Inspection of
Environment, Safety,
and Health Programs
at the

Idaho National Laboratory's Materials and Fuels Complex

August 2007

Office of Environment, Safety, and Health Evaluations
Office of Independent Oversight
Office of Health, Safety and Security
Office of the Secretary of Energy

OVERSIGHT

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Abbreviations Used in This Report

AIHA	American Industrial Hygiene Association
BEA	Battelle Energy Alliance
CFR	Code of Federal Regulations
CWI	CH2M Washington Group, Idaho, LLC
DOE	U.S. Department of Energy
EMS	Environmental Management System
ES&H	Environment, Safety, and Health
ESS	Evaluation of Safety of the Situation
FCF	Fuel Conditioning Facility
FSAR	Final Safety Analysis Report
HFEF	Hot Fuel Examination Facility
JCO	Justification for Continued Operation
MFC	Materials and Fuels Complex
HASS	Hazard Assessment and Sampling System
HSS	DOE Office of Health, Safety and Security
ID	Idaho Operations Office
INL	Idaho National Laboratory
ISM	Integrated Safety Management
ISO	International Standards Organization
NE	DOE Office of Nuclear Energy
PISA	Potential Inadequacy in Safety Analysis
SSO	Safety System Oversight

1.0 Introduction

The U.S. Department of Energy (DOE) Office of Independent Oversight, within the Office of Health, Safety and Security (HSS), inspected environment, safety, and health (ES&H) programs at the DOE Idaho Operations Office (ID) and the Idaho National Laboratory (INL) Materials and Fuels Complex (MFC) during June and July 2007. HSS reports directly to the Secretary of Energy, and the ES&H inspection was performed by Independent Oversight's Office of Environment, Safety and Health Evaluations. This report discusses the results of the review of the ID and INL ES&H programs as applied to MFC. Concurrently, the HSS Office of Environment, Safety and Health Evaluations also evaluated the ES&H programs applied to the Idaho Closure Project, and the HSS Office of Emergency Management Evaluations evaluated the ID and INL emergency management programs; the results of these inspection activities are discussed in separate reports.

Within DOE, the Office of Nuclear Energy (NE), within the Office of the Under Secretary of Energy, has line management responsibility for INL. NE provides programmatic direction and funding for advanced civilian nuclear technology research and development, facility infrastructure activities, and emergency management program implementation at INL. At the site level, line management responsibility for INL operations and emergency management falls under the ID Manager. Under contract to ID, INL is managed and operated by Battelle Energy Alliance, LLC (BEA), which began to operate INL on February 1, 2005.

Aerial View of MFC

INL's mission is to ensure the nation's energy security with safe, competitive, and sustainable energy systems and unique national and homeland security capabilities. To support these activities, INL operates numerous laboratories, reactors, test facilities, waste storage facilities, and support facilities. The mission of MFC is research and development for new reactor fuels and related materials, with a focus on the development of efficient reactor fuels and nonproliferation.

MFC activities involve various potential hazards that need to be effectively controlled, including exposure to external radiation, radiological contamination, nuclear criticality, hazardous chemicals, and various industrial hazards (e.g., electrical, noise, construction-like activities). Significant quantities of fissile and radioactive materials and hazardous chemicals are present in various forms at MFC.

MFC was formerly known as Argonne National Laboratory-West and managed by the Chicago Operations Office (under the purview of the Office of Science). As such, most aspects of MFC operations and ES&H program were governed by Argonne National Laboratory-West programs and processes. Concurrent with the new contract, DOE transferred line management responsibility for MFC to ID. Portions of the Idaho National Engineering and Environmental Laboratory and Argonne National Laboratory-West were combined to create INL with the new contract. The INL contractor, BEA, is responsible for transitioning MFC to operate in accordance with INL programs and processes.

As part of the contract transition, ID and BEA recognized that MFC ES&H programs and processes had a number of deficiencies that would take some time to address and that there would be some challenges in transitioning the former Argonne National Laboratory-West ES&H documentation and processes to the new BEA work management process. The areas of recognized deficiencies at the time of contract turnover (called pre-existing conditions) included potential inadequacies in the safety bases of MFC nuclear facilities, the lack of documented workplace exposure assessments as now required by 10 CFR 851, and a work control

process that was not sufficiently rigorous. As part of the transition to the new contract, ID and BEA identified approaches to address the pre-existing conditions. For the safety basis concerns, a safety basis upgrade plan and schedule were developed. For the work control process, ID and BEA agreed that the new BEA process would be implemented for all new activities beginning after March 29, 2007, and that there would be a five-year transition period during which old processes and documents could continue to be used unless they are deemed insufficient by line management.

The purpose of this Independent Oversight inspection was to assess the effectiveness of ES&H programs at MFC as implemented by BEA under the direction of ID and NE. Independent Oversight evaluated a sample of activities, including:

- Implementation of the core functions of integrated safety management (ISM) for selected MFC facilities and activities, focusing on work planning and control systems at the activity and facility level and their application in such areas as research, operations, and maintenance.

- Essential safety system functionality of the safety exhaust system and emergency power systems at MFC's Fuel Conditioning Facility (FCF), which is a Category 2 nuclear facility. The evaluation of these safety-related systems included a review of engineering design, safety basis, surveillance, testing, maintenance, operations, and system engineering and safety oversight. ID's and BEA's approach to addressing the potential inadequacies in MFC safety bases was also reviewed.

- NE, ID, and BEA effectiveness in managing and implementing selected aspects of the ES&H program that Independent Oversight has identified as focus areas, including environmental management system (EMS) implementation, workplace monitoring of non-radiological hazards, and safety system component procurement. Although these topics are not individually rated, the results of focus area reviews are integrated with or considered in the evaluation of other ISM elements. In examining the focus areas, Independent Oversight focused primarily on the application of institutional programs to MFC at the activity and facility level.

- NE, ID, and BEA feedback and continuous improvement systems, with a focus on their application to MFC.

Sections 2 and 3 discuss the key positive attributes and weaknesses, respectively, identified during this inspection. Section 4 provides a summary assessment of the effectiveness of the major ISM elements that were reviewed. Section 5 provides Independent Oversight's conclusions regarding the overall effectiveness of NE, ID, and BEA management of ES&H programs, and Section 6 presents the ratings assigned during this inspection. Appendix A provides supplemental information, including team composition.

Appendix B presents the findings identified during this Independent Oversight inspection. In accordance with DOE Order 470.2B, *Independent Oversight and Performance Assurance Program*, NE must develop a corrective action plan that addresses each of the findings identified in Appendix B. In most cases, the findings listed in Appendix B were derived from multiple individual deficiencies that have been described in the detailed results provided to the site. NE, ID, and BEA need to ensure that the corrective action plan for the Appendix B findings addresses these individual deficiencies and includes appropriate causal analysis, corrective actions, and recurrence controls. The findings are referenced in Sections 3 and 4 of this report. The weaknesses in Section 3 provide a management-level summary of the findings; the weaknesses do not need to be separately addressed in the NE corrective action plan because the findings encompass the scope of the weaknesses.

2.0 Positive Attributes

Positive attributes were identified in ES&H programs in such areas as the ID Facility Representative program, BEA preventive maintenance work packages, hoisting and rigging, and workplace-monitoring electronic databases at MFC.

The ID Facility Representative Program is an effective, mature, and well managed program. The Facility Representative program has a good set of safety analysis and trending tools. The ID Facility Representatives have strong personnel performance plans that provide clear management expectations, and a detailed and disciplined Facility Representatives oversight plan establishes clear expectations for the conduct of oversight and provides for good coverage of functional areas. Cross-training and rotation of Facility Representatives periodically from one facility assignment to another are effective practices. Facility Representatives' reporting and monthly and quarterly safety documents are effective in communicating issues, observations, and trends to senior ID and NE managers. Facility Representatives' assessments, surveillances, and operational awareness entries are of high quality and rigor. Issues are identified and communicated to the contractor, and Facility Representatives appropriately validate the closure of the contractor's corrective actions.

Although in the early stages of implementation, laboratory instructions and the initial format for Facilities and Site Services preventive maintenance work packages developed under the new work management system at MFC are comprehensive and adequately address hazards and controls for observed work. Only a few laboratory instructions and preventive maintenance work packages have been completed. However, several of the completed laboratory instructions and work packages were found to be logically arranged and outline specific hazards and controls associated with the work. For example, new laboratory instructions for analytical laboratory activities identified the major hazards associated with the work observed, including repetitive stress from using the manipulator arms and chemical and radiological hazards. The laboratory instructions also identified the appropriate controls, such as providing specific personal protective equipment for protection against each chemical used during the work and specifying guidance for ensuring compliance with waste management requirements.

MFC Facilities

The BEA hoisting and rigging program has a well-documented process for ensuring that appropriate controls are identified and implemented and that equipment is appropriately maintained. Assigning a subject matter expert, establishing a Laboratory-wide Hoisting and Rigging Committee, and using detailed written procedures provide effective controls. The observed lifts were well planned, the pre-job briefs were comprehensive, and the workers performed the lifts safely and in accordance with the established controls.

BEA has continued the development and implementation of a robust electronic database to support the workplace exposure monitoring requirements of 10 CFR 851. During the mid-1990s, an exposure assessment database, the Hazard Assessment and Sampling System (HASS), was developed, which over the years has evolved into a comprehensive, user-friendly exposure assessment management system that is operated and maintained by BEA but used by both BEA and CWI, Inc. (the Idaho Cleanup project

contractor) for evaluating, documenting, and trending workplace exposures. The initial exposure assessment program and the accompanying HASS database were designed to meet the intent of the *AIHA* [American Industrial Hygiene Association] *Sampling Strategy*, which also serves as the basis for the DOE workplace exposure strategy. The HASS electronic database has a remarkable level of detail with respect to work activity, hazard controls at the time of evaluation, work group sampled, and details of any sampling and monitoring that may have been performed. In addition, the HASS electronic exposure database has incorporated a statistical analysis program for determining the number of workplace samples required to meet AIHA sampling guidelines.

3.0 Weaknesses

Although some aspects of ES&H management are effective, there are weaknesses in ISM programs at MFC, most significantly safety bases, functionality, and safety oversight of essential safety systems, work planning and control, workplace monitoring, and feedback and continuous improvement processes.

The abilities of the safety exhaust system and emergency diesel generator power system to fully perform their safety functions under certain accident conditions are not adequately demonstrated because of deficient, insufficient, or non-conservative analyses and assumptions in the safety basis and surveillance testing processes. Numerous assumptions and modeling features in the argon cell accident analyses and in the safety exhaust system's responses may be non-conservative, or not supported by available documentation, or not enveloped by the safety bases. There are also numerous discrepancies in the technical surveillance requirement test procedures for safety exhaust system flow performance and in their analytical bases. In addition, few analyses have been performed to demonstrate the operability of critical emergency power systems in support of design basis accident conditions; those that exist contain non-conservative inputs, or do not consider applicable inputs. Further, changes to critical and non-critical emergency diesel generator electrical loads were not considered and integrated into related interfacing design calculations as required by configuration management requirements. These deficiencies call into question the ability of the safety exhaust and emergency diesel generator systems to perform their design safety functions, as required by 10 CFR 830. (See Findings #E-1, 2, 3, and 4.)

INL did not adequately assess and resolve the degraded condition of the Hot Fuel Examination Facility (HFEF) Substation Building, MFC-786. Despite the recognition, as early as 1999, that the degraded roof and attached insulation of the HFEF Substation Building presented a potential fire hazard to the FCF and a challenge to the availability of preferred power to the FCF, this condition was not assessed and resolved as required by DOE Order 430.1A, *Life Cycle Asset Management*. (See Finding #E-5.)

The BEA system engineer and ID safety system oversight programs for MFC nuclear facilities are not sufficiently mature or effective to ensure that nuclear systems at the FCF are reliably operated, maintained, and evaluated. The BEA system engineering program is not adequately defined and implemented in accordance with DOE Order 420.1B, *Facility Safety,* for MFC facilities. ID's safety system oversight (SSO) program for MFC has not ensured that sufficient reviews of safety systems are conducted as required by 99.OD.03, Attachment M, *SSO Qualification Program,* which implements the requirements of DOE Manual 426.1-1A, *Federal Technical Capability Manual*. In addition, although longstanding weaknesses in the safety bases of MFC nuclear facilities were recognized as a pre-existing condition in January 2005, and a formal potential inadequacy in safety analysis (PISA) for those facilities was declared in August 2006, ID has not ensured that timely, appropriate nuclear facility and system reviews are completed to establish interim controls or to validate existing controls. Also, ID has not yet approved the evaluation of safety of the situation (ESS) and a justification for continued operation (JCO) after the PISA was declared. (See Findings #E-6 and 7.)

The new BEA work management process described in LWP-21220 lacks sufficient requirements, expectations, and implementation guidance to ensure that the process is followed as intended so that all hazards are appropriately analyzed and reviewed. While the new BEA work management process provides a logical framework and outlines a systematic approach to work control, specific requirements and necessary criteria for proper implementation are lacking in several areas. The wide latitude allowed to line management has resulted in improper application of skill-of-the-performer provisions to high-hazard work activities and insufficient rigor in the review of pre-existing hazard analyses for legacy hazardous work activities, many of which will continue to be performed under the old system for several years.

These weaknesses have resulted in missed hazards, failure to involve appropriate safety professionals when required, and in some cases incomplete or ineffective controls. (See Findings #C-1, 2, and 5.)

BEA has not implemented or followed several programmatic radiation protection requirements at MFC to ensure that adequate radiological controls are maintained in accordance with institutional requirements. Although the design of the INL radiation protection program is generally sound, a number of intended radiological controls are not properly implemented at MFC. A lack of rigor in following and/or understanding institutional radiation protection requirements has resulted in ineffective and/or incomplete radiological controls in several areas, including radiological work permits, personnel contamination control, radiological surveys and monitoring, and bioassays. (See Findings #C-3 and 4.)

BEA management has not enforced workers' compliance with procedures and requirements sufficiently to meet DOE expectations for conduct of operations. During the inspection, the Independent Oversight team observed examples of workers from a variety of disciplines (operators, researchers, radiation control, maintenance, and industrial hygiene personnel) not following established requirements. Although isolated cases of failure to follow established controls might be expected, the number and significance of observed instances warrant increased management emphasis on compliance with procedures and requirements to ensure that workers are adequately protected from workplace hazards. (See Finding #C-5.)

BEA has not met the exposure assessment requirements of 10 CFR 851 for many of the work activities conducted at MFC, and BEA has yet to develop a detailed plan for meeting those requirements. The lack of adequate documented workplace assessments was identified as a pre-existing condition at the time of contract transition, and significant work was needed to achieve compliance. However, after more than two years, only about 10 percent of the current work activities have a documented exposure assessment. BEA missed its original milestone for completing exposure assessments and subsequently obtained ID's approval for a significant delay in the completion milestone, until October 2008. However, BEA does not have a formal or realistic plan for prioritizing the completion of the remaining exposure assessments to ensure that they are completed by the revised date. BEA has recently initiated a non-compliance notification for 10 CFR 851 to formally notify DOE of this deficiency. (See Finding #F-1.)

Glovebox at MFC

NE, ID, and BEA feedback and improvement systems and management priorities have not been sufficient to ensure timely improvements in the recognized deficiencies in the work control system, workplace monitoring, and essential safety systems. Although NE, ID, and BEA have the frameworks for effective feedback and improvement programs, there are weaknesses in various aspects of their programs. NE's management of requirements was not effective in identifying the need to address some Department directives in the areas of operating experience/lessons learned, employee concerns, and self-assessments. ID needs to strengthen rigor and discipline in implementing its issues management process, and has deficiencies in its employee concerns and lessons-learned programs. Many BEA assessment activities at MFC are not fully effective in evaluating the safe performance of work because they do not include sufficient performance-based observation of work activities. In addition, BEA has not adequately reviewed some safety areas, including some aspects of radiation protection (e.g., radiation work permits, bioassays, and radiological work planning) and MFC nuclear facility safety systems. For several BEA occupational injuries and illness investigations, the recorded information is insufficiently detailed and rigorous to demonstrate that appropriate corrective actions were identified and implemented to prevent incident recurrence. In addition to process and performance weaknesses in the feedback and improvement programs, NE, ID, and BEA management priorities have not been sufficient to drive timely improvements in areas of recognized deficiencies. Management has been aware of the

weaknesses in work control, workplace monitoring, and essential safety systems since the contract transition in 2005. However, management has not ensured that assessments are sufficiently focused on these areas and that improvements are made in a timely manner. As examples, the plan for enhancing the work control system was not developed in a timely manner, the milestones for completing the workplace assessments was missed, and there is still no adequate plan for achieving compliance with workplace assessment requirements. Additionally, NE and ID have not used contractual performance evaluation and performance objectives effectively to drive timely improvements in these areas. (See Findings #D-1, 2, 3, 4, 5, and 6.)

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4.0 Results

The following paragraphs provide a summary assessment of the NE, ID, and BEA activities that Independent Oversight evaluated during this inspection.

4.1 Work Planning and Control Processes

As discussed previously, ID and BEA recognized the work control process for MFC as a pre-existing deficient condition at the time of contract turnover in February 2005. MFC is in the process of transitioning former Argonne National Laboratory-West contractor work control documentation and processes to the new BEA work management process. The new process was implemented for all new activities beginning March 29, 2007, with a five-year transition period during which the old process and documents could continue to be used unless they are deemed insufficient by line management.

MFC has acceptable technical work documents and other processes in place for defining the scope of work. However, much of the work considered as "skill of the performer" has not been sufficiently defined to ensure adequate hazard analysis. (See Finding #C-1.)

In many cases, hazard analysis was sufficient for observed work that was covered by technical work documents prepared under the new and legacy work control systems. However, incomplete analysis of hazards was evident in some maintenance work packages and legacy technical work documents. Systematic deficiencies in the BEA work control process for skill-of-the-performer work have resulted in overuse of this provision and inadequate analysis of hazards, including failure to involve appropriate safety professionals in review and analysis of hazardous work activities. (See Findings #C-1 and 2.)

Engineering controls are used effectively to mitigate many activity-level hazards. Administrative controls such as procedures, work instructions, postings, entry control restrictions, permits and training, coupled with personal protective equipment, are also used extensively to control activity-level hazards. Although a number of controls are comprehensive and effective, weaknesses were identified in the application of administrative controls in several areas, including training and certification and industrial hygiene. For the significant amount of radiological work performed in MFC facilities, the radiological controls were adequate in some areas. However, systematic deficiencies were identified in the flowdown and implementation of a various programmatic radiation protection requirements, including radiological work permits, personnel contamination control radiological surveys and monitoring, and routine bioassay. (See Findings #C-2, 3, and 4.)

Most work was performed within established controls. The workers who were interviewed indicated that they felt empowered to stop work if safety concerns arose. However, several instances were observed where workers failed to comply with procedures or other requirements, indicating an increased need for management attention in this area. (See Finding #C-5.)

In summary, most existing technical work documents and the previously performed legacy hazard analyses adequately address activity-level hazards and controls, notably in existing nuclear operations instructions at HFEF. At all MFC facilities, however, some hazards associated with some legacy technical work documents and new work that has transitioned and been planned under the new process, including maintenance work packages and skill of the performer work, have not been adequately analyzed. Deficiencies were also identified in the flowdown and implementation of a number of programmatic radiation protection requirements, including personnel monitoring and contamination control, routine bioassay, radiation work permit development, and radiological surveys and monitoring. Finally, several instances were observed where hazardous work was never analyzed or properly documented, or where workers failed to comply with procedures, indicating an increased need for management attention in this area.

4.2 Essential System Functionality

In the review of essential system functionality, Independent Oversight evaluated the engineering designs, safety bases, and supporting analyses, as well as conditions of the selected MCF safety systems – the FCF safety exhaust system and the emergency diesel generators. The purpose was to determine whether they were capable of performing their safety functions with a high level of confidence, commensurate with their importance to safety. Independent Oversight also evaluated the effectiveness of the BEA processes for surveillance, testing, operations, maintenance, procurement, and system engineering in ensuring that safety systems remain fully capable of performing their safety functions. Additionally, Independent Oversight evaluated ID's safety system oversight at FCF and its approach to addressing the PISA for all MFC nuclear facilities.

Potential inadequacies in the safety bases of MFC nuclear facilities were recognized as a pre-existing condition at the time of contract turnover. As part of the transition to the new contract, ID and BEA prepared a plan and schedule, currently under revision, to develop 10 CFR 830 compliant documented safety analyses. During the Data Collection phase of the Independent Oversight inspection, the FCF was in a "secure" (shutdown) mode because the facility had identified a PISA. BEA has also transformed several processes, such as system configuration management, maintenance, and work control, which directly relate to essential system functionality.

Both the systems selected for this assessment are classified as "critical" to providing public protection in accordance with the DOE design standard that was applicable at the time the final safety analysis report (FSAR) for these systems was developed. The safety exhaust system, under accident conditions, exhausts the argon cell where most of the FCF fuel treatment work is performed. The emergency diesel generators provide emergency power for the safety exhaust system. The safety exhaust system and emergency-power diesel generators are housed in the relatively new safety equipment building, which is located adjacent to FCF and is designed to survive natural phenomena.

With some notable exceptions, the safety basis documents are very clear, well written, and comprehensive. The engineering drawings are particularly comprehensive and of high quality. However, the FSAR accident analyses for the safety exhaust system contain numerous weaknesses and discrepancies, indicating that they may not fully address all conditions that may exist at the time of an accident or as a result of the accident. For example, the accident analysis identifies the minimum safety exhaust system flow performance needed to ensure no unfiltered release; this analyses includes virtually no margin and may not be adequate. Additionally, similar discrepancies and weaknesses in the bases for the safety exhaust system technical surveillance requirement (TSR) flow surveillance testing procedures call into question their ability to demonstrate the flow performance of the system for the design basis accident. Further, the operability of the critical emergency diesel generators for design basis accident conditions is questionable because of the lack of defensible analyses and non-conservative assumptions. (See Findings #E-1, 2, 3, and 4.)

Facility staff promptly and appropriately responded to these engineering and safety basis concerns with declarations of PISAs, unreviewed safety questions determinations, and occurrence reports. The occurrence reports committed that the FCF, which was already in the secure (shutdown) mode in response to an earlier PISA, would remain in this mode pending completion of the unreviewed safety question determinations and further evaluations. A draft corrective action strategy included resolving the most readily resolved items first, and implementing additional operational controls that might allow resumption of limited operations, as well as long-term analyses and facility changes that could allow eventual resumption of full-scale operations.

Most surveillance testing procedures are adequate, and surveillances are performed when appropriate and are generally completed in a rigorous manner. However, in addition to the weaknesses noted above in technical bases and surveillance testing procedures for the safety exhaust system flow rate, some deficiencies were noted in procedures for conducting the observed surveillances and preventive maintenance. A common aspect of these deficiencies is that the procedures do not specify demonstrating the specific performance or capabilities required by the FCF safety basis document, TSRs, or FSAR. In addition, INL procedures do not address age-related replacement of high efficiency particulate air (HEPA) filters.

The operational status of safety system equipment is adequately monitored by FCF operations personnel. Operating procedures are technically accurate to achieve required system performance for normal, abnormal, remote shutdown, and emergency conditions. Operations personnel are trained and knowledgeable

about proper system response, failure modes, and required actions for credible accident scenarios in which the safety exhaust system and emergency power systems are required to function. Operations and maintenance personnel exercise good conduct of operations when performing operations activities with the safety systems.

The FCF maintenance program is effective in maintaining the selected safety systems, but the transition to INL's new processes and documentation requirements is challenging. Safety-related facilities and equipment are in good physical condition. Management and staff are diligent in ensuring that preventive maintenance is conducted when due. However, life cycle asset management for one facility – the HFEF Substation, which provides offsite preferred power to essential systems – has not been effective. The HFEF Substation roof and attached insulation are significantly degraded, presenting a potential fire hazard to the FCF and a challenge to the availability of preferred power to the FCF. (See Finding #E-5.)

The INL procurement program is robust, and no deficiencies were identified. For example, the defined INL program for identification, segregation, and reporting of suspect/counterfeit items is effective.

BEA has recently established its system engineer program. The system engineers assigned to the FCF are actively engaged in supporting the operations and maintenance of the safety exhaust system and the emergency diesel generators, but the overall system engineering program lacks adequate definition and implementation. For example, the purpose, scope, and frequency of system assessments and reviews are not adequately defined; the training and qualification program has important deficiencies; and periodic system reviews are not routinely scheduled and performed in a formal manner. ID established its SSO program nearly two years ago, but, there is little evidence of its implementation at FCF. Moreover, ID has not ensured that nuclear facility and safety system reviews have been conducted to establish adequate interim controls or to validate existing controls in the light of potential safety basis inadequacies for MFC nuclear facilities, which were identified in January 2005, nor has ID approved the ESS/JCO for MFC nuclear facilities. (See Findings #E-6 and 7.)

Overall, the FCF safety systems are well maintained and in good condition, and BEA has made improvements in certain areas, such as the maintenance program. However, there are deficiencies in the safety basis and surveillance testing, such that the abilities of the systems to fully perform their safety functions under certain accident conditions are not adequately demonstrated and there are significant weaknesses in safety system engineering and oversight.

4.3 Focus Areas

Environmental Management System and Pollution Prevention Program. At INL, Independent Oversight evaluated the status of ID in meeting the requirements of DOE Order 450.1, *Environmental Protection Program,* to implement an EMS. The ID program was examined for management and oversight of EMS activities, the BEA environmental compliance program, and the implementation of EMS for activities involved with research, operations, maintenance, and construction-like activities at the MFC. ID verified in December 2004 to DOE Headquarters that the site's EMS had met the requirements of DOE Order 450.1, and following award of the new contracts re-verified in December 2005 that BEA continued to have an effective EMS based on BEA having achieved International Standards Organization (ISO) 14001:2004 certification. ID's Environmental Technical Support Division continues to provide comprehensive oversight through participation in the third-party ISO 14001 audits and in joint operational awareness reviews with the Facility Representatives. At MFC, the EMS has been has been implemented within the contractor's ISM systems, and significant environmental aspects, including pollution prevention, have been integrated into ISM tools used for new work. This implementation has been strengthened by program environmental leads who have been deployed to support line organizations at MFC. Although EMS has been integrated into ISM across INL, incorporation of environmental hazards and controls within laboratory instructions and other work control documents at MFC is only in the early stages of implementation and has not yet demonstrated a mature program that ensures compliance and effectively identifies opportunities to reduce waste.

Workplace Monitoring. DOE Order 440.1A, *Worker Protection Management for Federal and Contractor Employees,* and 10 CFR 851 establish the basis and requirements for an effective workplace monitoring and exposure assessment process. BEA's workplace exposure monitoring architecture, exposure assessment procedures, and the HASS electronic database should fulfill these requirements. The HASS electronic data has evolved over the past ten years into one of the most robust workplace exposure databases in the DOE complex. However, the need for several

exposure assessment program enhancements were identified that are common to both BEA and CWI, such as improved exposure assessment reports for line management, documentation of sampling decisions, development of a technical basis for exposure assessment thresholds, and more precise exposure controls in work documents.

At MFC, much work remains to meet the requirements for documented exposure assessments. Currently, only about 10 percent of the current work activities have a documented exposure assessment, and BEA does not have a formal plan for prioritizing the completion of the remaining exposure assessments to ensure that the projected completion date of October 2008 can be achieved. BEA has initiated a non-compliance notification for 10 CFR 851 to address this concern, although the issues management system entry to address this non-compliance has a low priority and does not reflect the importance or magnitude of the exposure assessment issue at MFC. Many of the work activities observed by the Independent Oversight team did not have documented exposure assessments. (See Finding #F-1.)

4.4 Feedback and Improvement Systems

NE. NE has made significant progress in meeting the oversight requirements of DOE Order 226.1, including developing and implementing the *NE Safety Management Process* and the NE *Safety Management Plan for Risk Based Oversight Standard Operating Procedure.* NE coordination with ID is maturing and improving, and NE maintains sufficient operational awareness at the Headquarters level to provide a strong basis for informed decision making. NE's development of an oversight schedule that integrates the efforts of a program secretarial office, the central technical authority (through the efforts of the Chief of Nuclear Safety), and a field element is a positive accomplishment. Although NE has made good progress in defining and implementing most Headquarters oversight processes, NE has not yet developed or implemented some directive-required processes and has not provided sufficient direction for implementing an effective NE Headquarters self-assessment process, and guidance for planning oversight activities does not provide sufficient detail. NE has also not provided sufficient direction and guidance to ID for timely, adequate action on the safety basis vulnerabilities identified for MFC nuclear facilities. (See Findings #D-1 and #E-7.)

ID. Many aspects of ID oversight have improved in the past few years through such actions as development of the Management System Description Document and the ID Management System, achievement of ISO 9001:2000(E) registration, and implementation of a structured and automated issues management system (Pegasus). In addition, ID has an effective Facility Representative program and has established an effective training and qualification program that encompasses personnel who perform oversight of both non-defense and defense nuclear facilities. Although many aspects of ID oversight are effective and/or improving, there are weaknesses in a number of areas, including rigor and discipline in implementing issues management, employee concerns, and lessons-learned programs. In addition, the oversight baseline needs to be better defined so that ID can demonstrate adequate coverage of required assessments within a reasonable period of time, and increased management attention is needed to ensure that MFC work planning, industrial hygiene/workplace monitoring, and radiological controls are adequately assessed and that the needed improvement are achieved in a timely manner. Further, ID has not adequately implemented its SSO program and has not sufficiently reviewed the MFC safety systems and the BEA system engineer program. Finally, increased ID management attention is needed to ensure that ES&H contract metrics and performance objectives are challenging and measurable and that contractual incentives are used effectively to drive timely performance improvements at MFC. (See Findings #D-2, 3, and 4.)

BEA. BEA has many elements of an effective feedback and improvement program in place. The institutional processes are well defined, and a formal, institutional integrated assessment program is established that includes management self-assessments/reviews, inspections/surveillances, and independent assessments for safety compliance and performance. At MFC, assessment planning and performance have been completed in accordance with an approved assessment scheduled. In some areas, MFC assessments have identified various process and performance deficiencies and, in most cases, are clearly documented. For example, BEA's focus on electrical safety has contributed to significant performance improvements in such areas as lockout/tagout and zero-energy checks. BEA has established and implemented an issues management program that, with few exceptions, captures and evaluates safety issues, develops corrective actions and recurrence controls, verifies corrective action completion, and

tracks the management of issues to closure. BEA has established an adequate lessons-learned program and uses performance metrics to monitor ES&H performance and identify trends and potential problem areas. Further, BEA has a number of ongoing actions and promising initiatives that are in various stages of implementation and maturity and that have the potential to enhance the BEA feedback and improvement program as applied to MFC.

However, there are weaknesses in important aspects of the BEA feedback and improvement program as applied to MFC, most notably in the areas of assessments and accident/injury investigation and reporting. Many assessments do not include work observations and have not been adequate to provide effective reviews of some aspects of radiological controls (e.g., radiation work permits, bioassays, and radiological work planning) or numerous MFC safety systems. The weaknesses in assessments contributed to the deficiencies in work control, essential safety systems, radiological controls, and workplace monitoring identified during this Independent Oversight inspection. Also, in many work activity-related incidents, there is insufficient detail and rigor in the documentation of the investigations and in specified corrective actions to demonstrate effective analysis and adequate recurrence controls.

BEA management has a good understanding of the current weaknesses in the feedback and improvement program, and many of the ongoing and planned initiatives are appropriate to achieve the needed improvements. However, ID and BEA management have been aware of systemic deficiencies in MFC work control, essential safety systems, and workplace monitoring since the 2005 contract transition; deficiencies in these areas persist, and progress in addressing them has been limited. Increased management attention is needed to accelerate the enhancements and/or verify their effectiveness to ensure that the feedback and improvement program drives needed improvements in ES&H programs at MFC. (See Findings #D-5 and 6.)

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5.0 Conclusions

NE, ID, and BEA have many aspects of an effective ISM program in place, and many other elements are in development and/or improving. For example, INL has a strong environmental management system, and nuclear operators are well trained and qualified. ID management has been proactive in identifying and utilizing best practices from other sites such as the Pegasus information management system. ID management has also worked with other sites sharing their strengths (i.e. facility representative program) in support of improvement efforts. Through their oversight and evaluations in support of the transition of MFC, they have identified significant pre-existing deficiencies in work control, documented exposure assessments, and nuclear facility safety bases and supporting analyses. These deficiencies present NE, ID, and BEA with a number of unique challenges in enhancing MFC ES&H programs to meet DOE requirements and management expectations.

The weaknesses in work control, documented exposure assessments, radiological controls, and essential safety systems warrant increased NE, ID, and BEA management attention. Realistic, detailed, and appropriately monitored corrective action plans that identify milestones and needed resources are particularly important. Continued and increased attention to enhanced ID and BEA feedback and improvement programs applied to MFC is needed to ensure that senior management has an accurate picture of the status and progress in implementing the needed improvements. The enhancement of the ID SSO program and BEA system engineering program warrants immediate attention and high priority. ID, NE, and BEA should consider coordinating their efforts to develop a sound approach along with adequate interim safety controls to address the identified safety basis vulnerabilities and the PISA for MFC nuclear facilities.

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6.0 Ratings

The ratings reflect the current status of the reviewed elements of INL ISM programs, as applied to MFC. The ratings for Work Planning and Control and Essential System Functionality reflect the performance of both ID and BEA.

Work Planning and Control

Core Function #1 – Define the Scope of Work ..... NEEDS IMPROVEMENT
Core Function #2 – Analyze the Hazards ..... NEEDS IMPROVEMENT
Core Function #3 – Develop and Implement Controls ..... NEEDS IMPROVEMENT
Core Function #4 – Perform Work Within Controls ..... NEEDS IMPROVEMENT

Essential System Functionality

Engineering Design and Authorization Basis ..... SIGNIFICANT WEAKNESS
Surveillance and Testing ..... NEEDS IMPROVEMENT
Operations ..... EFFECTIVE PERFORMANCE
Maintenance ..... NEEDS IMPROVEMENT
System Engineering and Oversight ..... SIGNIFICANT WEAKNESS

Feedback and Continuous Improvement - Core Function #5

NE and ID Feedback and Continuous Improvement Processes ..... NEEDS IMPROVEMENT
BEA Feedback and Continuous Improvement Processes ..... NEEDS IMPROVEMENT

APPENDIX A
SUPPLEMENTAL INFORMATION

A.1 Dates of Review

Planning Visit	May 21-25, 2007
Onsite Inspection Visit	June 4-15, 2007
Report Validation and Closeout	July 10-12, 2007

A.2 Management

Glenn S. Podonsky, Chief Health, Safety and Security Officer
Michael A. Kilpatrick, Deputy Chief for Operations, Office of Health, Safety and Security
Bradley Peterson, Director, Office of Independent Oversight
Thomas Staker, Director, Office of Environment, Safety and Health Evaluations

A.2.1 Quality Review Board

Michael Kilpatrick	Bradley Peterson	Thomas Staker	Steven Simonson
Dean Hickman	Robert Nelson	Bill Sanders	

A.2.2 Review Team

Thomas Staker, Team Leader
Jeff Robertson, Deputy Team Leader

Phil Aiken	Vic Crawford	Larry Denicola	Robert Freeman
Janet Macon	Marvin Mielke	Bill Miller	Shiv Seth
Jim Lockridge	Tim Martin	Joe Panchison	Don Prevatte
Ed Stafford	Mario Vigliani		

A.2.3 Administrative Support

Lee Roginski	Tom Davis

A.3 Ratings

The Office of Independent Oversight uses a three-tier rating system that is intended to provide line management with a tool for determining where resources might be applied toward improving environment, safety, and health. It is not intended to provide a relative rating between specific facilities or programs at different sites because of the many differences in missions, hazards, and facility life cycles, and the fact that these reviews use a sampling technique to evaluate management systems and programs. The rating system helps to communicate performance information quickly and simply. The three ratings and the associated management responses are:

- **Significant Weakness (Red):** Indicates that senior management needs to immediately focus attention and resources necessary to resolve management system or programmatic weaknesses identified. A Significant Weakness rating normally reflects a number of significant findings identified within a management system or program that degrade its overall effectiveness and/or that are longstanding deficiencies that have not been adequately addressed. In most cases, a Significant Weakness rating warrants immediate action and compensatory measures as appropriate.
- **Needs Improvement (Yellow):** Indicates a need for improvement and a significant increase in attention to a management system or program. This rating is anticipatory and provides an opportunity for line management to correct and improve performance before it results in a significant weakness.
- **Effective Performance (Green):** Indicates effective overall performance in a management system or program. There may be specific findings or deficiencies that require attention and resolution, but that do not degrade the overall effectiveness of the system or program.

APPENDIX B
SITE-SPECIFIC FINDINGS

Table B-1. Site-Specific Findings Requiring Corrective Action

	FINDING STATEMENTS
C-1	The BEA work management process does not provide adequate expectations or criteria for "skill of the performer" and "skill of the craft" work to ensure that activities involving multiple tasks and/or adverse environments receive the appropriate hazard analysis as required by DOE Policy 450.4, *Safety Management System*.
C-2	BEA has not assured that sufficient rigor has been applied to activity-level hazard analyses to ensure that all hazards are adequately identified and analyzed as required by DOE Policy 450.4, *Safety Management System*.
C-3	MFC radiological work permits do not ensure that work scope and hazards are clearly defined, the necessary radiological controls are developed and tailored to the work, and the hazards and controls are understood by workers, as required by BEA institutional processes and procedures.
C-4	MFC has not followed BEA radiation protection requirements in the areas of radiological surveys and monitoring, air sampling, and routine bioassay as necessary to ensure adequate radiological safety.
C-5	BEA management has not enforced compliance with worker procedures and requirements sufficiently to meet the DOE expectations for conduct of operations set out in DOE Order 5480.19, *Conduct of Operations*.
D-1	Headquarters NE's management of requirements has not been effective to ensure that all safety related requirements established in Department directives (i.e. employee concerns program, operating experience/ lessons learned, self assessment) are adequately addressed.
D-2	Contrary to the requirement in work instruction 03.WI.04.02 (which implements requirements of DOE Order 226.1, *Implementation of DOE Oversight Policy*), not all ID assessments or self-assessments conducted in the last year are included in Pegasus.
D-3	The ID employee concerns program does not fully meet some DOE Order 442.1, *DOE Employee Concerns Program*, requirements in such areas as procedures, roles and responsibilities, ECP coordinator training, postings, organization and protection of files, and confidentiality of concerned individuals.
D-4	The ID operational experience/lessons-learned program has not been implemented with sufficient rigor and does not incorporate the field element roles and responsibilities of DOE Order 210.2, *DOE Corporate Operating Experience Program*.
D-5	Many BEA-approved assessment activities at MFC are not fully effective in evaluating the safe performance of work via direct observation of activities or in adequately reviewing some safety areas, including some aspects of radiological controls and MFC nuclear facility vital safety systems, as required by DOE Order 226.1, *Implementation of DOE Oversight Policy*.
D-6	For several BEA occupational injury and illness investigations, the recorded information is insufficiently detailed and rigorous to demonstrate that appropriate corrective actions were identified and implemented to prevent recurrence, as required by DOE Order 226.1, *Implementation of DOE Oversight Policy.*

Table B-1. Site-Specific Findings Requiring Corrective Action (continued)

	FINDING STATEMENTS
E-1	Numerous assumptions and modeling features in the FCF argon cell accident analyses and in the Safety Exhaust System organization's responses are potentially non-conservative, not supported by available documentation, or not enveloped by the safety bases, calling into question the system's ability to perform its design safety functions as required by 10 CFR 830.
E-2	Numerous discrepancies in the FCF TSR surveillance test procedures for safety exhaust system flow performance and the analytical basis call into question the surveillance test procedures' ability to validate the required performance in accordance with 10 CFR 830.
E-3	The required analyses to demonstrate operability of critical emergency power systems in support of FCF design basis accident conditions do not exist, contain non-conservative inputs, or neglect to consider applicable inputs, contrary to the requirements of 10 CFR 830.122, Criterion 6.
E-4	Changes in critical and non-critical emergency diesel generator electrical loads were not considered and integrated into related interfacing design calculations at FCF as required by the configuration management requirements cited in DOE Order 420.1B and DOE Standard 1073.
E-5	INL did not assess or maintain the condition of the HFEF Substation Building, MFC-786, as required by DOE Order 430.1A, *Life Cycle Asset Management*, in that the first condition assessment study was not conducted until May 2007 and the degraded roof and attached insulation present a potential fire hazard to the FCF and a challenge to the availability of preferred power to the FCF.
E-6	The BEA system engineering program is not adequately defined and implemented for MFC nuclear facilities in accordance with DOE Order 420.1B, *Facility Safety*.
E-7	ID has not ensured systematic, timely reviews of nuclear facilities and systems to establish and validate interim controls for potential inadequacies in MFC nuclear facility safety bases that have been recognized since January 2005, has not approved a justification for continued operation, and has provided little safety system oversight at those facilities as required by the DOE *Federal Technical Capability Manual*, 426.1-1A.
F-1	BEA has not met the exposure assessment requirements of 10 CFR 851 for many MFC work activities, and BEA has yet to develop a detailed plan for MFC that describes the extent of the backlog of exposure assessments, the prioritization of critical exposure assessments on higher-risk activities, and a justification for continued operation without the completion of these exposure assessments, and that provides assurance that the backlog of exposure assessments will be eliminated by the date committed to ID of October 15, 2008.