the Department's safety enforcement program, which has contributed significantly to improving safety performance throughout the DOE Complex. Before joining DOE, he had 14 years of legal experience on the regulatory and industry sides of commercial nuclear power. This experience includes representation of the Nuclear Regulatory Commission (NRC) technical staff in reactor licensing and enforcement proceedings, service on the personal staffs of two NRC Commissioners, and legal representation of and consultation for two commercial nuclear utilities. His accomplishments as a member of the Senior Executive Service resulted in his receipt of a Presidential Rank Award as well as several DOE commendations for outstanding service.

Director, Office of Price-Anderson Enforcement (2002–2006). Mr. Sohinki managed a staff of engineers, health physicists, occupational safety and health and administrative professionals in implementation of the Department's enforcement authority pursuant to the Price-Anderson Amendments Act of 1988 for nuclear safety, as well as the 2002 Authorization Act that provided DOE, for the first time, with the mandate to enforce worker safety and health regulations. He was responsible for taking enforcement actions against contractors for violations of DOE nuclear safety requirements and for the planning and implementation of an enforcement program that will begin in February 2007 to enforce compliance with newly promulgated DOE worker safety and health regulations in 10 CFR 851. He was responsible for the initiative to move the DOE Complex away from its current focus of reacting to safety events toward the goal of excellence in performance assessment programs as a means of finding and addressing precursor issues before they result in significant safety incidents.

JAMES E. TARPINIAN
Director, Environment, Safety, Health and Quality
Brookhaven National Laboratory

James Tarpinian is the Assistant Laboratory Director for Environment, Safety, Health & Quality (ESH&Q) providing leadership for three Divisions and one Program Office in support of BNL's science mission. With a staff of 165 professionals, technicians, and administrative staff, the ESH&Q Directorate works in concert with other support and science organizations by providing services that protect people, property, and the environment.

Mr. Tarpinian received a B.A. in Biology from the University of Connecticut at Storrs and an M.S. in Radiological Sciences and Protection from the University of Lowell. He has over 25 years of experience developing and administering safety and health programs for the Department of Energy (DOE), Environmental Protection Agency, US Army Corps of Engineers, and commercial projects.

Jim currently serves as vice chair of the American Board of Health Physics. He is a past-president of the American Academy of Health Physics and a past Director of the Health Physics Society. Jim's contributions to the field of radiation safety earned him two awards by the Health Physics Society -- the Elda E. Anderson award in 1991 and the Fellow award in 2002. In 2004, Jim was presented with the Joyce P. Davis memorial award by the American Academy of Health Physics.

KYLE H. TURNER, Ph.D.
Principal, McCallum-Turner, Inc.

EDUCATION/CERTIFICATION: Georgia Institute of Technology, Bachelors of Science, Electrical Engineering (1968); Georgia Institute of Technology, Masters of Science, Nuclear Engineering (1969); Georgia Institute of Technology, Ph.D., Nuclear Engineering (1971); Georgia Tech Academy of Distinguished Engineering Alumni; American Nuclear Society 1996 Leadership Award; Member – American Nuclear Society – Treasurer 2001-2003; Board of Directors 1999 – 2003; Chair, Power Division 2000 – 2001; Chair, Special Committee on New Construction (1993 – 2002)

EXPERIENCE:

Chief Executive Officer, McCallum-Turner, Inc., Evergreen, CO: 1994–present. Principal Investigator for update of industry Siting Guide, Early Site Permit Model Program Plan, Combined Operating License Program Plan, and New Plant Program Development Model for nuclear power plants. Led assessments of nuclear safety, authorization basis, conduct-of-operations, and maintenance work practices at ORNL. Conducted independent assessments of ISM systems readiness at PNNL, ISM and nuclear safety system effectiveness at ORNL, ISM mandated ES&H budget/risk prioritization, Waste and Environmental Management Division procedural compliance, ISM Phase I/II Verification readiness, and management and independent assessment processes (10 CFR 830.120) at Brookhaven National Laboratory (BNL); conducted independent evaluation of the ISM System for laboratory management transition at Oak Ridge National Laboratory. Conducted independent oversight investigation of a waste management pile fire and management assessment of Environmental Management Directorate work planning processes at BNL. Provided authorization basis/safety analysis support for Rocky Flats nuclear safety group. Provided operational management of the radioactive materials license for the first licensed geotechnical testing laboratory in Colorado. Acts as project manager/senior nuclear engineer for NEPA compliance support services contract at Rocky Flats. Provided nuclear technical issues/senior management review of twelve DOE program-level EISs (including those for research reactors and reactor-based plutonium disposition, isotope production, and tritium production) and senior consultation and support for two national public information/public involvement programs.

Managing Principal-in-Charge, Dames & Moore, Denver, CO: 1992–1993. As senior corporate management officer, provided management coordination of business and technical activities, personnel management, and facilities administration for 130-person operating office.

Manager, DOE and Nuclear Programs, Dames & Moore, Denver, CO: 1989–1993. Responsible for marketing, operations and financial management of a \$10 million profit center. Provided a broad spectrum of technical services to DOE sites including baseline risk assessments, treatability/feasibility studies, engineering evaluation support, contaminant fate and transport studies, RFI/RI, CMS/FS, NEPA compliance, regulatory analysis, safety analysis and health and safety support. Assignments were at DOE Chicago, Savannah River Site, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, and involved active experience with Federal Facility Compliance Agreements (FFCA) at the Hanford Site, Idaho National Engineering Laboratory, and Rocky Flats Plant.

Prepared the industry Siting Guide for nuclear power plant Early Site Permits. This Guide was prepared for the nuclear power industry and presents a siting roadmap for the next generation of

nuclear power plants; it addresses evolving licensing requirements, vendors' standard plant designs characteristics, and utility requirements developed by the Electric Power Research Institute.

APPENDIX D

Lines of Inquiry

The following lines of inquiry (LOI) formed a basis for a systems-level effectiveness assessment of the BNL Facility Safety Management and Facility Operations systems. Additional LOI and specific questions may be identified during the course of conducting the assessment.

The approach for applying the LOIs was to ascertain the degree to which the following characteristics are found in the BNL systems and implementation. Except as noted, the LOIs were applied to investigation of both the Facility Safety and Facility Operation management systems.

1. Management systems clearly recognize, incorporate, and effectively implement applicable requirements of DOE orders and regulations.
2. Management systems provide comprehensive guidance that ensures preparation and maintenance of robust facility authorizations. Line organization's processes for maintaining facility safety basis documents are effective in them current and consistent with actual operating conditions and requirements.
3. Facility safety documentation produced under the management systems is technically adequate and provides for appropriate safety in facility work authorization, operations, and maintenance.
4. Lines of authority for stewardship of management systems are clearly identified. Reporting relationships of responsible positions are properly linked to Laboratory management.
5. Responsibilities of management system stewards are clearly defined.
6. Persons with management system stewardship exhibit ownership of their responsibilities and discharge those responsibilities effectively.
7. Lines of authority for and responsibilities of personnel who prepare, review, and approve safety documentation are clearly defined, and the persons exhibit ownership of their responsibilities and discharge those responsibilities effectively.
8. Lines of authority for and responsibilities of personnel who implement, maintain, and operate under the requirements of approved safety documentation are clearly defined, and the persons exhibit ownership of their responsibilities and discharge those responsibilities effectively.
9. Review, approval, and oversight roles and responsibilities are clear between EM, SC, and site office. Lines of communication between laboratory and site office personnel responsible for facility safety are effective.
10. Lines of authority and responsibilities for Nuclear Safety Officer and Nuclear Criticality Officer positions are clearly defined, and the persons assigned to them exhibit ownership of their responsibilities and discharge those responsibilities effectively.

11. The charter, role, and authority Nuclear Safety Committee are clear and the processes and work products of the Committee appropriately implement the associated responsibilities.
12. Qualifications and competency for personnel responsible for management and implementation of facility safety and facility operations management systems are documented, and personnel filling these positions have qualifications and competencies consistent with these requirements.
13. Management systems provide clear mechanisms for assessing system effectiveness on a risk-prioritized basis.
14. Feed back from management system effectiveness measurements is routinely and effectively used to improve system performance.
15. Facility safety management systems described in SBMS properly reflect relevant DOE requirements.