Volume II
Technical Appendices

ISM

Independent Oversight Inspection of Environment, Safety, and Health Programs at the

Argonne National Laboratory

May 2005

SSA
Office of Security and Safety Performance Assurance

Office of Independent Oversight and Performance Assurance
Office of Security and Safety Performance Assurance
Office of the Secretary of Energy

INDEPENDENT OVERSIGHT
INSPECTION OF
ENVIRONMENT, SAFETY, AND HEALTH PROGRAMS
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Acronyms

AGHC	Alpha-Gamma Hot Cell
AGHCF	Alpha-Gamma Hot Cell Facility
ALARA	As Low As Reasonably Achievable
ANL	Argonne National Laboratory
APS	Advanced Photon Source
ARF	Airborne Release Fraction
ASD	Accelerator Systems Division
ASO	Argonne Site Office
CAIRS	Computerized Accident/Incident Reporting System
CAP	Corrective Action Plan
CBDPP	Chronic Beryllium Disease Prevention Program
CFR	Code of Federal Regulations
CH	Chicago Operations Office
CY	Calendar Year
D&D	Decontamination and Decommissioning
DBE	Design Basis Event
DART	Days Away, Restricted, or Transferred
DOE	U.S. Department of Energy
dp	Differential Pressure
DSA	Documented Safety Analysis
ECP	Employee Concerns Program
EH	DOE Office of Environment, Safety and Health
EQO	Environment, Safety, and Health/Quality Assurance Oversight
EMS	Environmental Management System
ES&H	Environment, Safety, and Health
ESF	Essential System Functionality
FEC	Facilities, Engineering, and Construction Department
FHA	Fire Hazards Analysis
FR	Facility Representative
FY	Fiscal Year
HEPA	High Efficiency Particulate Air
HPP	Health Physics Procedure
HPTN	Health Physics Technical Notice
ISM	Integrated Safety Management
JHQ	Job Hazard Questionnaire
JSA	Job Safety Analysis
LCO	Limiting Condition of Operations
MAR	Material at Risk
NFPA	National Fire Protection Association
OA	Office of Independent Oversight and Performance Assurance
OJT	On-the-Job Training
ORISE	Oak Ridge Institute for Science and Technology
ORPS	Occurrence Reporting and Processing System
OSHA	Occupational Safety and Health Administration
P2	Pollution Prevention
PAAA	Price-Anderson Amendments Act

Acronyms (continued)

PFS	Plant Facilities and Services
PPE	Personal Protective Equipment
PISA	Potentially Inadequate Safety Analysis
QA	Quality Assurance
QAPP	Quality Assurance Program Plan
RCT	Radiation Control Technician
RF	Release Fraction
RSO	Radiation Safety Officer
RWP	Radiation Work Permit
SAR	Safety Analysis Report
SC	DOE Office of Science
SIMS	Site Integrated Management System
SME	Subject Matter Expert
SOP	Standard Operating Procedure
SSCs	Structures, Systems, and/or Components
TLD	Thermoluminescent Dosimeter
TSR	Technical Safety Requirement
USQ	Unreviewed Safety Question
USQD	Unreviewed Safety Question Determination
WCP	Work Clearance Permit
WMO	Waste Management Operations
XFD	Experimental Facilities Division

APPENDIX C

Core Function Implementation (Core Functions #1 - #4)

C.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) evaluated work planning and control processes and implementation of the first four core functions of integrated safety management (ISM) for selected Argonne National Laboratory (ANL) activities. The OA review of the ISM core functions focused on environment, safety, and health (ES&H) programs as applied to selected aspects of ANL activities:

- Advanced Photon Source (APS) (see Section C.2.1)
- Waste Management Operations (WMO) (see Section C.2.2)
- Plant Facilities and Services (PFS) (see Section C.2.3)

The sampling approach provides for a review of a representative sample of ANL organizations, facilities, programmatic activities, and work activities/tasks at ANL, including facilities operations, waste management activities, maintenance, and construction. For all the above areas, OA reviewed procedures, observed ongoing operations, toured work areas, observed equipment operations, conducted technical discussions and interviews with managers and technical staff, reviewed interfaces with ES&H staff, and reviewed ES&H documentation (e.g., plant standards, permits, and safety analyses). Specific processes in each area and OA team activities are discussed further in the respective results sections.

The scope of the review of ANL work planning and control considered the results of the 2002 OA inspection, which identified generally effective systems for controls for experimental activities in the 2002 timeframe. ASO and ANL had devoted considerable attention to the safe conduct of experiments, and had developed and effectively implemented an institutional experiment safety review process system at the division level. As a result of the analysis of previous results, on this 2005 inspection, OA focused primarily on non-experimental work, which was determined to be less effective in 2002, and on such specific deficiencies as systemic weaknesses in the institutional radiation protection program.

C.2 RESULTS

In addition to evaluating selected ANL activities, OA also evaluated the collective results of the application of ISM Core Functions 1 through 4 in the selected activities to identify commonalities and factors that contribute to the identified deficiencies. As discussed below, the evaluation of the collective results provides perspectives on the sitewide work control processes and ES&H programs.

The Argonne Site Office (ASO) and ANL have a system of institutional policies and lower-tier procedures to implement many aspects of the ANL ISM system. The 2002 OA inspection identified systemic deficiencies in the implementation of the ANL ISM program core functions in such work activities as facility operations, maintenance, and construction. Specific deficiencies were identified in important elements of various ES&H programs, such as work control processes, radiation protection, industrial hygiene, beryllium controls, and flowdown of requirements to the worker level. In response to the 2002 OA findings, ANL identified and completed a set of corrective actions, which were approved and recorded as complete by ASO. In some cases, the corrective actions have resulted in improvements in ISM core function implementation. For example, one of the APS divisions recently implemented a facility hazards analysis process to identify and control hazards at individual shops and laboratories, and

WMO has successfully incorporated several changes that has resulted in more effective hazards analysis and controls tailored to the specific work being performed.

Although there have been some improvements in implementation of ISM since the 2002 OA inspection, there are deficiencies in the work control processes for all of the organizations evaluated on this 2005 OA inspection. For these organizations, corrective actions from the 2002 OA inspection have not been fully effective, as evidenced by the continued and recurring process and performance deficiencies identified by this OA inspection. In addition, recent events that resulted in worker injuries revealed deficiencies in work planning and control. For example, a PFS worker was injured when a chain broke during a job that was performed with inadequate planning, ineffective safety controls, and insufficient safety reviews. In another example, deficiencies in work planning and safety controls resulted in a steam burn to a PFS worker. While some actions were taken for each of the 2002 OA findings, the corrective actions have not been effective in addressing the root causes and preventing recurrences of deficiencies. As a result, a number of aspects of worker safety are still not adequate to provide a level of assurance consistent with DOE ISM expectations.

In addition to ISM process and performance deficiencies in the evaluated organizations, this 2005 OA inspection identified three findings associated with institutional-level ES&H programs. These findings impact some or all ANL facilities and activities. These three findings are presented below for easy reference and are briefly discussed. Additional organization-specific observations contributing to these findings are discussed and referenced to the applicable finding in the results section for each of the three activities reviewed (Sections C.2.1 through C.2.3). The three institutional findings are similar in scope and nature to some of the findings and weaknesses from the 2002 OA inspection, further indicating that corrective actions have not been sufficiently comprehensive or effective.

The first institutional finding reflects deficiencies in flowdown and implementation of institutional requirements, including requirements in the ANL ES&H Manual and the ANL quality assurance program plan. As discussed throughout this report, ANL has not implemented some applicable institutional requirements. Some of the specific areas where institutional requirements were not implemented by line management include radiation protection (see Finding #2), feedback and improvement processes (see Appendix D), the cognizant system engineer program (see Appendix E), medical surveillance (see Finding #3), lockout/tagout assessments, hoisting and rigging, lead control, and beryllium program assessments. A common theme in these deficiencies is that ANL does not have adequate processes for ensuring that applicable requirements are implemented. ANL has not clearly defined roles, responsibilities, authorities, and requirements for developing and implementing key ISM processes in institutional Tier 2 documents, and some safety requirements have not been flowed down into line organization Tier 3 documents. Although subject matter experts (SMEs) have been assigned that are responsible for specific sections of the ES&H Manual, the institutional-level ownership of safety programs and processes is unclear. In addition, the authority and importance of some requirements delineated in Tier 2 documents are not understood or accepted by line organizations as reflected in the number of ES&H Manual and quality assurance program plan requirements not implemented by line organizations.

Finding #1. ANL has not established adequate processes for ensuring that all applicable requirements are identified, responsibilities for implementation are assigned, appropriate implementing documents/procedures are developed, and effective implementation is verified by management.

The second institutional finding reflects systemic deficiencies in the structure, processes, and performance of the ANL institutional radiation protection program with respect to the requirements of 10 CFR 830, 10

CFR 835, and implementation guidance associated with these requirements. Chapter 5 of the ANL ES&H Manual defines the radiation protection program requirements applicable to work with radioactive materials and radiation sources at ANL. Some of the facilities at ANL reviewed during the assessment, such as those operated by WMO, Energy Technology, and Chemical Engineering, are also subject to the DOE nuclear facility regulations of 10 CFR 830. As such, these facilities maintain approved DOE safety analysis reports (SARs), which define the authorization basis for operations and serve to implement the nuclear facility requirements of 10 CFR 830. The ANL radiation protection program does not fully meet the expectations that DOE considers sufficient to meet radiation protection and nuclear facility regulations in several key areas, including implementing procedures, radiation control technician (RCT) training and qualifications, organization and administration, and technical basis documentation, as discussed below.

ANL has not developed sufficient health physics implementing procedures as needed to ensure effective performance of assigned functions and compliance with ES&H Manual requirements, nuclear facility SARs, quality assurance requirements, the ANL nuclear facility conduct of operations manuals, and quality assurance plans. Contrary to these requirements and DOE expectations, formal procedures are not in place to govern the performance of a number of fundamental radiological control activities that have potential worker health and safety implications or that require a specific method be followed to properly complete the task. Many performance deficiencies discussed in this report can in part be attributed to the lack of procedures governing the specific expectations for these activities. Some examples of routine radiological tasks that are not governed by formal procedures include workplace radiation and contamination surveys, retrospective air sampling, operation of all specific radiological measuring and counting systems, preparation and use of radiation work permits (RWPs), development and maintenance of radiological protection records, radiological posting and entry control, and related tasks. While some controlled procedures are included in the Health Physics Procedures Manual, the manual is incomplete, the format and content of the material varies widely and do not meet some nuclear facility procedure requirements, and responsibilities for implementation are not always defined. There also is no documented plan defining what minimum procedures must exist to properly implement all radiological program requirements and no associated schedule for completion. Similar concerns were identified with the lack of sufficient health physics procedures in the 2002 OA inspection. In a related concern, the lack of health physics implementing procedures and/or detailed standardized job performance measures to gauge successful completion of RCT practical proficiency testing raises questions about the adequacy of the RCT certification process, as discussed below.

Insufficient institutional requirements for performing and documenting RCT proficiency testing has resulted in failure to meet minimum DOE expectations for training and qualification of RCTs. A sampling of WMO proficiency testing records indicates the process used at ANL does not meet the minimum expectations outlined in the core course for RCTs (DOE-HDBK-1122-99), which DOE considers the minimum acceptable level of training for RCTs. Specifically, job performance measures (or equivalent methods) have not been developed as a means of grading RCT proficiency in completing assigned tasks. Certification of successful completion is based solely on the subjective discretion of the evaluator for each assigned task, with no supporting grading criteria. A review of training records also demonstrates this approach can and has resulted in insufficient testing methods and criteria. For example, one ANL requirement is to conduct a contamination survey; however, a survey form documenting passage showed only that a qualitative large area wipe had been taken. This evidence cannot be construed as successful demonstration of the ability to perform a contamination survey that meets the requirements for evaluation of 10 CFR 835 surface contamination criteria. Because of the lack of systematic approach to grading DOE-required practical training exercises, RCT training and certification at ANL does not meet minimum DOE expectations necessary to ensure regulatory compliance.

Another institutional concern with the ANL radiation protection program is the lack of formal technical basis documentation for important elements of the program. The absence of such documentation may impact the ability to demonstrate compliance with DOE regulations. Under the DOE regulatory implementation guides, technical basis documents are needed to document decisions and approaches used to achieve regulatory compliance, such as those decisions where professional judgment has been exercised. The documents should include supporting analyses and justifications sufficient to demonstrate that regulatory compliance can be achieved and maintained. In several areas, ANL technical basis documentation does not meet these DOE expectations. For example, the basis and rationale for job-specific and retrospective air sampling, including how they are to be used to achieve regulatory compliance at the site, are not defined. As shown in Section C.2.2, these air sampling methods are sometimes not implemented in a consistent, appropriate, or defensible manner. Similarly, the technical basis for parameters established for counting equipment used to count air samples and portable instruments used for measuring contamination are not described. For instance, all radiological counting and measuring equipment is calibrated to a high energy beta source (strontium [Sr]-90) for beta measurements, which will result in an underestimate of the actual activity for most beta emitters and a possible failure to meet regulatory requirements for evaluation of surface contamination and air activity. However, both the basis for using Sr-90 as a calibration standard and any necessary compensatory measures needed to ensure that measurement of lower-energy isotopes is accurate are not defined.

Finally, DOE implementation guides and the DOE radiological control standard (the successor to the DOE Radiological Control Manual) establish the expectation that a radiological control organization separate from the line organizations be established to provide relevant support to line managers and workers. These documents state that for the radiological control organization to function effectively, it should be independent of the line organizational element responsible for production, operation, or research activities and have an equivalent reporting level. The SARs for Buildings 306 and 212 reference the DOE Radiological Control Manual as a requirements document. However, the current ANL organization does not fully function as described in the referenced requirements document nor does it have the authority and responsibility for directing the implementation and maintenance of radiological control functions across the site. For example, while the current interim radiation safety officer has a staff of several professional health physicists, none of these individuals has primary duties or responsibilities for providing the infrastructure support to line managers and workers in the key areas discussed above; most current Health Physics staff members are fully engaged in other areas, such as administration of the site's internal and external dosimetry and instrumentation programs. In the absence of dedicated radiation protection staff to complete these tasks, ANL has relied on the Operational Health Physics Coordinating Committee for some actions including development and issuance of procedures. This approach has not been timely or fully effective, as evidenced by the continued lack of procedures and other documents in key areas discussed above. Aside from the radiation safety officer's staff, the remainder of the ANL Operational Health Physics Coordinating Committee is comprised of full-time line organization health physicists who have primary duties and responsibilities to the line and not the institution. As a result, there is no mechanism to ensure timely performance of tasks delegated to these individuals.

Finding #2. The ANL institutional radiation protection program does not meet minimum DOE expectations in such areas as organization and administration, implementing procedures, radiation control technician training and qualifications, and technical basis documentation as needed to ensure effective sitewide radiation protection performance and compliance with 10 CFR 830 and 10 CFR 835 requirements.

The third institutional finding reflects deficiencies in medical surveillance. ANL has developed the elements (e.g., procedures, computer databases) required for an effective medical surveillance program. However, these elements are not integrated and are not consistently implemented. As a result, ANL does not meet all applicable medical surveillance requirements of DOE orders and Occupational Safety and Health Administration (OSHA) standards. Specific concerns were identified in medical surveillance for lead, respiratory protection, and beryllium.

Prior to this OA inspection, approximately 70 ANL workers were enrolled in the ANL lead medical surveillance program. However, recently the ANL Medical Department staff recognized that many of the ANL workers who had been identified as lead workers or lead users through the job hazard questionnaire (JHQ) process had not been enrolled in the lead surveillance program or evaluated or screened by the Medical Department. As a result, enrollment in the lead surveillance program has now surged to over 300 ANL workers. Although some of these workers may not need to be in the lead medical surveillance program, a medical review is required to determine their actual status. ANL Medical is currently developing screening criteria for the lead surveillance program. Furthermore, the thresholds for enrollment into the lead surveillance program are inconsistent between the ES&H Manual requirements and the ANL Medical lead surveillance program requirements.

Some ANL workers who are respirator wearers and have maintained annual respirator fit testing and training requirements do not have a current medical certification or certification updates. A respirator wearer is required by OSHA, DOE, and the ANL ES&H Manual to be medically certified prior to being fit tested. Section 12.2 of the ANL ES&H Manual requires that respirator wearers who have previously completed a medical questionnaire provide the Medical Department with an updated questionnaire before fit testing. In some cases, the medical updating process is being missed. According to ANL Medical, some respirator wearers have not had their medical status updated in over three years, although they have been fit tested and trained annually during this period. Furthermore, some construction workers are wearing filtering face piece respirators without the OSHA-required training, fit testing, or medical surveillance.

The deficiencies in the beryllium medical surveillance program include failure to offer medical surveillance and screening for beryllium workers, as required by the beryllium rule, and are discussed in Section F.2.3 of Appendix F.

Finding #3. Medical surveillances for a number of workers at ANL are not being implemented for beryllium, lead, and respiratory protection as required by DOE orders, OSHA standards, and ANL procedures.

C.2.1 Advanced Photon Source Work Planning and Control

APS is a state-of-the-art, high-energy accelerator research facility that is occupied, operated, and maintained by three ANL divisions – Experimental Facilities Division (XFD), APS Operations Division, and the Accelerator Systems Division (ASD). At APS, observed work activities included operational and maintenance activities in support of the beamline maintenance shutdown interval, and program support activities, such as facility modifications, work conducted by resident users, and management of hazardous materials and related wastes. Because the accelerator was in the shutdown mode during the OA inspection, no accelerator beam experiments or associated experimental work control processes were being conducted, and thus no programmatic research work activities were observed.

Core Function #1: Define the Scope of Work

At APS, facility-level work is adequately defined in the APS safety assessment document. This document provides extensive descriptions of accelerator and support operations such that adequate facility-level hazards analyses can be performed.

The scope of APS maintenance shutdown activities is generally covered by approved work documents (such as work plans and procedures) containing a description of the work sufficient to identify the most significant hazards. Work documents reviewed across the various APS divisions were approved and contained a description and/or drawings of the work, although procedural format, content, and quality differed among the three divisions.

Subcontractor work at APS includes such construction activities as extension of a modular room and some maintenance work. Most APS construction work is performed by subcontractors hired and managed by APS. Additionally, subcontracted maintenance work, such as disconnect and transformer preventive maintenance, is also conducted at APS and was observed. Subcontractor work is generally well defined in the respective contracts, job safety analyses (JSAs), procedures, and safety orientations.

Summary. In general, APS work is well defined through the safety assessment document and activity level work documents to permit adequate identification and analysis of the hazards to workers, the public, and the environment.

Core Function #2: Analyze the Hazards

Hazards for most operational and maintenance work at APS were adequately identified and analyzed. At the facility level, hazards analysis has been performed and documented in a comprehensive accelerator safety assessment document. In addition, many activity/task-level hazards are adequately identified and analyzed using the procedure development, review, and approval process. For example, the process for etching chromium films used by XFD is well described in a procedure, which also addresses hazards and the appropriate hazard controls, such as specific personal protective equipment (PPE) requirements. Other hazards, such as ergonomic hazards, are appropriately addressed in work planning. The work planning for a storage ring kicker magnet disassembly and reassembly appropriately considered ergonomic hazards associated with the work activity and provided a mechanical lifting device to reduce ergonomic stressors to the technicians performing this and like replacements. For those activities where work with hazardous materials has been identified in the work planning process, potential hazards to workers are typically appropriately analyzed. For example, hazards associated with the lead shot removal job were well defined and analyzed by ASD line management and appropriate ANL SMEs, such as the ANL industrial hygienists.

At the division level, XFD is developing facility hazards analysis documents for individual laboratories operated by XFD. The facility hazards analysis is a new concept within this division to identify the collective hazards and controls for a shop or laboratory. Each facility hazards analysis identifies the laboratory scope, hazards, equipment, PPE requirements, ES&H training requirements, and the relevant ES&H Manual chapters associated with work in the laboratory. For example, the Crystal Optics Fabrication Shop has recently completed a facility hazards analysis. The facility hazards analysis is particularly useful for fabrication and machine shops, because most work within the shop is skill of the craft using a variety of machines. This facility hazards analysis process is new, and has been implemented in approximately two-thirds of the XFD areas. Comparable processes are being implemented within the other two APS divisions.

Although most hazards are adequately analyzed, some deficiencies were identified in the areas of machine shop metal working, magnetic fields, and subcontractor hazard analyses and in the implementation of an administrative procedure addressing hazards analysis. The deficiencies are further described below.

APS line management does not ensure that adequate hazard exposure assessments are performed as required by DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, for some skill of the craft, resident user, or other routine activities (see Finding #4 under Core Function #3). The OA team observed or identified three work activities with inadequate hazards analyses, as described in the following three paragraphs.

Dust-producing machine shop equipment (i.e., grinding wheels and belt sanders) is present in numerous laboratory office module machine shop areas throughout APS, but some hazards in these areas have not been adequately analyzed and characterized. Worker exposure assessments have not been performed as required by DOE Order 440.1A. There are no well-defined restrictions on the machining of toxic metals (e.g., lead, cadmium, chromium) in these shops. A noticeable level of metal dust was identified in one shop directly below the sander, and room ventilation is minimal. Many of the shops are small, are provided with only one fresh air supply in the center of the ceiling, and do not have local ventilation for the dust-producing equipment. The ventilation system for a typical APS laboratory office module machine shop is based on controlling comfort conditions and is not suitable for machining toxic metals, particularly during cool room conditions when the shop air conditioning (i.e., the only source of room ventilation) is not operational. (See Finding #4.)

Magnetic fields for some accelerator equipment have not been sufficiently analyzed to ensure that appropriate controls have been implemented. For example, the magnetic fields near the insertion devices (i.e., undulator magnets) are high enough to meet ANL ES&H Manual requirements for postings to warn personnel with cardiac pace makers and postings to prohibit the use of ferromagnetic tools near or on contact with the magnets. These sources of magnetic fields are present throughout the APS storage ring and at several test and repair locations on the APS experimental floor; however, exposure assessments to quantify the intensity of these magnetic fields have not been performed, and these areas had not been posted as required. (See Finding #4.)

In another example, the potential dust and injection hazard from the cleanup of broken beryllium windows in research equipment was not sufficiently recognized. The breakage and subsequent cleanup of beryllium windows is an infrequent event, which typically does not result in beryllium contamination, as evidenced by Industrial Hygiene exposure assessments. However, in a few cases, detectable levels of beryllium have been identified. In one case, the level of beryllium contamination was more than twice the allowable surface contamination levels for non-beryllium work areas as prescribed in the ES&H Manual. However, beryllium windows have been considered by APS to be finished articles, even when broken, and therefore the requirements of the beryllium program have not been applied to the cleanup activities. (See Core Function #3 and Finding #3.)

Most hazards associated with the APS-observed subcontractor work were identified and documented in the JSAs prepared by the individual subcontractors for specific assignments. However, the potential hand injury hazard from cutting frame supports or handling metal with sharp edges was not adequately addressed in the JSA. Consequently, workers were performing metal sawing and handling work without adequate hand protection. (See Finding #4.)

Summary. For most work, APS operational and maintenance hazards are identified, well analyzed, and documented. The safety assessment document provides an extensive facility-level hazards analysis, and several mechanisms, such as the procedure development process, JSAs, and other work control processes, provide appropriate analyses of activity/task-level hazards. In a few cases (machine shop dust hazards, magnetic fields, and sharps/cutting hazards), individual activities or facility conditions have not been sufficiently analyzed to ensure that the appropriate controls can be identified and implemented.

Core Function #3: Identify and Implement Controls

APS uses the appropriate combination of engineered controls, administrative controls, and PPE to effectively control most hazards. Such engineered controls as computerized area access control and key interlock switches for equipment lockout are extensively used to protect personnel from radiological, electrical, and other hazards directly associated with accelerator operation. With the facility in maintenance beamline shutdown mode, such administrative controls as procedures, permits, and training served to augment or replace some of the normally used engineering controls. In most cases, implemented controls were effective, although some deficiencies were observed (discussed below).

In general, the ANL ES&H Manual provides well-documented, site-specific requirements for translating and implementing regulatory requirements (e.g., OSHA, Environmental Protection Agency, and DOE) for ANL workers. For example, the chapter on chemical carcinogens in the ES&H Manual provides a listing of applicable carcinogens at APS, thereby eliminating the need for workers to analyze a variety of listings of known, suspect, and likely carcinogens and arriving at conclusions that are often inconsistent. Additionally, ANL has recently incorporated into the ES&H Manual requirements that apply when using lead, including the appropriate workplace requirements for lead usage and lead contamination levels; however, some requirements have not been fully implemented at APS.

APS has developed and implemented operating and maintenance procedures that define the appropriate hazard controls for most activities. Maintenance procedures typically document the need for PPE and administrative controls for equipment preventive maintenance. The hazard controls for such activities as etching films, which requires the use of highly hazardous chemicals (e.g., hydrofluoric acid), are well documented in procedures. Most work plans and procedures contain specific lockout/tagout requirements as procedural steps where required. Many APS procedures identify job-specific training requirements. In some cases, where procedures had not been issued for a work activity, detailed and formal technical notes were used to perform the work. The technical notes for the observed work were comprehensive and well written.

For most activities, APS has established and maintained the appropriate engineering and administrative controls. Radiological hazards are extensively controlled through engineered components and systems, such as shield walls and interlock systems. Other hazards are also addressed with such administrative controls as establishment of personnel access control. For example, appropriate barriers were used during ongoing maintenance shutdown activities within the APS storage ring, including establishment of a controlled area around sectors of the beamline. Boundary controls were established, including posting the immediate area with signage that read "Danger High Voltage," and using barrier curtains to limit worker contact. Additionally, appropriate boundary controls were established for APS ring vacuum chamber bake-out maintenance work. Work planning appropriately considered hazards associated with electrical, mechanical, and hazardous waste generation. For example, the JSA for a preventive maintenance activity on a 13200-volt switch and transformer appropriately addressed electrical and mechanical controls for the job. In another example, the work planning for a new saw in the XFD optics fabrication laboratory included installation of centrifuge to separate wet sludge from waste, to reduce the amount of hazardous liquid waste produced when operating the saw.

In general, workers are experienced, well trained, and knowledgeable of APS systems and hazard controls. With few exceptions, worker ES&H training requirements were appropriate for the work activity, and most workers were current in their training completion. Workers were knowledgeable of their equipment and facilities, with one exception (i.e., workers were unfamiliar with the purpose and function of a meter mounted on the fume hood in the XFD optics fabrication laboratory). Most of the workers interviewed were knowledgeable of the systems, activities, and associated requirements. For example, workers were extremely knowledgeable of the design and operation of the personnel safety system (personnel interlock system for user beamlines). The construction orientation provided to all APS construction subcontractors is an effective training mechanism to ensure that subcontractors are familiar with site safety and emergency requirements prior to performing work.

Although many hazard controls at APS were robust, deficiencies in certain aspects of management of hazardous materials and wastes, industrial safety, industrial hygiene, and radiological controls were identified as discussed below.

Administrative controls at APS have not been adequately implemented for lead usage, lead waste and lead scrap. In several examples, lead waste and lead recyclable scrap were incorrectly segregated, labeled and stored. Satellite accumulation areas for lead waste have not been established, and some lead waste was not stored in accordance with regulatory requirements as defined in the ANL Waste Handling Procedures Manual. In another example, a container was inappropriately marked as lead waste. This storage container located on the experiment ring floor was posted with a sign that read "Warning Lead Waste Only." However, upon further examination, the box contained both lead waste (i.e., lead-contaminated cardboard containers) and lead scrap intended for recycle. The lead waste was not in an approved satellite accumulation area. Requirements for lead storage areas are not adequately documented. Evidence of coffee drinking was located in one APS lead storage area, where eating and drinking should be prohibited. Some requirements in APS lead handling procedures are ambiguous. For example, the APS procedure requires posting of lead removal areas as respiratory protection areas; however, lead removal operations do not necessarily require respirators.

Additionally, some APS workers have not been evaluated for enrollment into medical surveillance programs, although their work activities may require such enrollment. For example, some of the workers performing removal of lead shot from collimators at APS had not been enrolled in the Medical Department's lead surveillance program and had not received routine lead medical examinations as required by the ANL Medical Department procedures. APS procedures, the ES&H Manual, and the completion of a worker's JHQ have not ensured that workers are screened by Medical staff and enrolled in the appropriate ANL Medical surveillance program(s). In addition, some workers across all ANL divisions who utilize respirators are not receiving medical reviews prior to being fit tested or respirator trained. (See Finding #3 and Appendix F.)

Some APS work planning documents and procedures do not sufficiently link hazards to the required hazard controls (e.g., PPE). Several XFD work plans for APS maintenance evolutions contained generic discussions of safety considerations (e.g., personnel should be aware that hazards associated with lead, other heavy objects, pinch points, compressed gases, vacuum systems, ladders, and thermally hot objects may be present at times while performing this work), but the work procedures did not identify where the hazards might be encountered or what controls were to be implemented to mitigate those hazards. In another example, the APS ASD "Beam Line Front End Component Vacuum" procedure includes a hazard control section with some specific controls addressed. However, one step lists a requirement to always wear PPE "as appropriate," but provides no specifics about when is "appropriate." In the tools and equipment section, PPE is listed that "may be required, useful, or helpful," but does not specify when PPE is required. The procedure body also provides no reference to when PPE is required. ANL ES&H Manual Chapter 12 requires the specific PPE to be used to be specified for specific job hazards. (See Finding #5.)

Other examples in which hazards and controls are not linked include procedures for APS technician disassembly and reassembly of storage ring kicker magnets that do not address chemical use, hazards, and requisite controls for worker protection. In another example, during the etching of a silica target by XFD researchers within the APS etching laboratory, the appropriate chemical gloves were in use, but there are no established requirements or criteria on reuse or disposal of gloves that become degraded from use with hydrofluoric acid. Initially, an operator discarded his chemical gloves in the trash, and then realized the gloves should be disposed of in the hazardous waste in the satellite accumulation area. Some workers reuse their chemical gloves. However, the observed reused gloves were discolored and becoming brittle, and their chemical protection properties had been degraded. Glove reuse and disposal is not addressed in the procedure. Additionally, although the procedure requires the two-person rule for using hydrofluoric acid, the procedure does not require that etching with hydrofluoric acid must always be attended. An exothermic reaction occurs when the material to be etched is placed in the nitric/ hydrofluoric acid bath. The evolution of vapors and heat increases with time, and bubbling of the bath will occur, with the eventual potential to dissolve the plastic bath container; these phenomena are not addressed in the procedure.

Finding #4. For some APS activities, hazards and hazard controls (including exposure assessments and the resultant requisite controls) have not been sufficiently documented at the activity level in procedures or other work documents to ensure that risks to workers and the environment have been adequately identified, analyzed, and controlled.

In some cases, hazard controls identified in the ES&H and Waste Handling Procedures manuals have not been incorporated into APS procedures and have not been implemented. The OA team identified several work control documents with requirements in conflict or less restrictive than the ANL ES&H Manual, and in most of those cases the requirements were not met at the work activity level. Examples include:

- The XFD procedure for cleaning the Trinco™ Dry Blaster in the Crystal Optics Fabrication Shop identified carcinogen hazards; however the procedure did not incorporate the applicable carcinogen control hazards identified in the ES&H Manual (e.g., training, postings, and an Industrial Hygiene review of the procedure). As a result, several of these requirements were not met.

- Some APS technical procedures generically refer workers to the ES&H Manual for guidance in the selection of hazard controls (particularly PPE). However, because the ES&H Manual identifies many potentially applicable requirements, this practice may result in some workers not selecting the correct PPE or frustration when confronted with conflicting or ambiguous recommendations.

- Area postings for some magnetic fields at APS do not meet the requirements of the ES&H Manual. For example, postings for some magnetic fields around components with permanent magnets (primarily insertion devices, such as undulators) do not sufficiently indicate potential exposures to workers. (See Core Function #2 for further discussion.)

- Lead hazards postings in the APS machine shops have not been implemented as required by the ES&H Manual and APS procedures.

- The APS bakeout of the beamline front-end component vacuum system was conducted using an ASD procedure, including the use of multi-plug power strips plugged into standard extension cords throughout the bakeout area. ES&H Manual Chapter 9.1, "Temporary Wiring and Extension Cords," prohibits the connection of these cords in series.

- During the ion pump change-out at APS, the pump mating surfaces are cleaned with ethyl alcohol and absorbent wipes. Although these wipes contain residual amounts of alcohol and therefore are considered hazardous waste because of flammability concerns, workers dispose of them as regular trash. This is not in accordance with the waste handling requirements for hazardous waste as specified in the Waste Handling Procedures Manual.

- The APS procedure for the cleanup of broken beryllium windows does not incorporate all applicable Industrial Hygiene recommendations, contained some misleading statements, and incorrectly presumes that a broken beryllium window can be assumed to be a beryllium article. As a result, some requirements in the beryllium section of the ES&H Manual are missing from the beryllium window procedure, including Industrial Hygiene review of work procedures, medical surveillance requirements, training requirements, and designation of who can perform the beryllium cleanup work. In some cases, non-ANL employees may perform this cleanup activity.

- Open flame permits currently in use at APS include at fixed locations and at maintenance locations throughout the APS where work is conducted by APS Mechanical Engineering staff. The permits in use at APS have been issued by the fire inspector and have been issued for consecutive intervals as noted on the individual permits for periods of approximately one year (not to exceed); however, this practice does not meet the ANL ES&H Manual Chapter 11 requirements on duration of open flame permits, which states "No permanent open flame permits will be issued. Areas permitted for continuous operations must be issued a permit for the requested period of time, not to exceed 90 days." The actual revision dates indicated in the field are greater than 90 days. Additionally, APS permits currently posted on the experiment floor and in the individual APS Mechanical Engineering maintenance shop areas are expired. No ongoing open flame work could be confirmed following the expiration of these permits on April 30, 2005. APS management has been informed of the current status of the expiration of these open flame permits by the OA team and has taken action to address the expired permits.

Finding #5. APS line management has not ensured that all applicable requirements in the ANL ES&H Manual and the Waste Handling Procedures Manual flow down to activity-level work control documentation.

Some radiological controls and radiological work practices have not been effectively implemented at APS. For example, the design of APS extremity dosimetry may not be reflective of actual exposures. Specifically, the lack of requirements for dosimetry on both hands when using both hands, and the potential for wearing the thermoluminescent dosimeter (TLD) chip in an incorrect orientation (i.e., not facing toward the palm of the hand), could result in a recorded dose not being representative of the highest dose. The extremity dosimetry in use at APS contains only two TLD chips and therefore may not be representative of actual exposures if it is not oriented correctly on the worker's hand/finger. An APS technician assigned to work on a magnet assembly was issued and was observed wearing one extremity dosimeter (finger ring TLD) on his left hand (middle finger). When questioned, the technician stated that he was left handed; however, the technician used both hands while performing the maintenance activities. Single rings are typically used at APS, with no direction to avoid contact with potential hot spots with the un-monitored hand, but both hands were required to conduct the observed work. In cases such as this, individuals may allow the less dominant hand to linger longer in the area of concern, because the dominant hand is typically used for work requiring additional dexterity (resulting in greater movement in and out of a relatively small area where the activated components are of concern), and the less dominant hand is typically used to stabilize or hold an object in place, potentially resulting in a different exposure scenario to each extremity of concern. Design and issuance of extremity dosimetry is not governed by an approved ANL implementing procedure or technical basis document. (See Finding #2.)

Additionally, some radiological survey methods at APS may not have sufficient sensitivity to accurately detect and quantify removable contamination resulting from all potential activation products. For example, removable contamination smear samples from a green particulate material discovered in the area in and around known activated components at the booster ring septum indicated no detected removable radioactivity. However, the analytical method for analysis of the smears by alpha-beta-gamma proportional counting may not provide sufficient detection sensitivity for detection of manganese-54 and iron-55, the potential activation products of concern listed in the APS safety assessment document and APS radiological design consideration (APS-LS-141). Subsequent laboratory analysis of the suspect green particulate indicates the material is most likely not activated, and the material is believed to be residual from a synthetic fastener. However, the site and line management have not developed sufficient technical basis documentation demonstrating that counting methods and calibration standards and efficiencies in use are sufficient to meet regulatory requirements for the specific applications. (See Finding #2.)

Some controls for work performed by subcontractors (i.e., construction workers and service vendors) have not been identified in ES&H plans or work documents. For example, the APS construction subcontractor responsible for the modular enclosure construction project did not develop an OSHA-required respiratory protection program and did not fit-test workers for the filtering face pieces (dust masks), as required by their contract. The filtering face pieces were required by the subcontractor's JSA to be worn during the installation of wall insulation. For the same construction work activity, the subcontractor did not identify PPE requirements for sawing metal or handling sharp edges (see Core Function #2 for further discussion). Additionally, ES&H requirements in ANL construction contracts and the ES&H Manual have not been clearly defined or adequately rolled down to subcontractors. For example, the ANL construction contract for modular enclosure construction requires the subcontractor to follow the requirements of both 29 CFR 1910 and 29 CFR 1926. However, the subcontractor has not integrated the requirements of 29 CFR 1910 into their work documents. The ANL contract does not require the subcontractor to follow the DOE worker protection requirements of DOE Order 440.1A, even though these requirements are applicable to other ANL construction workers. In addition, some ANL and DOE hoisting and rigging requirements were not included in the subcontractor's contract or ES&H plan, although ANL has committed to ASO to include such requirements (see Section F.2.2). APS has not formalized policies and/or procedures that provide guidance for APS line management direction and oversight of construction activities when performed by APS construction subcontractors.

Summary. In most cases APS has established the appropriate engineering, administrative, and PPE controls commensurate with the hazards for which these controls are intended. The extensive use of operating and maintenance procedures has enabled effective identification and consistent execution of most hazard controls. However, in some cases, engineering and administrative controls have not been adequately implemented. Instances were identified where the ES&H requirements identified in the ES&H Manual, the Waste Handling Procedure Manual, and contracts were not incorporated into activity-level work documents and therefore have not been implemented. In addition, a few important radiological controls have not been effectively implemented.

Core Function #4: Perform Work Within Controls

The OA team observed a number of jobs at APS, and the majority of the work was performed safely and in accordance with established controls. Workers used the proper PPE in most cases, radiation surveys were performed as required, and the work was controlled by approved work plans. For example, several jobs within the ASD Power Supply Group included installing an analog voltage meter, bench testing a directional magnet, and performing general preventive maintenance in a power supply cabinet. Workers were aware of the electrical hazards and used appropriate lockout/tagout and voltage checks to ensure safety. In another example, during zero voltage checks of a high-current system, the worker used the appropriate PPE, including hard hat hood, fireproof (flash) suit, hearing protection, and high-voltage gloves. Additional protective measures were taken for this activity, including the worker installing a personal lock on the breaker in addition to the system lockout already in place. Work conducted in support of a work request for the repair of a water leak at APS storage ring corrector 2AV2 was conducted in a safe manner, followed an appropriate "open flame operating permit" for soldering, and had appropriate PPE available for use when required. Workers appropriately stopped work and contacted supervision for guidance following discovery of an error in the procedure. In this work evolution, during the annual functional test of the personnel safety system, discrepancies were encountered (test procedure typographical errors) and the workers appropriately stopped the procedure and contacted the system engineer and author of the test instruction for guidance. (However, some administrative requirements were not followed for the procedure change, as discussed below).

In a few cases, workers did not follow requirements in APS procedures, the ANL ES&H Manual, and a subcontractor JSA as described below (see Finding #4).

- The ASD lead handling procedure requires that "handling of lead shall be done with leather gloves, although other gloves may be specified by IH." Latex gloves were used in lieu of leather gloves, and IH did not specify the appropriateness of this alternative glove selection.

- A worker filling a liquid nitrogen dewar (a type of container) from an automatic fill station did not use the established procedures and controls and instead manually filled the dewar. The APS liquid nitrogen automatic fill station is equipped with transfer lines, fittings, relief venting, and logic controllers to automatically fill cryogenic liquid dewars. Although engineering controls are available at APS for this type of activity, none were utilized, other than the individual hand throttling the valve while filling the dewar to attempt to prevent spillage and potential pressure hazards. This area is posted with instructions on how to use the automatic fill capability. Additionally, although the worker wore PPE, including a company uniform, face shield, safety glasses and insulated gloves, the individual did not wear his shirt outside the trousers as required by the ES&H Manual to prevent cryogen from spilling into the belt area.

- During the conduct of APS subcontractor construction work the subcontractors performed installation of conduit in poorly lighted work areas, contrary to the lighting requirements documented in the JSA.

- In one evolution, workers did not follow all administrative requirements for a field pen-and-ink procedure change to a personnel safety system functional test procedure as described in the introductory sections of the procedure.

- The ASD procedure, "Approval Process for ASD Procedures," requires that any essential safety system test procedure be reviewed by the Division ES&H coordinator and the APS Radiation Safety Policy Committee; however, these reviews had not been performed on the personnel safety system functional test procedures.

Summary. At APS, observed work was generally performed safely and in accordance with established controls. Workers were aware of the associated hazards and controls, and supervisors were actively involved in the ES&H aspects of the work tasks. Although workers did not follow requirements in a few isolated cases, the management and worker commitment to safe work performance was evident.

C.2.2 Waste Management Operations Work Planning and Control

OA's evaluation of implementation of the first four core functions of ISM for WMO focused on evaluation of safety performance of programmatic activities in WMO waste storage and treatment facilities and at client and waste generator sites across ANL. The ANL WMO is a department within the PFS division, responsible for supporting and implementing the ANL waste management program. As the operator of hazardous waste and Category 2/Category 3 nuclear facilities, WMO is subject to more stringent nuclear and conduct of operations requirements than other PFS departments; these considerations are reflected in WMO-specific manuals and operating procedures. Details associated with review of other PFS departments may be found in Section C.2.3.

WMO collects radioactive and hazardous wastes generated at ANL for transport to WMO Waste Management Facilities. This waste is then stored and/or further processed and is ultimately transported to an approved disposal facility. WMO also provides a variety of other services to onsite clients, including decontamination, hazardous and radioactive material cleanup, and related activities. OA's observation of WMO work consisted of review of waste sorting, compacting, solidification, and similar repackaging activities in Building 306, decontamination and decommissioning (D&D) work at Buildings 40 and 202, and various waste pickup and transportation activities.

Core Function #1: Define the Scope of Work

The scope of work within WMO is generally well defined through use of several formal mechanisms. Project execution plans are developed for such work as D&D efforts and long-term projects that exceed a certain budget threshold. The project execution plan for phase one of the Building 40 demolition project adequately defined the overall project scope, schedule, and deliverables for removing hazardous and radioactive materials and contamination within the building. At the task level, work clearance permits (WCPs) are used in conjunction with operating procedures and/or job plans to define the discrete scopes of work to be performed by WMO personnel. For example, a WCP for the pickup of chemical waste adequately addressed the scope of work and identified the WMO procedures to be used to implement the work. Beryllium abatement work conducted by WMO is well defined in WMO procedures and WCPs.

While most discrete work activities were adequately defined, the scope of work for some routine WMO work within Building 306 was not defined by any formal mechanism. For example, movement of drums and waste containers using manual labor and powered industrial trucks is not governed by an approved operating procedure or WCP.

Summary. With the exception of routine waste handling and movement, the scope of work for activities conducted by WMO was generally clearly defined and sufficiently detailed to enable effective hazard identification.

Core Function #2: Analyze the Hazards

Hazards associated with ANL waste management activities are analyzed through various mechanisms, including facility- and task-level mechanisms. In Building 306, many hazards, including radiological and chemical hazards associated with facility operations, are identified and documented in the SAR. Several other waste management facilities used for waste storage also have similar documents that describe the nature of the hazards associated with routine facility operations.

At the task level, hazards for WMO work are analyzed and documented using WCPs, job safety assessments, RWPs, as-low-as-reasonably-achievable (ALARA) reviews, and supplemental work package documents tailored to the discrete tasks being performed. In general, these processes provide an adequate framework to address most hazards associated with WMO work activities. The current process represents an improvement since the 2002 OA inspection and results from efforts undertaken by WMO to address the concerns raised during that inspection. WMO has successfully incorporated several changes that more effectively analyze and tailor hazards and controls to the specific work being performed. For example, individual WCPs are now being prepared for each discrete waste management “batch” of material to be processed rather than the broader application in effect during the previous inspection. This tailoring has resulted in more effective hazard analysis as evidenced by the proper identification of hazards in most cases. Similarly, Health Physics personnel review and attach supplemental information to the WCPs defining the specific radiological hazards associated with the particular material being processed and any additional controls deemed necessary that are not identified in the RWP. Workers acknowledge review of the information by signing each permit. Job safety assessments prepared for the beryllium remediation work previously conducted in Building 330 were detailed and tailored to the work activity. The WMO revisions to the hazards analysis and control process represent an improvement from the previous inspection and a positive step toward ensuring a robust and mature work planning process within WMO.

Notwithstanding improvements discussed above, additional actions are needed to ensure that the hazards analysis process is sufficiently developed and documented such that effective implementation can be assured. While discussed generally in the WMO Conduct of Operations Manual, documentation and performance expectations for some aspects of the hazards analysis process are not defined. For example, requirements and instructions for job safety assessment preparation are not included in the Conduct of Operations Manual. The form appears as an attachment to the WCP section with no supporting information pertaining to its use. Similarly, while unique radiological hazards associated with individual waste batches are being documented in an addendum to the WCP, expectations for preparation and content of this material and its relationship to the RWP and ALARA review processes required by the ES&H Manual are not clear. (See Finding #1.)

While generally effective, work planning documentation did not properly identify a few hazards. For example, the WCP, RWPs, and other addenda for an observed waste sorting effort did not address the unique radiological hazards or necessary controls associated with potential tritium surface and air contamination from a container of tritium waste, resulting in some missed controls, as described later in this section. In another example, the approved WCP and job safety assessment for compacting did not include references to some applicable hazards, such as the use of box cutters, electrical tools, and noise producing equipment. Lastly, the approved job safety assessment for an asbestos removal project did not address hazards that could be encountered while removing materials in areas above a partially removed dropped ceiling, such as sharp metal edges and an energized lighting circuit. These failures were not widespread and appear to represent isolated instances and inattention to detail rather than systemic weaknesses in the hazards analysis process.

Summary. WMO uses several mechanisms to identify and analyze task-level hazards. These mechanisms are generally well tailored to the work being performed and represent an improvement in hazards analysis since the last OA inspection. However some additional attention to detail and better definition of the processes would further enhance the accuracy of hazards analysis information.

Core Function #3: Identify and Implement Controls

WMO appropriately uses a combination of engineering controls, administrative controls, and PPE to control hazards associated with ongoing work. Engineering controls include use of containment and ventilation systems to control airborne radiological and chemical hazards as well as shielding for external radiation hazards. Administrative controls include training and the use of procedures, permits, signs, labels, and related tools to guide operations. WMO maintains a comprehensive set of procedures that govern most routine work operations, including waste sorting, pickups, compaction, stabilization, and related treatment processes. Much of the WMO waste treatment and repackaging work also requires the use of PPE, including respiratory protection and protective clothing. Administrative controls and PPE requirements for discrete jobs are defined on WCPs, job safety assessments, and RWPs.

WMO workers receive comprehensive ES&H training based on their potential exposure to hazardous and radioactive materials as well as various industrial safety hazards. The ANL JHQ is used to indicate the types of hazards each employee may be exposed to during work in WMO. An individual training profile is generated based on responses to the questionnaire. This profile lists required courses, status, last completion date, and next due date. The system is robust, and a sampling of workers' and managers' training records confirmed that all individuals were enrolled in the appropriate training and were current on all required ES&H training.

As indicated in Core Function #2, preparation of specific WCPs for discrete jobs represents a positive initiative toward development of a rigorous and effective work planning and control process within WMO. A number of observed work activities were supported by WCPs and work package documentation that accurately conveyed the hazards and needed controls for the work. For example, work packages for beryllium abatement efforts included the appropriate hazard identification and controls. Furthermore, the centralization of beryllium abatement work within WMO has enhanced the rigor and consistency of hazard controls (e.g., procedures, training, and medical surveillance) when working in beryllium-contaminated areas. Similarly, WCPs and supporting documentation governing chemical waste pickups, radioactive waste pickups, and inspection of retention basins in Building 303 effectively identified the hazards and the required controls.

However, there were also a number of examples of inadequacies in the approved work planning documents that control work efforts, including conflicting controls and/or inadequate specification of controls needed to adequately mitigate hazards. Some specific examples are shown below. Because approved WCPs represent the facility authorization to perform the work, these types of deficiencies have the potential for adverse health and safety consequences and are indicative of weaknesses in the quality assurance associated with development and issuance of formal WMO work approval mechanisms. (See Finding #6.)

- The WCP, job safety assessments, and RWP for stabilization work conflicted with each other in terms of the type of required gloves. The WCP and RWP require leather outer gloves, while the job safety assessment required nitrile outer gloves because of a high salt content.

- The WMO procedure specified in an approved WCP for bulking and neutralization did not accurately convey the specific activities to be performed. As discussed in Core Function #4, this concern was appropriately self-identified before the work was performed.

- While ergonomic hazards were identified on the job safety assessment for waste sorting, there were no specific controls identified for workers required to bend over a 55-gallon drum to scoop waste material from the bottom. In this case, workers were observed repeatedly attempting to shovel and scoop caked-on waste material from the bottom of a 55-gallon drum while stretching and reaching in a full bent over position. There was no use of tooling to bring the drum to a stable tilted position that would have reduced the potential for back injuries. Workers recall such a device being employed in the past.

- No controls were specified for another ergonomic and physical hazard during waste compaction. In order to wipe down the sides and bottom of full 55-gallon drums before removal from the room, one worker was observed with hands and arms directly beneath a tilted drum being secured only by a second individual without the use of a drum cart or other mechanical load stop.

- Performance of required inspections of powered industrial trucks in WMO is not covered by a waste operations procedure as are other types of required facility inspections (e.g., eyewash stations and vehicle use). In addition, the daily inspection checklist used to perform these inspections did not contain all information required by the ES&H Manual, resulting in some required inspection criteria not being met.

- The asbestos removal procedure, "13.3 Glovebag – Asbestos Removal," incorrectly required installation of a glovebag as a prerequisite before donning any PPE.

- There was no mechanism or procedure defining the extent of conditions that must exist to pass or fail weekly inspections of secondary containment vaults. Cracks and peeling paint in these secondary containment vaults have been a continuing problem and have not been formally evaluated against permit requirements for containment integrity.

In a related concern, there is no formal process governing change control of work clearance forms and job safety assessments. The WMO Conduct of Operations Manual does not convey any specific change control requirements for the WCP process (such as it does for procedure revisions). In practice, "pen and ink" changes to approved documents are being made without a requirement for additional formal review and approval. For example, when a foreman realized it was incorrect, a pen and ink change to an approved job safety assessment and WCP for compacting waste was made to add noise hazards and requirements for hearing protection. Similarly, a pen and ink change to the approved job safety assessment for work in Building 205, Room K116, added some PPE requirements, with no additional review or signatures from other SMEs. The lack of formal change control requirements on work control documents limits the ability of SMEs (e.g., health physics and industrial hygiene) to ensure the accuracy and synergy of controls and results in a scenario where several different versions of approved work authorization documents may exist. (See Finding #6.)

Finding # 6. The definition, rigor, and quality assurance associated with preparation of some WMO work planning and control documents are not sufficient to ensure consistent and effective implementation of controls.

As discussed in the institutional findings elsewhere in this appendix, continuing weaknesses in the infrastructure of the ANL radiation protection program (including lack of procedures) have contributed to ineffective implementation of radiological control functions by line organizations. Specific radiological control implementation problems pertaining to OA's observation of work in WMO are discussed in the remainder of this section.

Radiological posting and labeling within Building 306 were not being fully implemented in accordance with institutional and DOE requirements and standards (see Finding #7). Examples of posting and labeling deficiencies identified during the inspection include:

- One of the two entryways to a contamination area and airborne radioactivity area in Room D033 had no visible radiological posting to indicate the radiological status of this room. Someone had placed a non-radiological posting over the area where the radiological posting had been located. It is not evident how long this posting had been obscured.

- The rope and stanchion entryway to a radiation area in the West High Bay was incorrectly left in the down position while workers were performing tasks in the area.

- There were no "Radioactive Material Area" postings at the entrances to the downstairs tank farm area of Building 306 to warn of a potential contamination hazard. This location contained numerous metal containers with radioactive material labels. The ANL posting manual requires that each type of radiological area be shown on area postings. In this case, only a radiation area posting was present to warn of an external exposure rate hazard, which is different than the potential contamination hazard.

- Several evaporators adjacent to Room D033 were not properly labeled to indicate their status as ionizing radiation sources in an area where support personnel linger while waiting to assist individuals working inside Room D033.

- The size of posted radiation areas is not as small as practicable, which is needed to adequately convey the locations where higher dose rates exist, such as adjacent to Room D033. In practice, large contiguous areas are over-posted as radiation areas for convenience in anticipation of the possibility for high dose rate drums to be present rather than posting the area at the time the hazard is actually present.

Line management and health physics personnel within WMO have not properly implemented a number of applicable radiological requirements identified in the Tier 2 ES&H and health physics manuals. For example, routine radiological surveys are required by regulations to support posting efforts as well as to assess the potential for changes in radiological conditions. However, WMO has not developed and documented annual routine survey plans for their facilities, as required by the ES&H Manual. (See Finding #1.)

While some routine surveys are being performed, the basis is not clear; the frequency of the surveys, the specific types of surveys conducted, and the records associated with performance of the surveys are not adequate to demonstrate compliance with regulatory requirements. Similar concerns with the lack of appropriate radiological surveys were identified in the 2002 OA inspection. (See Findings #2 and #7, and Appendix D.)

In one example, some posted radiation areas, such as the tank farm, receive only semi-annual documented radiation surveys. This frequency is far less than the weekly frequency specified in DOE implementation guidance for occupied radiation areas. If these areas have a high potential for frequently changing radiological conditions, semi-annual surveys are not sufficient to meet regulatory requirements for assessing changes in radiological conditions. A weekly or greater frequency, as stipulated in the implementation guides, is considered necessary to adequately meet the intent of the regulation. In addition, this scenario represents another drawback to the practice of over-posting radiological areas for convenience and potential conditions. Further, large area swipes are used extensively to support contamination control practices; however, in some areas of the facility, these surveys are not supported by quantitative swipes, which can be used as a basis for comparison of surface contamination levels against DOE regulatory surface contamination criteria. Similarly, no direct or fixed radiation measurements are being taken or documented as needed to ascertain the potential presence of non-removable contamination, which also is required under the DOE regulations. (See Findings #2 and #7.)

OA identified deficiencies in WMO's performance of survey and sampling efforts, including failure to use standardized ANL survey forms and practices required by Health Physics Procedure (HPP)-100, and in the record keeping needed to support regulatory compliance. For example, records of air sampling evolutions are not being documented and maintained on ESH-38 forms as required and as needed to maintain an accurate and retrievable historical record of sampling efforts. In addition, the spreadsheet software being used as the only record of this information has not been subjected to many ES&H Manual requirements for electronic media, including validation, verification, and prevention of unauthorized changes. During the inspection, air sampling data was noted to be missing from this spreadsheet. Investigation revealed that the missing data was the result of RCTs entering the required information on an incorrect spreadsheet. (See Findings #1 and #7.)

OA noted a wide variety of deficiencies with the records and documentation from a limited sampling of routine radiological surveys (see Findings #2 and #7). As examples:

- Contamination survey records do not contain all the information necessary to adequately interpret the survey results, such as counting efficiency, counting time, correction factors, minimum detectable activity, etc.

- Data reporting is not in accordance with HPP-100 requirements.

- Maps being used to record data have a field to document the reason for the survey, but these reasons are not being filled out accurately (e.g., recording a weekly routine for a semi-annual routine).

- Quantitative swipes are being incorrectly averaged over more than 1 square meter of surface area.

- The types of measurements taken during routine surveys for the same area vary depending on the surveyor (swipes versus exposure rates or both).

- Smear locations shown on some maps are not representative of potential room or area conditions.

- Smear locations are not shown as required.

- Survey forms were missing either the surveyor and/or reviewer signatures.

In the area of radiological work planning, some radiological controls were not clearly defined and/or effectively implemented. For example, a waste sorting operation taking place in Room A160 involved opening a container of waste with tritium contamination; however, neither the WCP nor the RWP required any special controls for tritium. Specialized analytical techniques, which are needed to detect the presence of tritium contamination on surfaces, were not properly implemented to evaluate the potential for spread of tritium contamination. One RCT took several wipes for tritium analysis on the drum being removed from the work area; however, the work area and closeout surveys, and routine surveys of the area, did not include any tritium smears. Further, no mechanism is in place to drive the conduct of tritium smears other than RCT discretion. The RWP required job-specific air sampling, but it was not clear whether tritium air sampling was necessary. The type of particulate air sampling being performed was not sufficient for evaluation of tritium airborne contamination. Similarly, the RWP specified bioassay but did not indicate whether special job-specific tritium bioassay was needed. The semi-annual urine bioassay frequency currently in use in WMO may not be sufficient to quantify potential intakes from discrete tritium jobs. (See Findings #2 and #7.)

In other examples, RWP 020 required job-specific and retrospective air sampling; however, no job-specific air samples were pulled while sorting waste in Room A160 prior to compacting in Room A161. Similarly, the Building 205 vacuum and wet mop improperly specified use of a weekly retrospective air sampler for job-specific coverage. Additional clarity on RWPs is needed to ensure appropriate types and requirements for air sampling. RWPs 013 and 020 required retrospective air sampling; however, RCTs did not verify function of the surrounding retrospective samplers on jobs in the decontamination shop and tank farms. During one job in Room A160, a retrospective air sampler in the decontamination shop was noted by OA to be inoperable. It was later determined that someone had shut off the breaker providing power to the pump. Although the breaker was reset, RCTs did not check whether the sampler flow was adequate. Visual observation of the flow meter showed half the required flow rate. RCTs adjusted the flow when this was brought to their attention. In a different concern, there were no instructions or precautions for passing waste into a posted contamination and airborne radiation area from the decontamination shop. Workers outside the contamination area boundary dropped waste materials into the contamination area, resulting in possible resuspension of contamination while the door was open. Similar concerns with RWP information and specification of radiological controls were identified in the 2002 OA inspection. (See Findings #2 and # 7 and Appendix D.)

Finding #7. Some radiological control requirements in WMO, including posting and labeling, radiological surveys and monitoring, radiological recordkeeping, air sampling, and radiation work permits, are not being effectively implemented in accordance with institutional and/or regulatory requirements.

Summary. Administrative controls, such as permits and procedures, and PPE are used extensively to mitigate radiological, industrial, and chemical hazards posed by WMO activities. While the application, implementation, and quality control of these mechanisms are generally adequate, various deficiencies have resulted in insufficient specification of controls for some work evolutions. The continuing deficiencies with the ANL radiation protection program are evident in WMO's implementation of radiological control functions in the areas of posting and labeling, radiological surveys and monitoring, radiological record-keeping, air sampling, and specification of radiological controls.

Core Function #4: Perform Work Within Controls

Readiness to perform work in WMO is the responsibility of the operations supervisor and waste crew foremen, who authorize the conduct of individual activities, based on completion of required WCPs. With the exception of routine waste handling and movement (discussed previously), all observed work in WMO was accompanied by an approved WCP and work package. However, as indicated in Core Function #3, deficiencies in some WCPs and planning documentation can result in work being performed despite inaccuracies in the approved work control documents. Readiness to perform work is also ensured through the conduct of daily pre-job and pre-shift briefings/meetings, which are held daily for each waste crew to inform workers of assignments, tasks, hazards, and controls for their operations.

Pre-job briefings were effective and provided the mechanism to ensure that all personnel were familiar and comfortable with the planned tasks, hazards, and controls. Each pre-job briefing was initiated with a review of a general safety topic to emphasize the safety culture and importance of safety to daily work. WMO mechanics were knowledgeable and skilled at their operations, reviewed each day's activities and permits, and appropriately raised safety questions and/or requested clarification if they were uncertain about the tasks to be performed. For example, when an approved WCP for bulking and neutralization referenced unclear procedures, the work was not performed pending development of a new WCP and a revised procedure. There was also good interaction between the foreman and workers on the potential hazards and the appropriate controls.

Much WMO work observed by OA was performed safely and in accordance with required controls. For example, mechanics successfully performed work requiring confined space entry in accordance with the weekly inspection procedure for retention basins beneath waste storage areas; the work included testing the breathing space air, standing watch, and preventing work above the basins. In addition, workers conducting waste pick-ups performed a detailed vehicle inspection, ensured that containers matched the requisition for pickup information, and coordinated with generator and health physics personnel. The radioactive waste crew in Building 306 performed a number of waste treatment and/or repackaging activities safely and in accordance with established controls. For example, workers properly donned and doffed required PPE during compacting, solidification, and waste sorting operations and displayed good communication techniques while using respiratory protection, including use of hand signals, dry erase boards, and verbal communications. While compacting waste, mechanics were diligent in ensuring that a contamination control shroud was in place as required by the RWP, and mechanics followed requirements for performing solidification activities under the walk-in hood in Room D033.

While workers followed many requirements during observation of work, there were many examples where workers did not follow established requirements or procedures or ensure that procedures were corrected before conducting the work, indicating a systemic deficiency in the area of procedure compliance, which is required by the WMO Conduct of Operations Manual. Examples included the following:

- Workers did not use an organic vapor analyzer to measure for the presence of organic vapors upon opening waste containers being sorted, as required by Procedure 9.1.

- Drums were rolled manually without the use of a drum cart as required by the job safety assessment for waste compacting.

- Workers did not always wear leather gloves while handling drums or sharps as required by the job safety assessment and RWP for waste compacting and sorting.

- During solidification work, workers did not identify a discrepancy between the RWP, the WCP, and the job safety assessment regarding the type of glove needed. The RWP and WCP called for leather gloves, but the job safety assessment required nitrile outer gloves due to high salt content. This discrepancy was not identified or questioned and leather gloves were worn.

- A compactor limit posting was not followed, corrected, or questioned. The posting prohibits metal from being compacted, and the requisitions being processed contained various metal items.

- Several steps in Procedure 9.12 for stabilization were not followed, including calculation of the amount of Aquaset media to be used and a warning step to test compatibility by using a small quantity of Aquaset prior to dumping the entire bag into the waste container.

- The procedure governing asbestos removal incorrectly called for installation of a glovebag as a prerequisite action, prior to donning any PPE. However, the procedure was not corrected before performing the work.

- No work area radiological surveys were performed as required by RWP 013.

- First count factors to evaluate beta to alpha activity are not being consistently performed or documented for quick evaluation of potential problems per Health Physics Technical Notice (HPTN)-109 (“Compacting”).

These examples do not reflect willful or intentional violation of requirements or procedures by workers; rather, they reflect a lack of attention to governing procedures and requirements, including the expectation to be familiar with and follow governing procedures or identify and correct procedure deficiencies before continuing work. The current level of procedure compliance is not consistent with the WMO Conduct of Operations Manual or DOE expectations for a nuclear facility, and indicates the need for additional management attention in this area.

Finding #8. WMO workers are not always meeting facility procedure compliance expectations outlined in the WMO Conduct of Operations Manual.

Summary. Many work activities in WMO were conducted safely in accordance with established controls. Worker experience and skill in performance of waste management duties contributes to safe performance of work. However, lack of attention to requirements and governing documents has resulted in failure to meet some nuclear facility conduct of operations and quality assurance requirements. Additional attention to detail is needed to ensure that work activities are either conducted in accordance with postings, job safety assessments requirements, and procedural steps or that these items are identified and corrected before proceeding.

C.2.3 Plant Facilities and Services Construction Section, Construction Crafts, and Building Maintenance

This PFS portion of this inspection sampled three groups within PFS: Construction Section, Construction Crafts, and Maintenance Operations (Building Maintenance). The Construction Section and Construction Crafts are part of the Construction Group in the Facilities, Engineering, and Construction Department (FEC). The Building Maintenance group reports to the Buildings and Grounds Department. As discussed in Section C.2.2, OA also performed a detailed review of waste management activities and associated nuclear and chemical hazards performed by the WMO Department, which is also one of the PFS departments. OA's selective reviews of three other PFS groups provides a broader perspective of overall PFS performance and focuses primarily on industrial-type hazards associated with construction and maintenance activities.

The Construction Section provides planning, engineering, construction, and project management services for ANL facilities and programs. This includes engineering and project management for the design, construction, modification, and upgrades of ANL facilities; technical support for scientific and maintenance programs; and coordination of onsite construction firms. Construction Section projects vary in scope from sitewide ladder replacements to complete cooling tower and air handler removal and replacements. The Construction Crafts group consists of an assortment of crafts comprised of electricians, carpenters, pipe fitters, and painters. Crafts perform construction tasks for ANL that are less than the Davis-Bacon-regulated financial ceiling and do not require use of outside contractors. Tasks performed by this group include installing furniture, shelves, trim, and ceiling tile and grids; installing light fixtures, switches, receptacles, conduit, and raceways; installing faucets, fixtures, and steam, air, and water lines and drains; and painting offices, corridors, windows, and doors. The Construction Crafts group reports administratively to the Construction Section Manager but do not perform work according to the Construction Manual; instead, they operate to the controls outlined in the ES&H Manual and the PFS Supervisory Handbook. The Building Maintenance group operates, maintains, and repairs buildings and building systems; performs preventive and predictive maintenance; renders field support to the Construction Section and scientific programs; and provides sitewide fire protection system inspection and maintenance.

Core Function #1: Define the Scope of Work

Construction Section (subcontractor project development and management) work activities are well defined in the pre-job bidding process and final bid package. The Construction Section work packages have detailed project work scope descriptions that define the work for the potential subcontractor. In addition, the project work scope description provides the necessary details for Construction Section personnel to walkdown the project and analyze the hazards to be controlled. Projects reviewed were well defined and had undergone a thorough review prior to the actual conduct of work.

In the vast majority of cases, the Construction Crafts' service requests and/or work order descriptions provide a limited description of the scope of work but are still sufficient to define the work for these low-complexity jobs that are normally covered within the skill of the crafts. However, for higher complexity tasks, limited work descriptions do not always provide enough information to sufficiently identify all potential hazards. For example, for new installations or significant alterations, Construction Crafts do not have detailed written descriptions of the scope of work but rely on informal instruction and walkdowns with the original requestor, supplemental detail from the supervisor, and individual work experience and training. (See Findings #1 and #9.)

Building Maintenance work is defined in work orders created for each maintenance activity, including all preventive, predictive, and corrective maintenance. For preventive or predictive maintenance, the site integrated management system (SIMS) maintains a schedule for each piece of equipment or system and generates work orders when scheduled maintenance activities are due. For corrective maintenance, the maintenance foreman generates a work request and then meets with the customer to refine and revise the scope as necessary. In most cases, work is skill of the craft, and an abbreviated work description along with discussions with the requestor are all that is necessary to ensure that adequate hazards analysis can be performed. For the majority of work observed, the informal communication between the mechanics and foreman was comprehensive and sufficiently covered the required information for the mechanic to perform the task. However, some tasks are more complex, and abbreviated descriptions on the work orders, such as "repair piping," may not be sufficient to identify all the hazards. In addition, the SIMS database provides limited space for describing the work, and personnel who generate the work orders do not typically include additional work steps or instructions on the work order document. For example, during a cooling tower preventive maintenance, a mechanic did not know whether the deposits removed from the cooling tower needed to be analyzed prior to disposal, and the work order did not specify that spoils were to be sampled for bromide solution prior to disposal. In this particular case, the mechanic appropriately asked the foreman about sampling requirements; however, the lack of detail in the original scope of work resulted in a reactionary control instead of preplanned controls.

Building Maintenance is currently developing a procedure manual that provides detailed, step-by-step instructions for many of their routine work activities (e.g., cooling tower maintenance and freeze protection of systems). The draft procedures are detailed and effectively incorporate the hazards within the work steps.

Summary. For most cases, PFS work scopes are adequately described. Subcontractor work is adequately described in the pre-job bidding process and final bid packages. The majority of Construction Crafts and Building Maintenance work is skill of the crafts, and an abbreviated work description along with discussions with the requestor are all that is necessary to ensure that adequate hazards analysis can be performed. However, the formal work request process for the Construction Crafts and Building Maintenance groups sometimes results in definitions of work that do not provide sufficient detail to fully analyze all potential hazards for those occasional complex activities beyond the skill of the worker. While this weakness did not result in a significant number of observed performance deficiencies, the process as implemented relies upon individual work experience and informal communication between supervisors and workers.

Core Function #2: Analyze the Hazards

PFS provides its own hazards analysis methods in the PFS Supervisory Handbook to address the ES&H Manual requirements for hazards analysis of non-experimental work. The pre-job work planning section of the PFS Supervisory Handbook provides a checksheet, or "memory card," that contains most (but not all) of the information from the ES&H Manual hazard assessment checklist. However, the manual is written in a narrative form and provides no expectations or requirements for use of the supervisory memory card. Consequently, OA did not identify any PFS personnel within the organizations reviewed that actually use the PFS memory card defined in the Supervisory Handbook or the ES&H Manual hazard assessment checklist (although an informal card process is used by Building Maintenance, as discussed below).

The PFS Supervisory Handbook also provides descriptions of several other hazard evaluation and control development mechanisms. For example, the handbook briefly describes a task evaluation process and provides a form to be used for evaluations. The handbook gives a comprehensive list of important information provided by the evaluation. The handbook states that the task evaluation form identifies the scope of work and authorizing documents, all known safety hazards and necessary precautions, necessary training, necessary permits, and other information important to a comprehensive review. However, the manual only states that the foreman may need to perform a task evaluation; it provides no requirements or criteria for when this mechanism is to be used. In addition, no specific instructions are provided for performing the evaluation or how to complete the form. (See Finding #9.)

Work hazards for subcontractor construction projects overseen by the PFS Construction Section were generally well analyzed in work packages. Subcontractor construction packages contained PFS approved subcontractor corporate safety plans, JSAs, and required permits that adequately analyzed the project-specific and facility-specific hazards. Part of the hazards analysis is performed during job planning walkdowns. Walkdowns typically included project managers, Industrial Hygiene personnel, health physics personnel, engineering personnel, construction field representatives, building managers, a subcontractor foreman, and the safety officer. Work entry clearance forms (permits) are also used to document hazards and controls for subcontractor construction projects.

Industrial hazards for Building Maintenance and Construction Crafts work are well analyzed in most cases. Building Maintenance mechanics and Construction Crafts personnel each complete a JHQ for their assigned position that helps determine required training. For high-hazard, high-complexity activities, JSAs and/or comprehensive task evaluations address the majority of industrial hazards that the maintenance mechanics or crafts encounter. JSAs are used when a job can be broken down into several subtasks and to identify hazards unique to each subtask and associated controls. The form for JSAs and some general instructions applicable to all pre-job planning (including JSAs and task evaluations) are provided in the Supervisory Handbook; however, no specific criteria or instructions are provided for when or how JSAs are to be used. (See Finding #9.)

For various work activities, Building Maintenance and Construction Crafts use different mechanisms to perform task-level hazards analyses. Building Maintenance uses a card system to address task-level hazards analysis for Building Maintenance work. Maintenance foremen and mechanics use internally developed cards (not the memory cards described in the Supervisory Handbook) as a hazards analysis checklist to help identify potential hazards and recommended controls related to each work order. However, no administrative controls exist to describe this internally developed work control process or to ensure that the checklist is sufficiently comprehensive to address all hazards. Hazards analysis is primarily derived from mechanics' and foremen's knowledge of the work and work environment. The lack of a formalized work control process does not ensure that ES&H Manual requirements are met, does not document management approval of the process, does not include safety professional review of the process, and could result in incomplete hazards analysis in some cases. (See Finding #9.)

The Construction Crafts group typically uses task evaluation forms (described above) and work entry clearance forms for hazards analysis of most work. Work entry clearance forms are permits used to communicate with and obtain permission to perform work from building managers and resident safety personnel, such as the Health Physics representative. The task evaluations and work entry clearance forms reviewed by the OA team contained the appropriate checks for hazards needing permits as controls; however, in all evaluations reviewed, the task evaluation listed only one phase of work, and listed only generic hazards specific to the craft involved, not hazards unique to the activity. While this approach may be adequate for some low-complexity skill of the craft activities, the use of generic hazard lists could result in missed hazards in some cases. (See Finding #9.)

Finding #9. Requirements for hazards analysis methods presented in the ES&H Manual and the PFS Supervisory Handbook do not provide sufficient performance criteria and descriptions to ensure that all hazards are adequately analyzed and that appropriate controls are identified.

In the Construction Crafts shop, one non-work order driven activity had not been adequately analyzed. A new process to use paint hardener to better dispose of waste latex paints was not adequately analyzed for vapors. The Construction Crafts paint shop area had numerous one-gallon paint cans and five-gallon paint buckets drying out with waste paint hardener additive. The material safety data sheet for labeled paint cans requires ventilation to avoid vapor buildup. Local ventilation was not being utilized, and no worker exposure assessments had been performed for this activity, as required by DOE Order 440.1A.

Summary. Construction project hazards were generally well analyzed during work package development for subcontractor projects. In most cases, hazards encountered by Building Maintenance mechanics and Construction Crafts are adequately addressed by the JHQ, JSA, and other hazards analysis processes. However, criteria and instructions for use of all hazards analysis processes have not been developed, and in some cases, the rigor placed on hazards analysis is not sufficient to identify all hazards. It appears that the PFS Building Maintenance procedure manual in development would be an improvement in existing hazards analysis and control systems if the manual is completed and implemented as planned.

Core Function #3: Identify and Implement Controls

In most cases, PFS groups use the same hazards analysis processes described in the previous section to identify and develop hazard controls. For PFS subcontracted work projects performed by the Construction Section, the bidding process requires each company to provide their corporate safety plan and JSAs and have them approved by the PFS Construction Safety group. Responsible PFS SMEs also develop activity-specific hazard controls in conjunction with the hazards analysis walkdowns. The controls are then specified in project work packages. Construction field representatives and safety personnel ensure that required work permits are in place before work can begin. For the Construction Crafts and Building Maintenance groups, activity-level hazard controls, such as lockout/tagouts, confined space permits, work entry clearances, and fall protection devices, were in most cases appropriately identified in JSAs, Construction Crafts task evaluations, work entry clearance forms, and Building Maintenance hazard control cards. Personnel were well trained and knowledgeable of their assigned systems and the hazard controls for those systems. These groups also use engineered controls in some cases. For example, built-in local ventilation systems in the Construction Crafts shop are effective in controlling dust from carpentry equipment.

Although most controls are effective, some deficiencies were observed. Construction Craft personnel generally document adequate task-level controls in the task evaluation forms and work entry clearance forms for work requested by others; however, several administrative hazard controls within the Construction Crafts shop were not properly implemented:

- Eye wash stations were not inspected.

- Carpenter tools stored on the wall obstructed a hearing protection posting.

- A responsible person within Construction Crafts has not been designated for the satellite accumulation area or flammability cabinets to assure adherence to chemical safety/waste management inventory requirements.

- Two single manlifts stored in the crafts shop had annual certifications, but no pre-use checks have been performed in a significant period of time.

- The Construction Crafts shop is not satisfying chemical storage requirements as required by the ES&H Manual, which requires that employees must not store flammable liquids adjacent to, above, or below corrosives, oxidizers, or other such materials; however, the acid and corrosives storage cabinet is stored on top of a flammable storage cabinet. Additionally, the ES&H Manual specifies that cabinets are not permitted in corridors or stairwells, or within five feet of either side of a doorway or an exit; however, flammable cabinets are adjacent to the craft shop loading door. (See Finding #1.)

Building Maintenance personnel do not use the work entry clearance form for all work as required by the PFS Supervisory Handbook. Personnel use the work entry clearance form only at the foreman's discretion. In addition, Building Maintenance personnel did not identify some specific hoisting and rigging controls in JSAs.

Summary. PFS personnel were well trained and knowledgeable. PFS hazard controls are adequately implemented in most cases through the same mechanisms used to perform hazards analysis. However, several hazard control deficiencies were observed in the Construction Crafts shop, and in some cases, Building Maintenance personnel do not use the work entry clearance form when required.

Core Function #4: Perform Work Within Controls

The majority of work for the Construction Section is performed by subcontractors. All subcontractors performing work at ANL are subject to daily inspections by the Construction Section's construction field representatives. These individuals ensure that the subcontractor is performing work properly and in accordance with OSHA and ANL safety requirements. The construction field representatives are empowered to issue safety deficiency tickets to subcontractor personnel who violate those safety requirements. Multiple citations to an individual, or incidences of personnel causing an imminent danger scenario, may result in suspending personnel from site access. The construction field representatives were knowledgeable, demonstrated the necessary expertise in their responsible areas, and effectively monitored and ensured subcontractor compliance with safety requirements. In addition, daily interaction with subcontractors facilitated the construction field representative approval for required permits as the job progressed.

In general, construction crafts personnel successfully performed observed work in accordance with such established controls as permits and PPE requirements, with one exception (see below). All workers who were interviewed demonstrated an appropriate understanding of safe work practices and were knowledgeable of their tasks. Electrical work was the most significant hazardous work observed by the OA team, and the ANL site adheres to the National Fire Protection Association (NFPA) 70e electrical safety requirements. The NFPA standard requires a greater level of PPE for electrical work than is typical for the DOE complex. Arc flash masks and protective coveralls are routinely utilized for any electrical work over 240 volts.

Although Construction Crafts personnel were generally conscientious, in one case, an electrician did not follow established controls. The electrician disconnected an electrical furnace in accordance with a properly completed work entry clearance form, and the electrician understood the assigned task. However, when completing the lockout/tagout, the electrician incorrectly listed the lock serial number rather than the lock identification number indicated on the lockout/tagout board. Additionally, the task evaluation plan specifically required workers to know the location of the nearest shower and eyewash station; however, the worker was not aware of the location of this equipment prior to starting work.

Building Maintenance crews also successfully performed work in accordance with established hazard controls. For example, during work on an enclosure replacement and float change-out for a deep sump pump work package, workers prepared and appropriately followed a confined space permit. The depth of the pit necessitated a fall arrest retrieval system, and workers used the appropriate PPE. NFPA 70e PPE was appropriately used for the electrical isolation and associated lockout/tagout. The work entry clearance form was completed with required signatures.

In another example, a Building Maintenance man-lift operator and signalman demonstrated good communication skills during variable air volume filter replacements at the APS. The work boundaries were properly marked and posted, and the workers used proper PPE, including a fall harness, hardhat, safety gloves, and safety glasses. Also, during a preventive maintenance on an air conditioning handler unit at APS, the Building Maintenance mechanics performed work safely and in accordance with controls, including use of proper PPE (e.g., arc protection when engaging and disengaging a 480-volt supply).

In one case, Building Maintenance workers did not follow established hazard controls. Mechanics assigned to APS carry safety lockout/tagout locks in anticipation that they may need them in an emerging job; however, they are not required to sign out the locks in the logbook unless they use them that day. The ES&H Manual requires that locks be recorded in the logbook upon removal from the board.

Summary. In general, PFS personnel perform work safely and effectively. Workers used appropriate PPE for all identified hazards and followed the established hazard controls. Mechanics were knowledgeable of the work to be performed, and in most cases, the foremen and building managers were aware of additional hazards in their respective facilities. However, in a few cases, workers did not follow administrative requirements.

C.3 CONCLUSIONS

ANL ISM systems for control of non-experimental work are implemented with varying levels of effectiveness by line management in the various line organizations. ANL personnel are typically very experienced, and many work activities are performed with a high regard for safety. Some hazards are adequately analyzed and controlled. However, there are deficiencies in work planning and control in all organizations reviewed. In addition, there are deficiencies in implementation of some institutional safety requirements, institutional radiation protection programs, and medical surveillance. The deficiencies in the institutional programs have contributed to implementation deficiencies at the activities reviewed on this OA inspection and may impact other ANL facilities and activities. ASO and ANL have made only limited progress in correcting a number of longstanding and systemic deficiencies identified by various internal and external assessments. Because of weaknesses in developing and verifying corrective actions, many findings have been closed before the effectiveness of the corrective actions was validated and verified.

APS operational and maintenance activities are generally well defined, and most hazards are well analyzed. The APS safety assessment document and activity-level work documents define work to be conducted, and the safety assessment document further provides an extensive facility-level hazards analysis. Such mechanisms as the procedure development process, JSAs, and other work control processes provide appropriate analyses of activity/task-level hazards in most cases. However, in a few cases individual activities or facility conditions have not been sufficiently analyzed to ensure that the appropriate controls can be identified. Although APS has established many of the appropriate engineering, administrative, and PPE controls commensurate with the hazards present, in some cases engineering and administrative controls have not been adequately implemented. Instances were identified where the ANL ES&H Manual and Waste Handling Procedures Manual requirements were not incorporated into activity-level work documents. Although individual requirements were not followed in a few cases, the vast majority of work was performed safely and in accordance with established controls.

The scope of work for activities performed by WMO is generally clearly defined and sufficiently detailed to enable effective hazard identification. Several mechanisms are used for hazards analysis, and recent WMO efforts to tailor these tools to specific work activities represent a continuing improvement and, with few exceptions, effective hazards analysis. The prevalence of radiological and chemical hazards associated with WMO work dictates significant use of administrative controls and PPE to mitigate hazards. However improvement is needed in the definition, application, implementation, and quality control of these mechanisms to ensure effectiveness of controls. In addition, continuing deficiencies in fundamental aspects of the site's radiation protection program and line implementation of radiological requirements limit the effectiveness of radiological controls and defensibility of radiological data needed to ensure compliance with regulatory requirements. Many work activities in WMO were conducted safely and in accordance with established controls. However, lack of attention to requirements and governing documents has resulted in the failure to meet some nuclear facility conduct of operations and quality assurance requirements. Additional management attention is needed to ensure that workers understand all procedure compliance expectations, including the need to review and either follow or correct governing work control mechanisms before completing their tasks.

In many cases, the PFS organizations that OA reviewed have adequately implemented the first four core functions of ISM. The Construction Section has established a rigorous process for definition of work. PFS personnel were well trained and knowledgeable. The work activities observed by OA were generally performed safely. In most cases, standard industrial hazards encountered by Building Maintenance mechanics and Construction Crafts are adequately addressed by the JHQ, JSA, and task evaluation processes, and construction project hazards were generally well analyzed because of the formal requirements placed in subcontractor contracts and involvement of construction field representatives and safety personnel in work planning. Although PFS has shown improvement in implementation of ISM since the 2002 OA inspection, some deficiencies still exist. The formal work order process for Construction Crafts and Building Maintenance sometimes results in a definition of work that is not sufficiently detailed to adequately analyze all potential hazards. PFS hazard controls are implemented through various mechanisms; however, the informality and/or lack of administrative direction for some of these mechanisms have resulted in deficiencies in implementation of controls. In some PFS groups, corrective actions from the 2002 OA inspection have not been fully effective as evidenced by recent events resulting in injuries to PFS workers (see Appendix D for further details). Overall, the PFS work hazards analysis and control processes as implemented rely too much on individual work experience and informal communication between supervisors and workers.

ASO and ANL need to evaluate and address the institutional and specific findings at each applicable facility/activity and perform an extent-of-condition evaluation for the site. The corrective actions need to include both institutional and facility/activity-specific corrective actions and address all of the individual concerns that are referenced to a specific finding.

C.4 RATINGS

ANL ACTIVITY	CORE FUNCTION RATINGS			
	Core Function #1 – Define the Scope of Work	**Core Function #2 – Analyze the Hazards**	**Core Function #3 – Identify and Implement Controls**	**Core Function #4 – Perform Work Within Controls**
APS	Effective Performance	Effective Performance	Needs Improvement	Effective Performance
WMO	Effective Performance	Effective Performance	Needs Improvement	Needs Improvement
PFS	Effective Performance	Needs Improvement	Needs Improvement	Effective Performance

C.5 OPPORTUNITIES FOR IMPROVEMENT

This OA inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site to be reviewed and evaluated by the responsible line management, and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

The opportunities for improvement below are structured to include institutional opportunities for improvement that should be considered by all of the ANL organizations and activities. Specific opportunities for improvement for each of the reviewed activities are also provided for consideration. In all cases, ANL should evaluate activities not reviewed during this inspection to determine the applicability of the opportunities for improvement to those activities.

ANL Institutional

1. **Increase the level of management oversight with respect to incorporating requirements from institutional Tier 2 documents into Tier 3 procedures, work documents, and training programs.** Specific actions to consider include:

    - Line management should conduct a comprehensive review of existing processes to ensure that the ES&H Manual and quality assurance program plan requirements are adequately incorporated into quality assurance plans, Tier 3 implementing instructions, and ANL work documents, and that those requirements are being properly implemented.

    - Increase the frequency and rigor of assessments performed by line organizations, Environment, Safety, and Health/Quality Assurance Oversight, and ASO to verify the adequacy of requirements flowdown and implementation.

2. **Strengthen the organization of the existing institutional health physics infrastructure, consistent with expectations defined in the DOE Order 441.1 implementation guidance, to provide all needed support to line organizations.** Specific actions to consider include:

    - Re-define the radiation safety officer position roles, responsibilities, authorities, and accountabilities sufficient to ensure that the individual in this position can provide adequate direction, implementation, and maintenance of radiological control functions across the site.

    - Consider augmenting existing central health physics resources either temporarily or permanently to address completion of needed health physics procedures, training materials, and technical basis documents.

    - Assign responsibilities, establish schedules, establish consistent formats, and complete development of a comprehensive set of ANL health physics implementing procedures for health physicists and health physics technicians to ensure consistent implementation of duties in accordance with the expectations of the ANL ES&H Manual.

    - Develop or re-establish health physics procedures for all activities with potential worker health and safety implications or that require a specific method be followed, such as air sampling, posting, radiological surveys, recordkeeping, RWP preparation, and other such activities in which consistent implementation of requirements is necessary for technical defensibility of program activities and accountability.

    - Re-train all RCTs on all new procedures, including expectations for procedure compliance and methods to complete each assigned task.

    - Develop a series of institutional and line technical basis documents to document decisions and approaches used to achieve regulatory compliance in areas where professional judgment has been exercised. Include supporting analyses and justifications sufficient to demonstrate that regulatory compliance can be achieved and maintained. Technical basis documents should be considered for air sampling, instrument calibration and contamination control, and internal and external dosimetry.

    - Evaluate current ANL line organization RCT practical training methods against the minimum standards contained in DOE-HDBK-1122-99 and document deficiencies.

    - Establish RCT practical training job performance measures to be used by the line as a basis for determining and documenting proficiency of RCTs in completing assigned tasks.

3. **Increase emphasis on radiation protection mentoring activities and information sharing with other DOE sites around the complex.** Consider establishing line management and health physics staff visits to various DOE facilities for analysis of other radiation protection programs, with a goal of providing recommendations to foster continuous improvement of ANL programs based on positive attributes noted at other facilities.

4. **Evaluate and enhance the ANL medical surveillance program.** Specific actions to consider include:

    - Ensure that current medical surveillance procedures encompass the types of medical stressors for which a medical surveillance program is required and/or needed (e.g., beryllium, respiratory protection, and lead).

- Verify consistency for thresholds for enrollment into medical surveillance programs among the ES&H Manual, Medical Department procedures, JHQs, etc.

- Develop improved computer systems for interfacing among the various ANL databases that contain information useful to the medical surveillance program, such as the TMS, the Industrial Hygiene exposure assessment record database, the JHQ database, and medical record database(s).

- For beryllium and lead workers, expedite the medical screening process for workers in the various databases who have been identified as potentially requiring medical surveillance.

- Establish a process for industrial hygienists to assist line management in the enrollment and screening of workers for medical surveillance.

- Ensure that the medical surveillance requirements defined in OSHA and DOE Order 440.1A are incorporated into ANL subcontracts and are effectively implemented.

ANL – APS

1. **Increase line management attention on determining causal factors and correcting deficiencies related to industrial hygiene and safety concerns, including exposure assessments, lead contamination control, waste management, and flowdown of ES&H Manual requirements.** Specific actions to consider include:

    - Determine root causes for failures to identify ES&H Manual and Waste Handling Procedures Manual requirements and incorporate these requirements into work planning documents.

    - Conduct additional training for supervisors and ES&H coordinators on their responsibilities for ensuring appropriate involvement of SMEs and the conduct of exposure assessments when appropriate.

    - Provide specialized training to APS personnel (including those resident users with authorization to work with lead); address lead contamination control techniques, with an emphasis on such areas as the machine shop and waste handling.

2. **Consider establishing thresholds and guidelines addressing how hazards and requisite controls are going to be integrated into procedures, work instructions, and/or other activity-level work instructions.** Specific actions to consider include:

    - Establish mechanisms for use by all APS divisions for the inclusion and linkage of hazards and requisite controls in procedures at the activity step.

    - Determine whether special controls (e.g., requirements for working with beryllium and lead) are adequately addressed by training, posting, and existing procedures to ensure that both task-specific controls (e.g., use of respiratory protection) and special controls (e.g., enrollment into beryllium or lead monitoring program, awareness training) are integrated into the work planning process.

3. **Review all potential radiological hazards posed by APS operations (resulting from both operational and shutdown conditions) to establish an appropriate technical basis for radiological controls and to ensure compliance with institutional and regulatory requirements.** Specific actions to consider include:

- Using results of hazards analyses, develop a technical basis for instrumentation and radiological monitoring equipment, including counting and survey instruments and personal dosimetry. Correct any deficiencies and/or establish justification for any anomalies.

- Using results of hazard analyses, develop technical bases for radiological controls, including survey requirements, release of materials or personnel, labeling and posting, etc.

- Review APS radiological controls against the ES&H Manual and ANL radiation protection requirements for activated materials to ensure compliance. Revise as necessary.

ANL-WMO

1. **Increase efforts at more clearly defining expectations and requirements and promoting consistent implementation of work planning and control processes within WMO.** Specific actions to consider include:

   - Expand the detail in the Conduct of Operations Manual to better define expectations for content and preparation of WCPs and job safety assessments.

   - Consider eliminating duplicate specification of controls in WCPs and ancillary documents, focusing more on the JSA and RWP as the primary hazard identification and control mechanisms.

   - Expand the job safety assessment form to include more specificity for specific steps in the task where hazards appear and the specific controls that must be employed. For example, instead of simply listing ergonomic hazards, identify which tasks present those ergonomic hazards that require specific controls to be employed.

   - Institute a WCP/job safety assessment change control process similar to that required for procedures.

   - Conduct special training for WMO staff on a routine basis to review the Conduct of Operations Manual requirements and expectations for attention to detail, clarity, and accuracy in work planning documents and operating procedures.

2. **Increase efforts to improve effectiveness of work controls.** Specific actions to consider include:

   - Review such routine work activities as drum movement to determine whether all activities are appropriately covered by a WCP and procedure with hazards and controls specified. Revise as necessary.

   - Review such current procedures as those governing inspections to ensure that adequate instructions are provided and that inspection criteria necessary to enable pass/fail determinations are included.

   - Prepare instructions for completing job safety assessments that ensure that the work planner identifies all possible steps in a process where hazards are introduced and considers the possible control mechanisms that can be implemented. Document justification when controls are considered unnecessary.

   - Conduct formal ergonomic evaluations of waste sorting and compacting operations to determine whether existing controls are adequate.

3. **Increase attention to better compliance and adherence to institutional requirements.** Specific actions to consider include:

    - Review applicable ES&H Manual chapters to determine a listing of specific requirements that must be met by WMO.

    - Create a crosswalk defining each institutional requirement with linkage to specific WMO plans, policies, procedures, etc., where the requirement is implemented. Establish a plan and schedule to correct deficiencies.

4. **Increase emphasis on creating sufficiently specific RWPs, with more attention to detail in hazard identification and ensuring that the controls are specifically tailored to individual tasks.** Specific actions to consider include:

    - Prepare and utilize job-specific RWPs rather than general RWPs when there is a potential for changing radiological conditions, in accordance with ES&H Manual requirements.

    - Eliminate the use of work package addenda to define specific radiological hazards and controls associated with WMO work, and issue specific RWPs for this purpose.

    - In the absence of specific procedures, provide more detail in RWPs on techniques needed for successful application of specific controls, such as air sampling, surveys, contamination control, and extremity dosimetry. Expand the RWP form or attach additional sheets as needed.

ANL – PFS

1. **Strengthen the rigor and documentation of the PFS work control processes.** Specific actions to consider include:

    - Provide clearer expectations for the performance and documentation of activity-level hazards analyses.

    - Establish mechanisms to document activity-level hazard controls, and link the controls to hazards. Ensure that hazard controls that are beyond skill of the craft are documented in the work package.

    - Develop standard JSAs or other documentation to define skill of the craft expectations and criteria for each craft (e.g., painters, sheet metal workers, carpenters, and mechanics).

    - Re-assess the current job risk levels to provide a greater use of risk levels. (The vast majority of work tasks currently are categorized as "high risk").

    - Expedite development of the draft Building Maintenance procedures manual for common operations (e.g., cooling tower work and compressor work).

    - Evaluate the SIMS capability to incorporate identified hazards and controls from the completed PFS version memory card into the preventive maintenance work packages automatically generated in SIMS.

    - Formalize the current Building Maintenance hazard checklist card system. Ensure that the system addresses all hazards analysis requirements of the ES&H Manual.

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APPENDIX D

Feedback and Continuous Improvement (Core Function #5)

D.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) evaluation of feedback and improvement processes at the Argonne National Laboratory (ANL) included an examination of the DOE Argonne Site Office (ASO) and contractor environment, safety, and health (ES&H) programs and performance. The OA team examined DOE Office of Science (SC) and ASO line management oversight of ANL integrated safety management (ISM) processes and implementation and the SC employee concerns program (ECP). The OA team also reviewed such ANL institutional processes as assessments and inspections, corrective action/issues management, injury and illness investigation and reporting, lessons learned, the ANL ECP, and such activity-specific processes as post-job reviews. In addition, the discussion of safety system oversight, as discussed in Appendix E (primarily in section E.2.6), is an integral part of the overall feedback and improvement system and its evaluation results are considered in the evaluation of feedback and improvement systems.

The scope of the review of feedback and improvement at ANL considered the results of the 2002 OA inspection. Specifically, OA focused on the ASO and ANL institutional feedback and improvement programs, which were determined to have a number of weaknesses in 2002. OA also focused on the implementation of feedback and improvement processes at the division and activity level for non-experimental work activities and for the organizations identified in Appendix C. The 2002 review identified a number of improvements in safety management for experimental work and a number of concerns with non-experimental work.

D.2 RESULTS

D.2.1 DOE Line Management Oversight

SC Headquarters

SC has transitioned to a site office and service center approach as part of its “One SC Project,” which provides a realignment of line management functions. The site office roles, responsibilities, and authorities have been documented and delegated appropriately. The service center approach is functioning and service plan is in place, although some service center internal procedures need to be revised to reflect the new organizations and interfaces. As another step in the One SC Project, SC Headquarters is currently undergoing re-engineering to evaluate Headquarter management systems and processes to reflect the new approach to field operations and interfaces. Discussions with ASO personnel indicate that ASO typically uses service center support in such areas as security, legal, and human resources, and relies on the Chicago Operations Office (CH, which is now part of the service center) to manage the ECP. The service center also has a fire protection subject matter expert (SME). However, ASO generally has not solicited service center support for most ES&H issues and is generally self-sufficient in the area of line management oversight of ES&H. As discussed below and in Appendix E (primarily Section E.2.6), ASO resources for nuclear safety need to be strengthened; the potential for the service center to provide nuclear safety support to ASO and other site offices needs to be evaluated as a means to promote efficient use of SC resources.

Under the One SC approach, SC Headquarters has been more active and involved in safety at its sites. SC has established processes for developing performance indicators, setting goals, and monitoring performance measures across SC laboratories. This management focus has contributed to a generally improving trend in performance indicators at SC laboratories, such as the total recordable cases (TRC) and days away/restricted/transferred from job (DART) indicators.

SC has also increased its focus on communicating lessons learned, including Office of Environment, Safety, and Health (EH) safety and health alerts, to SC site offices and laboratories. SC has also interfaced with its site offices, including ASO, to ensure that the site offices monitor their laboratory performance in the area relevant to the lessons learned. For example, SC required its site offices and laboratories to review and strengthen their hoisting and rigging programs, which has resulted in the development of improvement initiatives for the ANL hoisting and rigging program. As another example, SC required its site offices to take a number of actions to enhance electrical safety following the recent electrical incident at the Stanford Linear Accelerator Center. These actions have resulted in some improvements in ANL electrical safety practices. In addition, SC is conducting reviews of laboratory systems and processes for conduct of electrical hot work at all of its sites to provide assistance and promote lessons learned from the incident. SC site offices will be required to address, implement, and report the status of corrective actions that were taken in response to SC review team recommendations.

SC has been actively involved in helping sites achieve improvements in a number of cases. For example, SC's monitoring of ANL performance metrics indicated a need for improvement in ANL efforts to meet as-low-as-reasonably-achievable (ALARA) and person-roentgen equivalent man (rem) goals. SC, in coordination with ASO and ANL then identified funding for ANL upgrades to Alpha-Gamma Hot Cell Facility (AGHCF) windows/shielding and replacement remote manipulator arms, which resulted in lower dose rates. In a number of cases, the SC director has been personally involved in follow-up of occurrences at SC laboratories.

Notwithstanding the positive SC efforts and initiatives, deficiencies in ASO line oversight programs and ANL feedback and improvement processes are hindering effectiveness of ES&H improvement initiatives. For example, ANL feedback and improvement processes were not fully effective in ensuring that the July 2004 lessons-learned actions on hoisting and rigging incidents at SC laboratories were implemented for all ANL construction subcontractors (see Section F.2.2). SC efforts to provide a leadership role in driving improvements in TRC and DART rate performance at its sites have resulted in a general improving performance trend in worker safety performance at ANL; however, further progress in achieving SC future worker safety performance goals is hindered by weaknesses in ANL injury and illness investigation processes.

In addition, SC, ASO, and ANL have not established and applied sufficient resources, including personnel with appropriate nuclear safety experience, to effectively manage nuclear facilities in accordance with DOE expectations and 10 CFR 830 requirements. For example, these organizations have limited expertise in the current codes and standards applicable to ANL nuclear facilities. As discussed in Section E.2.6 of Appendix E, ASO and ANL line management oversight of nuclear safety has not been fully effective in identifying weaknesses in a number of key areas, including the unreviewed safety question (USQ) process, technical safety requirement (TSR) implementation, surveillance and testing, documented safety analysis (DSA) accident analysis, and configuration management. Similar concerns regarding implementation of nuclear safety requirements were also identified in a 2002 OA inspection, and actions to date have not been fully effective in addressing performance weaknesses. SC has not sufficiently focused attention on the management of nuclear facilities and the requisite resources for managing a nuclear facility, including options for using the nuclear safety expertise within SC and/or external expertise to support ASO, ANL, and other SC site offices and laboratories.

ASO

Roles, Responsibilities, Authorities, and Competencies. ASO line oversight of ANL ES&H performance is adequately described in a set of procedures, plans, and individual position description documents. These documents have been revised to reflect the ASO role under the One SC project and delineate the activities and responsibilities of ASO staff, including team leaders, Facility Representatives (FRs), ES&H SMEs, and project managers on safety and health, environmental and emergency management, and infrastructure and project management teams. The ASO annual management plan is an effective mechanism that links the ASO mission and functions to the overall SC priorities and goals, and flows down major functions and goals to ASO organizational elements (e.g., work teams). ASO personnel who were interviewed demonstrated an adequate understanding of their assigned roles, responsibilities, and authorities. With the exception of nuclear safety, ASO generally has personnel with appropriate expertise and qualifications in the appropriate ES&H disciplines, such as industrial safety and industrial hygiene. However, as discussed below, ASO has not sufficiently applied its expertise to conducting performance-based evaluations of ANL ES&H programs.

Assessments. ASO line ES&H oversight program assessments include routine operational awareness activities (e.g., walkthroughs, surveillances) and formal functional area reviews, which are adequately defined in ASO standard operating procedures. FRs/SMEs conduct various operational awareness activities, including numerous facility walkthroughs, safety/operations and experimental review meetings, and technical document reviews. Deficiencies or concerns raised through these activities are typically communicated and resolved informally with ES&H coordinators or facility management. ASO also established a tracking system for documenting operational awareness activities by FRs/SMEs and institutionalized it in ASO procedures.

Although surveillances of work activities are limited, ASO operational awareness activities are identifying ES&H program and facility condition deficiencies and facilitating continuous improvement at ANL. For example, a number of industrial safety deficiencies were identified by FRs/SMEs during a walkthrough of an accelerator and were brought to the attention of the ES&H division coordinator for action and disposition. This walkthrough also identified a potential institutional concern with implementation and consistency of welding requirements, which subsequently was communicated to the Environment, Safety, and health/Quality Assurance Oversight (EQO) Division for resolution.

In response to the 2002 OA inspection, ASO has strengthened management expectations for FR/SME oversight of occurrences in their site operating procedures, and training on causal analysis has been provided. FRs/SMEs are actively involved in monitoring laboratory actions in response to occurrences; they typically provide advice and input to the ANL facility manager as part of the evaluation of the occurrence and monitor occurrences for potential performance trends. For example, a FR notified ANL management about a potential adverse performance trend in work control and configuration management at an accelerator. In addition, FRs/SMEs have developed a good working relationship with the laboratory, and are frequently contacted by ANL personnel to provide clarification and guidance on ES&H requirements.

In addition to operational awareness activities, ASO has established an assessment program for conducting functional area reviews of the laboratory. In response to the 2002 OA inspection, ASO has developed a master schedule of assessment activities with proposed frequencies that includes appropriate elements of major ES&H functional areas. In coordination with the laboratory, a schedule of proposed reviews is developed annually to identify joint assessment activities and to minimize duplication of review efforts. With few exceptions, the scheduled calendar year (CY) 2004 assessments were conducted as planned.

Although some aspects of the ASO oversight are effective, there are a number of weaknesses in ASO assessment activities limiting the effectiveness of ASO oversight of ANL performance.

- **Surveillance (e.g., observation of work) activities, as described in ASO procedures, are not yet being sufficiently performed and documented to adequately evaluate ISM core function implementation.** Operational awareness activities still primarily consist of document reviews, facility walkthroughs, and attendance at meetings to determine facility and ES&H performance status. Several FRs/SMEs stated that primary focus of their operational awareness activities was directed at gathering information on the status of facility operations and actions in response to events/occurrences. In addition, FRs/SMEs are not always formally documenting the results of operational awareness activities (within logbooks or the FR database) in sufficient detail to support ASO management's evaluation of ISM core function implementation. FRs/SMEs stated that progress in addressing the deficiencies in conduct and documentation of FR surveillance activities identified in prior ASO self-assessment and benchmarking reports in response to the 2002 OA inspection has been limited, and that many of their activities are not formally documented. This approach will not support effective trending and analysis of results from site office operational awareness activities, precluding this data from consideration as part of SC efforts to further drive safety improvements at SC laboratories.

- **ASO operational awareness and functional area review activities have not always been conducted with sufficient rigor and depth to identify program and performance deficiencies.** ASO surveillances and functional area reviews were limited and were not effective in identifying process and performance deficiencies identified in this OA inspection. Routine surveillances of work evolutions, and verification of procedural adequacy and compliance, including facility safety basis TSR implementation, is not normally conducted as part of routine FR/SME oversight activities. In addition, functional area reviews that were conducted in areas that were assessed during this OA inspection were programmatic and not sufficiently focused on implementation at the activity level (i.e., not performance-based); they did not always provide an effective evaluation of ES&H programs and performance. For example, ASO functional area reviews of the USQ program, nuclear facility maintenance, and conduct of operations implementation did not identify any deficiencies or findings in program implementation. As discussed in Appendix E, OA identified significant weaknesses in the implementation of these programs and processes during this inspection.

- **Operational awareness activities and functional area reviews are not being sufficiently used to target previous performance areas of concern for follow-up and/or verification of effective flowdown of ES&H requirements.** ASO has not recently assessed some ANL programs, such as the lead control program, confined space reviews, the radiation protection program, injury/illness investigations, and line management self-assessment programs, that previously had performance concerns and/or recently had changes in ANL ES&H Manual requirements. The results of this OA inspection indicate that there are still deficiencies in implementation of these programs.

- **ASO has not established sufficient management systems for tracking, documenting, and reporting of FR/SME surveillance activities and for ensuring that functional area reviews are sufficiently focused on performance and implementation of ES&H requirements.** ASO standard operating procedures do not contain specific minimal requirements for the number of surveillances to be conducted or the level of documentation required/expected. FR/SME monthly reports do not provide adequate information on surveillance activity, nor are there any standard reports prepared from the FR database on surveillance information. In addition, ASO procedures do not require FRs/SMEs to develop formal evaluation plans delineating specific criteria and lines of inquiry or addressing standard attributes that should always be included in the scope (i.e., work observations, self-assessments, and corrective actions) as part of the functional area review process. While a new, web-based FR database system shows promise in providing expanded capability to effectively document, track, and trend ASO line operational awareness activities, ASO management has not yet been sufficiently engaged in the development of the new database system to ensure that their expectations and requirements for system use, necessary minimal data entry requirements, and management report requirements have been factored into its development.

Finding #10. ASO has not implemented a fully effective program of operational awareness and assessment activities with sufficient scope and rigor to ensure that contractor ES&H performance at all levels and in all organizations is sufficiently and accurately evaluated, as specified in DOE Policy 450.5.

Corrective Action and Issues Management. ASO uses a variety of mechanisms to monitor safety deficiencies and associated corrective actions to evaluate performance and track progress. These include weekly meetings between ASO and ANL at a number of levels (e.g., EQO, Laboratory Director, staff) to discuss ES&H issues, a weekly ASO/ANL senior management meeting that includes a discussion of major ES&H issues from ASO oversight activities, an ASO monthly report summarizing FR/SME activities, and daily reviews of Occupational Safety and Health Administration (OSHA) recordable case information.

However, ASO management systems to track and monitor contractor actions are still informal and rely primarily on the contractor corrective action and issues management program, which is not sufficiently effective (see Section D.2.2). Further, ASO actions to strengthen issues management and corrective action processes have not been fully effective and/or sustained. FRs/SMEs still do not always consistently track and document resolution of deficiencies and concerns noted during routine awareness activities. Logbooks and the existing FR database rarely document/describe follow-up actions being taken by FRs/SMEs to verify closure and effectiveness of contractor actions. FRs/SMEs are not consistently using the FR database, which was established to provide a mechanism for tracking issues and concerns in response to the 2002 OA inspection. In addition, an internal tracking system that was established for tracking the status of corrective actions to functional area reviews has not been kept up to date. Reporting mechanisms are informal or not effective, and routine mechanisms for periodically providing ASO management with the status of corrective actions to ASO findings and concerns have not been fully established.

Finding #11. ASO has not established and implemented a fully effective issues management and corrective action process that ensures that safety deficiencies identified through ASO line management oversight activities are appropriately documented and tracked to closure, as required by DOE Order 414.1B.

Verification of closure and effectiveness of corrective actions for deficiencies previously identified by ASO and by OA in its 2002 inspection has not always been sufficiently rigorous to prevent recurrence or drive continuous improvement of the contractor. ASO functional area reviews and surveillances have not been effective in monitoring the effectiveness of contractor corrective actions to previously identified process and performance deficiencies in the flowdown and implementation of OSHA requirements for lead exposure control and for annual confined space program reviews, and radiological control requirements. In addition, deficiencies in injury and illness investigations and radiological protection identified in previous ASO functional area reviews and in the 2002 OA inspection were found to be uncorrected during this OA inspection.

As discussed above, ASO procedures do not require and ASO management has not ensured that functional area reviews always include in their scope a sample of appropriate contractor corrective actions for follow-up and evaluation of their effectiveness. Operational awareness activities and functional area reviews are not always being sufficiently used to target previous performance areas of concern for follow-up and/or verification of effective flowdown of new and/or changing laboratory ES&H requirements to determine the effectiveness of implementation at the activity level.

In some instances, issues were closed prematurely based primarily on ANL planned actions rather than that actual completion of all specific actions. In other instances, effectiveness reviews of implementation of corrective actions are not always being required of the contractor. Examples include:

- The 2002 OA inspection determined that ANL had not implemented a systematic process for non-experimental work that defines how the core functions of ISM are performed and implemented. ASO verification of closure was based on paper reviews of ANL memoranda of planned actions, including a planned review of non-experimental work that was to be performed by EQO. This review has not yet been performed (it currently is scheduled for the third quarter of CY 2005, with no planned participation by ASO). ASO has not yet conducted any formal follow-up activities to assess the effectiveness of the corrective actions. Results from this OA assessment determined that implementation of the non-experimental work planning and control process is deficient (see Appendix C, including Findings #4 through #9).

- The 2002 OA inspection determined that there were deficiencies in ANL's requirements management system with respect to applicable DOE, OSHA, and ANL requirements for lead exposure. ASO verified this issue as closed in June 2003 based on planned actions to revise the ES&H Manual. The manual was not revised until early 2005.

- A 2002 ASO review of injury/illness recordkeeping cited several findings and recommendations to address weaknesses in the contractor's program. Review of the EQO tracking database indicates that the contractor completed the corrective actions for these issues in 2002; however, the "closed" field for these corrective actions is not filled out, indicating that ASO has not conducted verification activities to indicate they are satisfied with the effectiveness of the actions taken by the contractor. Discussions with the ASO issues/tracking coordinator indicate that ASO has not yet followed up on these actions. Several of the findings are similar in nature to the results of this OA inspection on injury/illness investigations.

- A 2003 ASO review of the ANL radiation protection program identified a number of findings. The ASO report was issued to the contractor in February 2004 and the contractor was requested to review the "draft report," review the findings in detail, and inform ASO of its plans for improvements. Review of the EQO tracking database indicates that the contractor completed these issues in 2004; however, the "closed" field for these corrective actions is noted as "n/a," indicating that ASO has not conducted verification activities to indicate they are satisfied with the effectiveness of actions taken by the contractor. Discussions with the ASO issues/tracking coordinator indicate that ASO has not yet followed up on these actions and no follow-on assessment activities have been performed (although the fiscal year [FY] 2004 schedule had radiation protection functional area reviews identified). One ASO issue dealt with the need to issue health physics procedures. This action was completed and closed based solely on ANL "defining a process"; it was not based on whether the process was effectively implemented. This weakness was identified in the 2002 OA inspection, and this 2005 OA inspection indicates that it still exists. Other findings from the ASO radiation protection program assessment were similar in nature to the deficiencies identified on this OA inspection.

- The 2002 OA inspection identified weaknesses in ANL line management assessment processes and performance. ASO verification actions to validate closure of the contractor corrective actions consisted of reviewing changes to ANL program documents and procedural changes, review of presentation material from a seminar that communicated to ANL line managers expectations for a robust line management assessment program, and review of the CY 2003 EQO schedule that indicated that evaluation of the ANL assessment program would be conducted. No further ASO actions were identified to verify the effectiveness of corrective action closure, and some of the corrective actions were not effective (see Section D.2.2).

Finding #12. ASO has not always conducted or required the contractor to conduct sufficient reviews of contractor corrective actions to verify closure and effectiveness in ensuring resolution of internal and external findings and preventing recurrence, as required by DOE Order 414.1B and DOE Order 470.2B.

Contract Management and Assessment of Contractual Performance. ASO has formalized a process in its standard operating procedures for developing annual performance measures and system assessment measures for ANL and the resultant performance evaluation measurement plan. The contract for ANL includes ISM as one of the mission-critical performance measures, which identifies four quantitative ES&H performance expectations (e.g., objectives) in ISM implementation, radiological and nuclear safety programs, worker safety performance, and environmental protection and stewardship performance. Upon receipt of ANL's mid-year and final performance assessment reports, ASO SMEs evaluate ANL's performance using ANL's self-assessment results and data and information from ASO's operational awareness program. Review of the performance evaluation measurement plan results indicates that ASO is using the contractual process to promote improved ES&H performance. For example, ASO has coordinated with SC and ANL to include SC DART and TRC goals for safety performance in its performance evaluation measurement plan, which has resulted in a generally improving performance trend in worker safety performance at ANL. In addition, ASO has driven improved performance at ANL in achieving environmental management system milestones and reinvigorating the pollution prevention program by using performance measures in the ANL contract (see Section F.2.1). However, the lack of formal documentation of results from ASO operational awareness activities challenges the basis for ASO's overall evaluation of laboratory performance, especially in cases were the laboratory and ASO differ on overall performance.

Employee Concerns. The ECP is managed and implemented by CH as part of the SC Integrated Service Center. The CH ECP is adequately described in CH Order 442.1 and is implemented in a manner that meets most requirements of DOE Order 442.1. Case files are adequately maintained and provide sufficient information to allow auditing and action tracking. The interface between the CH ECP and ASO on issues involving ANL is effective. ECP posters are placed on ANL bulletin boards and reflect up-to-date information. CH recognizes that their ECP procedure needs to be revised to reflect CH's transition to the SC service center.

Although most aspects of the ECP program are adequately implemented, formal annual management assessments of the ECP program have not been conducted for several years. DOE Order 442.1A requires annual management assessments of the ECP program. (See Finding #10.)

D.2.2 ANL Feedback and Improvement Systems

In May 2002, OA identified weaknesses in ISM program management systems at ANL and cited specific findings for which formal corrective action plans were required. The areas of weakness identified included requirements flowdown, non-experimental work control, the radiation protection program, safety requirements at the AGHCF, feedback and improvement programs, and line management leadership. ANL has made some improvements to feedback and improvement processes defined in the quality assurance program plan (QAPP) and conducts many assessment and inspection activities that result in safer work environments, improved safety processes, and better performance. Although corrective action plans were developed and the specified corrective actions were completed, ANL's feedback and improvement processes have not been sufficiently effective in addressing the management system weaknesses identified by OA in 2002. While progress has been made in several areas, the root causes of these performance deficiencies have not been sufficiently established and the corrective actions taken have not been comprehensive or rigorous. Many of the same feedback and improvement program weaknesses continue to impede continuous improvement in safety at ANL.

Assessments. The 2002 OA inspection identified weaknesses in ANL's self-assessment program, including inadequately defined roles and responsibilities for performing assessments, inadequate evaluations of ISM performance, failures to perform some OSHA- and ANL-required assessments, and a lack of rigor in performing assessment activities. ANL's corrective actions have not been fully effective in addressing these weaknesses. ANL continues to conduct a variety of self-assessment activities that identify deficiencies in safety processes, conditions, and performance, but assessment planning and performance deficiencies remain. Many assessment functions are informally defined and documented. Rather than proactive analysis and scheduling of self-assessments based on ongoing work activities and risks, formal line assessment activities are generally limited to physical condition inspections, reactions to events, and assessments driven by external organizations or regulations.

ANL conducts many assessments and inspection processes that evaluate ES&H programs and processes and the physical condition of work areas for unsafe conditions. The ANL quality assurance (QA) program plan (the QAPP, an institutional or "Tier 2" document) describes the expectations for performing management and independent assessments and for conducting management walkthroughs and includes procedures that apply to an EQO-coordinated annual management assessment, independent assessments conducted by EQO, and for management walkthroughs conducted by the laboratory director and the EQO director. Assessment program expectations are also outlined in the ANL QA program description and in the ISM program description. Other Tier 2 manuals, including the ES&H Manual, accelerator safety procedures, and the Construction Manual, identify specific assessments required by ANL or DOE and OSHA standards.

EQO issued a schedule of ASO and joint EQO/ASO assessments in CY 2003 and for CY 2005, including joint assessments with ASO. In CY 2003 EQO conducted 12 institutional-level assessments and 7 joint assessments with ASO, and in CY 2004 EQO conducted 21 assessments and 4 joint ANL/ASO assessments. For CY 2005 EQO has scheduled 17 institutional-level assessments and 12 joint ANL/ASO assessments. These assessments address a wide variety of safety functional areas and range from focused, limited-scope reviews, such as a review of powered industrial vehicles, to comprehensive evaluations of programs affecting most site organizations, such as emergency management, fire protection, or electrical safety reviews. Most of these assessments have DOE, OSHA, or other regulatory drivers. EQO has established an intranet site that could provide an effective and innovative tool for tracking the planning, scheduling, and execution of assessments and the disposition of findings. EQO personnel stated that the goal was to implement the intranet site for EQO assessments soon and make it available to the line in the future. However, this process is still in its infancy and its use has not been formally approved by management or integrated into Tier 2 documents.

Much of the ANL assessment resources and activity involves routine and formal inspections of the physical condition of plant facilities. Inspections of every facility at ANL are to be conducted twice per year to identify and document deficiencies for corrective action. In all organizations evaluated, many managers are conducting tours of workspaces, identifying physical condition deficiencies, and in some cases observing work activities and interacting with and getting feedback from workers. The Chemical Engineering Division, responsible for nuclear facilities and activities in the G and K Wings of Building 205, has an internal assessment procedure, issues annual self-assessment schedules, and performs planned, elective assessments of safety programs and performance. The WMO Department in PFS issues annual audit and surveillance schedules and conducts documented management walkdowns in accordance with a WMO Conduct of Operations Manual procedure. The PFS Division is conducting appropriate annual assessments of their implementation of the lockout/tagout program as required by OSHA and the ANL ES&H Manual.

ANL has established an effective safety inspection process for construction projects administered by PFS; this process is governed by the Construction Manual, which ensures that appropriate safety controls have been included in contract and subcontractor programs and provides for routine oversight of subcontractor performance. One construction safety supervisor, one safety inspector, and construction field representatives perform field safety inspections; review design package, safety plans (based on a structured checklist), and job safety analyses; conduct inspections of equipment when a contractor first comes on site; and ensures that all safety permits are in place. The safety inspector and construction field representatives, and to a lesser extent the construction safety supervisor, conduct routine daily safety inspections, which are documented in logbooks.

Notwithstanding the assessment and inspection activities that are being performed, ANL institutional and line policy and procedure documents do not sufficiently define the roles, responsibilities, authorities, and overall requirements for an effective assessment program. Further, assessment activities are not being tailored to ongoing risks and work activities. ANL assessments still lack sufficient focus on observing work activities, line implementation of ES&H programs, and the attributes of ISM, and often lack sufficient rigor to effectively evaluate safety processes and performance. The ANL procedures for independent and management assessments and management walkthroughs contained in the institutional-level QAPP only specify requirements for EQO-directed and coordinated assessments; they do not describe institutional processes and expectations for line organizations conducting these assessment activities. Line organizations have not adequately described their assessment programs as specified by the QAPP. For example, although the QAPP identifies the assessment program elements that line QA plans must describe, neither the QAPP text nor associated procedures specify or reference other documents that detail management's expectations or guidance for the implementation of these management systems. Although the division QA plans reviewed by OA addressed at least some of the elements specified in the QAPP, they did not clearly define the processes to be used, and with few exceptions (i.e., Chemical Engineering Division internal assessments and walkthroughs and WMO Department management walkdowns), divisions had not developed implementing instructions describing their processes and requirements for internal assessment programs.

Typically, the only independent assessments conducted are the assessments imposed on the organization by external entities; few independent assessments are identified based on an internal determination of a need for independent reviews. OA identified deficiencies in the implementation of assessment requirements by the EQO Division and most line organizations reviewed. No schedule of institutional "independent" assessments was developed by EQO in CY 2004, and no schedule of self-assessments was developed by EQO for CYs 2004 or 2005. The CY 2003 schedule was not maintained up to date, and 8 of the 24 assessments scheduled were not completed or completed as specified (e.g., an institutional ISM assessment was instead performed by individual divisions). Only the Chemical Engineering Division and the WMO Department could provide evidence of the required annual assessment schedules for CYs 2003, 2004, and 2005. In several cases, formal planned/documented assessments were limited to an annual "management assessment" and mandatory semi-annual safety inspections, mandatory regulatory driven assessments of waste operations or the radiological protection program, or reviews reacting to events or directed by DOE. There are limited documented assessment, inspection, and surveillance activities that address performance in ES&H functional areas, include watching work, or evaluate ISM core functions. Topical ES&H technical and administrative areas are not prioritized based on risk for periodic assessment. For example, for the AGHCF, there have been no self-assessments of the USQ process and performance, and reviews of TSR processes and implementation have found no issues in areas where OA identified significant weaknesses during this inspection (see Appendix E). The Energy Technology Division management assessment topic addressing "divisional corrective action program implementation" was limited to a discussion of how they tracked facility inspection results, and did not evaluate corrective actions as a program or system, as required by the QAPP.

Scheduling and documentation of management walkthroughs is often informal, and there is insufficient monitoring of performance to ensure that all managers are conducting documented walkthroughs. Identified deficiencies are seldom put into any formal tracking system, and there was little evidence of watching work. Much effort is expended on the facility condition inspections (every facility at ANL is required to be inspected twice a year), but there is no trending or analysis to identify repetitive deficiencies, poor performers and repeat offenders, or recurrence controls. Assessment resources are not being effectively and efficiently applied to safety program elements.

Recent annual management assessments being coordinated by EQO typically lack sufficient rigor and detail. Many of the required specific topical areas and most of the suggested topical areas contained in the EQO-issued instructions to divisions for the annual management assessment in 2003 were not addressed by ANL divisions. EQO did not compile or issue an institutional management assessment in FY 2003. The EQO rollup of individual division report results for FY 2004 contained little analysis or discussion of how individual divisional performance results reflected on ANL as an institution.

Several mandatory periodic assessments had not been performed by line organizations. PFS had not conducted the annual confined space permit reviews required by OSHA and the ANL ES&H Manual. EQO Industrial Hygiene is not receiving or reviewing division annual confined space activity reports, as required by ES&H Manual Section 7.4. Failure to conduct these required assessments was also identified during the 2002 OA inspection. The biennial assessment of the construction safety program required by the Construction Manual had not been performed or scheduled. ANL is required to perform periodic reviews of the chronic beryllium disease prevention program but has not conducted such reviews to date (see Appendix F). Other required assessments that have not been performed include the natural phenomena hazards assessment and maintenance condition assessment surveys as required by DOE Order 420.1 (see Appendix E).

The ANL corrective actions to the OA finding about contractor assessment programs primarily involved revisions to the QAPP and associated procedures to clarify requirements. All actions are considered completed by ANL. An action to conduct an EQO assessment of the assessment program in 2003 was completed and identified that several of the weaknesses identified above existed, including failures to plan and schedule independent assessments and failure to include required program elements in QA plans. However, the assessment was not sufficiently rigorous, especially regarding management assessments and walkthroughs, and focused on the quality of the planning document (i.e., the line QA plan) rather than on the quality of line performance (e.g., quality, depth, rigor, and scope of assessments and adequacy of corrective actions). Further, the program deficiencies identified in the assessment were not documented as weaknesses or opportunities for improvement–the only opportunity for improvement was to further revise the QAPP regarding independent assessments. An additional action, not transmitted to DOE, was added to the corrective action plan and addressed an assessment of the divisions' implementation of divisional QA plans, but this action was closed without requiring corrective actions for identified implementation issues.

Finding #13. ANL has not established and implemented a fully effective program of assessment activities with sufficient scope and rigor to ensure that ES&H performance at all levels and in all organizations is consistently and accurately evaluated.

Corrective Action and Issues Management. The 2002 OA inspection report identified weaknesses in ANL's corrective action and issues management program, including insufficiently defined institutional processes for managing corrective actions to safety deficiencies, inadequate and untimely corrective actions, and fragmented and informal tracking systems. The ANL causal analysis and corrective actions have not been effective in correcting these deficiencies. ANL documents many safety deficiencies in a variety of tracking systems or informally and takes many corrective actions that are tracked to closure. However, the program still lacks the consistency and rigor of a mature and effective continuous improvement system. Identified safety problems are not being consistently managed or adequately analyzed to identify appropriate recurrence controls.

As part of the corrective actions to the 2002 OA finding, the institutional QAPP was revised to require that organization QA plans describe processes for quality improvement and that organizations establish a corrective action system with specific elements, including causal and significance analysis, development of action plans with assigned owners and due dates, and tracking to verified closure. The QAPP also contains procedures for incident investigations. ANL tracks the correction of identified safety deficiencies using a variety of tracking systems and formal and informal processes. The QAPP requires that opportunities for improvement be addressed as well as weaknesses or violations of requirements. In many cases, process, performance, and physical condition deficiencies are not formally documented in any tracking system and resolution is handled informally using verbal communication or electronic mail to report the issue and its correction. PFS has an aggressive process for identifying construction subcontractor performance deficiencies and holding subcontractor personnel accountable for performance; the process provides for safety violation notices, escalating sanctions for repeat offenders, and suspension of subcontractors from site work for imminent danger violations.

Notwithstanding the above improvements and initiatives, the fundamental deficiencies in corrective action management identified in previous OA inspections have not yet been addressed. ANL still has multiple methods for resolving ES&H deficiencies, many of which are informal, and lacks a structured process to collect and evaluate issue and action data, hindering effective management of feedback information. Insufficient attention is directed at the identification of trends and precursors and structured evaluations of operational and injury/exposure incidents. Procedural and performance deficiencies are limiting the effectiveness of corrective action management at ANL. Specific deficiencies in ANL corrective action/issues management are described in the following paragraphs.

The procedures in the QAPP are limited in scope to activities specified by EQO or the laboratory director, rather than institutional-level instructions for conducting corrective actions and issues management, and they do not sufficiently address several of the elements of an effective corrective action program. The scope section of the QAPP corrective action procedure, which limits procedure applicability to external and EQO assessment results, is in conflict with the purpose section, which describes a more generic, institutional process. Further, this procedure does not address corrective actions for all identified deficiencies; the procedure is limited to weaknesses and improvement items identified during assessments and responses to events or investigations (i.e., occurrence reporting and processing system [ORPS] or Price-Anderson Amendment Act [PAAA] issues). There is no other institutional-level document establishing expectations or requirements for corrective actions for line self-assessments (management or independent) or for issues identified through means other than assessments. Similarly, the QAPP procedure for incident investigations is limited in scope to investigations commissioned by the Laboratory Director or the director of EQO rather than a set of institutional requirements for conducting investigations. The QAPP procedure for corrective action does not specify responsibility or a requirement for screening assessment results for ORPS reporting. The need to conduct PAAA screening is cited only in the responsibilities section for division directors/department heads and the EQO director, not in the requirements section of the procedure. Terms for assessment results (weaknesses, opportunities for improvement, strengths) are not defined in the QAPP or associated procedures for assessments or corrective actions. Although the QAPP corrective action procedure states that causes must be identified and describes various methods for conducting root cause analysis, it does not clearly identify or provide guidance for determining the thresholds and levels of rigor of analysis required. Further, there is no indication of how or where the results of this analysis are to be documented or whether the analysis must be retained. The EQO tracking system has no specific field for documenting causes, nor are causes being documented in other discussion fields. Determining the extent of condition is not addressed in the requirements section of the procedure. Although validation of corrective actions is discussed, it is not clearly identified as an action step in the procedure and there is no indication of where or how this validation is to be documented.

Although the QAPP now delineates a minimum standard for divisional processes, the divisions have not adequately described corrective action systems in their QA plans or developed implementing instructions detailing how safety issues will be managed, as required by the QAPP. Divisions have not developed procedures for how operational or injury/exposure incidents will be investigated and managed. The multiplicity of diverse formal and informal tracking systems significantly impedes data analysis for determining collective performance levels and identifying adverse trends or systemic issues. Informal tracking of issues in nuclear facilities may impact the screening or trends analysis of issues for PAAA reporting. Submittal of some corrective action plans and completion of corrective actions have not been timely, and senior management is not taking sufficient actions to ensure timely submittals (e.g., holding the line accountable for timeliness and quality). Periodic reports of corrective action status for ES&H inspections and assessment findings are not issued for information and use by management. Trend analysis is not performed for division-level safety deficiencies, institutional-level issues being tracked by EQO, or facility safety inspection results to identify systemic or chronic issues or adverse and positive trends. Additional examples of deficiencies in formally identifying and tracking corrective/preventive actions are detailed in the subsection on occupational injury and illness investigations.

ANL has not established sufficient processes at the institutional or divisional level that support the requirements of DOE Order 231.1A and DOE Manual 231.1-2 for tracking and trending incidents that do not meet the criteria for reporting to DOE. The FY 2005 contract performance evaluation measurement plan contains an opportunity for improvement to enhance the ANL accident/incident investigation program. In addition to the proposed centralized website for documenting incidents and assessments described in the assessment section above, EQO is also in the early planning stages for an incident investigation training course. ANL has conducted more extensive, cross-organizational investigations of recent events, including the January 2005 gas release at the Center for Nanoscale Materials construction site and the improper disconnection of energized equipment in Building 202. The details of the event and associated conditions were well documented in the recent investigation reports and a number of causes and judgments of need were identified. Although these steps have the potential to strengthen incident investigations, no formal plan has yet been developed detailing all of the intended actions and an implementation schedule; changes to investigation thresholds or to formal laboratory manuals or procedures need to be made; and additional rigor is needed in the identification of root causes, extent of condition, and institutional recurrence controls in incident investigations.

Weaknesses were identified in a root cause analysis for a PAAA noncompliance tracking system issue about deficiencies in design control for fire protection upgrades in nuclear facilities and for the special review of the July 2004 Advanced Photon Source (APS) laser eye injury event. Problems with the fire protection PAAA issue causal analysis included inadequately specified and unclear statements of the problems, insufficient depth in identifying root causes, lack of correlation of identified root and contributing causes to established corrective actions, and unclear derivation of contributing causes, which form the basis of the formal cause tree analysis in the analysis method used. The root cause statements in the conclusions were different than the root causes identified in the text of the report, the root causes statements were unclear, and a contributing cause in the text was changed to a root cause in the conclusions. The report did not formally identify several deficient conditions identified in the analysis as requiring corrective/preventive actions, and some identified root causes were poorly addressed in the corrective action plan (e.g., issues with inadequate communications and drawing deficiencies). Some corrective action statements were not sufficiently specific (e.g., "revise FEC operating procedures") and an action to assign a fire protection "authority having jurisdiction" was performed without establishing the attendant roles, responsibilities, and authorities in any Tier 2 documents. Further, this action did not address the extent of condition in that it did not address the need for an ultimate design authority for other critical design functional areas. Further, the corrective action plan for this PAAA issue did not require re-evaluation of at least two previously completed unreviewed safety question determinations (USQDs) related to the inadequate fire protection design issues (i.e., USQDs 2003-0002 and 2003-0005) that this OA inspection has determined were inadequate.

One concern identified in the review of the laser injury special review was that there was no clear correlation between the many judgments of need identified and the four brief corrective actions tracked in ORPS – the only actions documented and tracked for this event. In addition, the corrective actions did not address the failure of the injured party to report the event in a timely manner and the failure to report to the Medical Department until three days later. The analysis was not sufficient to fully identify the root causes, inadequately stated the causal factors, and did not sufficiently identify the fact that much of the cause of the event resulted from a failure to follow procedures rather than inadequate instructions or controls. The ANL special review report identified a number of lessons learned, including late involvement of root cause analysts, the need for early involvement of ASO, the need for effective standard checklists, and adequacy of assignment of resources to the investigation; however, these concerns were not captured in any tracking system for corrective action.

ANL does not have a structured process for ensuring that subcontractor management formally responds to ANL for imminent danger citations or repetitive lesser violations. Although safety infractions are addressed with sanctions against the individual, subcontractor management are not routinely held accountable for evaluating performance deficiencies and taking appropriate preventive actions.

Some identified deficiencies and opportunities for improvement have not been put into the EQO tracking system. For example, findings from a June 2003 life safety inspection program review were not input to the tracking system. The "Observations" and "Candidates for Improvement Opportunities" cited in the EQO summary letter for the CY 2004 management assessment were not put into the EQO institutional tracking system. A number of actions related to the 2002 OA inspection findings were prematurely documented as complete in the EQO tracking system. For example, actions for findings about validation assessments were documented as complete when the assessment had been put on a schedule, but the assessments were not performed as specified or rescheduled. Corrective actions for many of the findings and concerns identified by OA in 2002, including those related to requirements flowdown, radiation work permits, radiological surveys, feedback and improvement programs, USQs, and TSRs, have not been effective in resolving these deficiencies (see above subsections and Appendices C and E). In many cases, actions in the EQO system are accepted as complete without sufficiently verifying the adequacy of the closure justification documentation.

Finding #14. ANL has not established an effective corrective actions program that ensures that safety deficiencies are appropriately documented and rigorously categorized and evaluated in a timely manner, with root causes and extent of condition accurately identified, and appropriate recurrence controls identified.

Injury and Illness Investigation and Prevention. Injury and illness statistics for recordable and lost workday rates at ANL are about average for comparable SC laboratories and are continuing to show an improving downward trend. However, the investigation and resolution of occupational injuries and illnesses lack sufficient detail, are often undocumented or poorly documented, and are not consistently identifying root causes and recurrence controls, and formal tracking of corrective and preventive actions is rarely performed.

The requirements for occupational injury and exposure investigation and reporting are delineated in ANL ES&H Manual Chapter 1.7, "Incident and Near Miss Reporting and Analysis." Supervisors are required to promptly complete the manager's statement regarding injuries and illnesses on the investigation report form, providing details of the incident and conditions and activities that contributed to the incident, and the corrective actions to be taken. Facts related to cases of OSHA recordable injuries and first aid cases, including evaluations of the conditions and causes and specification of corrective and preventive actions, are documented on forms that are consistent with DOE requirements. The WMO Department has taken the initiative to document injuries/exposures on nonconformance report forms to provide a more structured means to document the details of the events, evaluations, and corrective/preventive actions. The EQO staff maintain the OSHA Form 300 Logs, manage lost and restricted workday cases, and report injury and illness data to the DOE computerized accident/incident reporting system (CAIRS). A comprehensive database facilitates collecting and processing injury and illness investigation information and reporting to CAIRS. An Occupational Injury and Illness Review Committee composed of Medical staff, an ES&H SME, and a line ES&H coordinator meets weekly to discuss new injuries/exposures and to review ongoing cases. This committee provides a good forum for communication, information sharing, case management, and decision making–primarily for recordability and restrictions.

EQO has in recent years identified adverse trends in injuries at ANL or the DOE complex and has taken actions to increase worker awareness of workplace hazards, although the process has not been formalized or performed routinely. Posters were placed in numerous locations across the site that addressed electrical safety and lifting/back injuries and identified actions that workers should take to avoid related injuries.

Although occupational injury investigation and reporting processes are in place and cases are being managed and reported to CAIRS, there are weaknesses in the processes and performance for investigation of injuries and exposures and the development and implementation of preventive actions. Further, the ES&H Manual-defined process for injury and illness investigation inadequately details the roles, responsibilities, and authorities for reporting and evaluating injuries/exposures and documenting corrective/preventive actions.

The OA team examined reporting and investigation case files for a sample of 15 injury or exposure events dating back to January 2003. These files revealed systemic weaknesses in the rigor being applied to the investigation and implementation of the injury/illness program requirements by various ANL organizations. Multiple deficiencies were identified with most case files, and the documentation of investigation was deficient in every case examined. Incident description documents were not completed by supervisors as required by the ES&H Manual. Investigation reports often inadequately described the conditions pertinent to the injury or exposure (e.g., the applicable work control document and whether it was used, identification of the hazard and controls, and the use of proper personal protective equipment or other specified controls). Investigation reports inadequately addressed ISM elements, causes, recurrence controls, and failure to report injuries in a timely manner. Several recent injury events, including a steam burn and significant trauma caused by improperly used tools, resulted from multiple work control deficiencies that did not receive sufficient documentation, analysis, or specification of recurrence controls for similar events. In some cases, there were unresolved conflicts between incident descriptions and investigation conclusions. The investigation form only documents immediate and planned actions and does address or facilitate corrective action tracking. Except for the WMO Department in PFS, corrective and preventive actions were not formally identified or formally tracked to completion, but were handled verbally or via electronic mail. In many cases, division directors had not signed the investigation forms indicating their review and approval, as required by the ES&H Manual. In at least one case sampled by OA, the worker's supervisor had not signed the form either.

Deficiencies in the ANL occupational injury and illness investigation program were identified by a joint ASO/ANL assessment in August 2002. ANL identified six corrective actions based on the assessment, including revision of the ES&H Manual, adding incident reporting and analysis to the required elements to be addressed in the planned FY 2002 EQO independent ISM assessment, review of the results of the independent review and correction of deficiencies, and documentation of the EQO process for reviewing and providing feedback to the divisions on injury and illness case documentation. All the actions have been recorded as complete. However, the ANL corrective action process failed to adequately develop and implement effective corrective actions. The divisional independent ISM assessments lacked sufficient depth and concluded that there were no weaknesses or opportunities for improvement in injury and illness investigation and reporting. This direct conflict with the findings of the ASO/ANL assessment was not discussed or justified in the summary ISM report. The evidence for documentation of the EQO review process was an unsigned sheet listing the responsibilities of EQO personnel that was not incorporated into any formal policy or procedure document. The poor quality of the investigation documentation indicates that neither EQO nor the review committee is performing any quality reviews or providing feedback to line management. The specified corrective actions were inadequate as specified and were not implemented as written, but were closed anyway. Further, no follow-up assessments have been conducted or scheduled by ANL or ASO for issues identified in their joint assessment involving failure to properly report to DOE (CAIRS), and inadequate investigation of occupational injuries. The applicable ES&H Manual section does not require any EQO or ES&H SME technical or quality review of incident investigation reports or incident description forms.

The responsibilities listing for line supervisors and visitor hosts in the ES&H Manual does not include the review or approval of the incident investigation form, although the form requires the supervisor's signature for review and approval. The investigation form is required to be submitted to Medical and EQO within seven days of the incident, and the manual does not address situations where more time may be required to fully evaluate an event and develop appropriate corrective and preventive actions. Line organizations have not developed Tier 3 implementing procedures detailing how injury or exposure events will be investigated and managed.

The manual and employee, visitor, or subcontractor orientation training do not sufficiently emphasize that all occupational injuries, exposures, or potential exposures, regardless of perceived severity, should be immediately reported to supervision and should result in a visit to the Medical Department for evaluation. The manual does not identify the supervisor's responsibility to ensure that injured or exposed workers go for medical evaluation.

Although the ES&H Manual requires calling 911 for emergencies only, the perception of ANL managers and employees stated in discussions with the OA team was that management's expectations and the ANL policy on reporting injuries/exposures is to call 911 for all incidents. This perception could result in a failure to report injuries and could introduce inaccuracies in occupational injury/illness performance statistics. In addition, subcontractors are not allowed to go directly to the Medical Department for treatment, and thus calling 911 is their primary option for reporting an injury. The elevated attention associated with a full response by emergency services can act as a deterrent to voluntary reporting of non-emergency injuries.

Some evidence of a reluctance to promptly report injuries and exposures was apparent in a number of instances occurring in the last three years where injured workers failed to report and seek evaluation or treatment for injuries until the severity of injuries or outside influences caused them to report to supervision or to the Medical Department. In several cases, these delays resulted in more extensive medical attention; several became OSHA recordables and one resulted in hospitalization. The APS laser exposure event in September 2004 was another case of untimely and ineffective reporting.

Finding #15. The ANL injury and illness program lacks sufficient rigor to ensure that incidents are reported and sufficiently documented, causes are identified, and appropriate, effective corrective and preventive actions are identified, documented, and implemented.

Lessons Learned. In 2002, OA determined that ANL had not established a structured, consistently applied process that ensured consistent identification, evaluation, and implementation of applicable lessons learned to prevent events and deviations from requirements. Although evidence indicates that lessons learned are being shared and applied at ANL, the corrective actions were ineffective in improving the level of rigor and formality being applied to the identification and application of lessons at ANL.

The responsibilities and requirements for the ANL feedback and lessons-learned program are delineated in the ES&H Manual. ANL has a designated lessons-learned coordinator responsible for reviewing sources and disseminating selected, applicable lessons learned to EQO group leaders and ES&H/QA representatives. EQO group leaders and the ES&H/QA representatives are also expected to review lessons posted to the DOE list server for applicability and distribute reports to line management as appropriate. Externally generated lessons learned are being screened, evaluated, disseminated, and shared with workers. Internal lessons learned are being generated and disseminated. However, consistent identification, evaluation, and implementation of applicable lessons learned to prevent events and deviations from requirements cannot be ensured because of the lack of formality and rigor in the lessons-learned program.

All lessons-learned reports posted to the DOE list server are transmitted to managers and ES&H/QA representatives in the monthly safety report issued by EQO. ES&H SMEs have issued safety memos on events and lessons learned occurring elsewhere in the DOE complex. There is evidence that both internally and externally identified lessons learned are being communicated to workers through a variety of vehicles, including electronic mails, safety meetings, the *Argonne News*, safety memos posted to the ANL lessons-learned webpage, and presentation at management staff meetings.

The lessons-learned coordinator is establishing a database on the ANL intranet identifying external lessons learned that the site coordinator or EQO director determines needs SME evaluation for applicability and identification of any needed changes in ANL processes. This database will provide a means for consistent documentation of these decisions and tracking of any needed actions to closure. This tool is still in a testing phase and has not yet been approved by management or integrated into ANL Tier 2 documents.

Although many lessons learned are being reviewed, generated, and disseminated, the existing processes and application are still informal. Reviews of applicability and needed action determinations are not required by the ES&H Manual to be documented. Line organizations have not developed any implementing instructions defining how lessons learned are screened, developed, or applied locally. Few specific actions are ever specified as required and are not formally tracked to completion. By far the most used action is to send the lesson to others for information or discussion at safety or staff meetings. (See the discussion of ANL's inadequate application of DOE lessons learned for hoisting and rigging in Appendix F.)

Few formal lessons learned are generated for internal events or work activities and even fewer are communicated outside a division. ANL has not shared lessons learned with the rest of the DOE complex. Only three lessons learned have been submitted to DOE Headquarters for possible inclusion on the DOE list server, and no ANL lessons learned are included in the DOE list server. Formal post-job or post-experiment briefings are not required by procedures or typically used to obtain lessons-learned feedback from workers.

The ES&H Manual has still not been revised to specify the use of a database for logging SME reviews of potentially applicable lessons learned; such a revision was a corrective action for an EQO/ASO FY 2001 program assessment finding, and the absence of a mechanism to record reviews was noted as a weakness in OA's 2002 inspection. Although the new database tool has been created and holds promise for adding structure to the lessons-learned program at ANL, a similar new database was intended to address the same need before the 2002 OA inspection but was never implemented.

Finding #16. ANL has not established a sufficiently rigorous lessons-learned program that ensures that applicable lessons learned are identified and that actions to apply the lessons are taken to improve safety performance and prevent adverse events or non-compliance with regulations.

Employee Concerns Program. ANL has established and implemented several means for employees, contractors, and visitors to voice and obtain objective evaluation and resolution of ES&H concerns. Two programs for reporting concerns are identified in the ANL Human Resources Policy and Procedures Manual. One program is an employee concerns and suggestion program called IMPACT, which in the past has included monetary awards for beneficial suggestions that are accepted and implemented. The IMPACT program forms and posters are located at each official site bulletin board. IMPACT forms are numbered to permit anonymous concerns to be reported and permit concerned individuals to retrieve resolution information. Few significant-safety concerns are being reported through this program. ANL also has a more formal program for filing employee concerns called the problem resolution process, which is administered by the Employee Relations group in the Human Resources organization. Safety concerns are rarely reported through this process.

Worker protection rights and means for employees and contractors to express and get resolution of OSHA and DOE Order 440.1A concerns are communicated to new employees during the ES&H awareness training course and refresher training. An EQO phone number and the DOE CH hotline number are provided, but there is no reference to the ANL employee relations programs described above. In addition, CY 2003 and CY 2004 memorandums from the Laboratory Director to "all hands" reiterating the ANL policies on harassment and "whistleblower" rights posted on site bulletin boards and the employee handbook has a short policy statement on whistleblower rights.

Although various means are available for employees to report and get resolution of safety concerns, several aspects of the ECP could be strengthened. There is no advertisement of the IMPACT program in visitor or new employee orientation or employee refresher training. The IMPACT program is not governed by a current instruction/procedure that defines requirements (e.g., confidentiality measures, investigation and reporting timeframes, disposition reviews, and feedback to the concerned individual), and ANL has not performed surveys of the users or conducted assessments of the implementation of the program.

Other Feedback and Improvement Processes. ANL employs other appropriate means to communicate feedback and initiate improvements in safety programs and performance. Quality and safety recognition awards are given to individuals for significant contributions to the improvement of safety or quality at ANL, with public recognition and articles in the *Argonne News*. A Joint Labor-Management Committee addresses ES&H issues and concerns raised by the represented labor organizations. Issues raised by this committee are put into the EQO corrective action tracking system for tracking to resolution. Several ES&H safety committees and regular meetings between EQO management and line ES&H/QA representatives serve as communication avenues for management expectations and for feedback from the workforce and line ES&H SMEs. Periodic reports of performance indicators and evaluations to the prime contract performance measures also reflect periodic analysis and communication of safety performance.

D.3 CONCLUSIONS

SC Headquarters has been more active and involved in safety at its sites. SC has established processes for developing performance indicators, setting goals, and monitoring performance measures across SC laboratories. This management focus has contributed to a generally improving trend in performance indicators at SC laboratories, such as the TRC and DART indicators. ASO has established processes for conducting operational awareness activities and evaluating contractor ES&H performance, and has made some improvements in its feedback and improvement processes. In addition, ASO is making effective use of the ANL contractual mechanism for driving improvements in worker safety and in performance in achieving environmental management system milestones.

Although some aspects of ASO's oversight of ANL performance are effective, there are a number of weaknesses in ASO assessment activities that limit their effectiveness. ASO operational awareness activities are not always being conducted with sufficient rigor and focus on observing work and ANL feedback and improvement processes to prevent recurrence or drive continuous improvement in the laboratory. ASO has not yet established sufficient systems to provide feedback on the implementation and effectiveness of ASO operational awareness activities to ensure that management expectations are being fully met. In addition, ASO has not established and implemented a fully effective issues management and corrective action process that ensures that safety deficiencies identified through ASO line management oversight activities are appropriately documented and tracked to closure. Verification of closure and effectiveness of corrective actions for deficiencies previously identified by ASO and by OA in its 2002 inspection has not always been sufficiently rigorous to prevent recurrence or drive continuous improvement of the contractor.

A variety of feedback and improvement activities are conducted at ANL and some ANL organizations have made improvements in feedback and improvement. However, the process and implementation deficiencies identified in the 2002 OA inspection continue to exist. ANL conducts assessments, inspections, and management walkdowns, identifies and corrects deficiencies, and shares lessons learned. In many cases, however, these activities are not proactively planned and scheduled, and the resolution of deficiencies is often informal. Little trend analysis of safety issues is performed. Some mandatory assessments are not being performed. Weaknesses were identified in the rigor applied to documenting the investigation of occupational injuries and exposures and the identification and implementation of preventive actions. Institutional policies, expectations, and procedures inadequately define the roles, responsibilities, authorities, and requirements for implementing Core Function #5 of ISM. There are few organizational implementing instructions. A number of cases of failure to comply or inconsistent compliance with specific institutional requirements were identified. ANL management has not ensured that sound feedback and improvement programs have been developed and effectively implemented. Management has not set sufficiently rigorous thresholds for acceptable ISM processes and performance.

As discussed in Appendix E, ASO and ANL feedback and improvement systems, including ASO safety system oversight and the ANL cognizant system engineer program, are not effective and do not meet applicable DOE requirements. Important elements of this program are missing or are not sufficiently effective, such as a rigorous configuration management program and effective condition assessments, and have not been afforded management priority or resources. The deficiencies in these important elements are contributing to the failure to correct identified deficiencies in TSRs, USQ processes, and various other aspects of nuclear safety. For example, ASO and ANL feedback processes do not provide for adequate verification of TSR compliance, and two TSR violations were identified by OA during this inspection.

As discussed in Appendices C and E, two important areas (the radiation protection program and nuclear safety systems) are subject to regulatory requirements and have continuing deficiencies. Through previous assessments, including the 2002 OA assessment, ASO and ANL management were aware of deficiencies, including potential regulatory violations. In these areas, ASO and ANL management did not establish clear expectations for full compliance, identify needed corrective actions, and set up the feedback mechanisms to ensure that their expectations were fully and effectively implemented.

Overall, ASO and ANL have made improvements in various aspects of their feedback and improvement systems as applied to non-experimental work activities. However, these improvements are not sufficiently effective in correcting some previous deficiencies and have not been effective in identifying and correcting deficiencies in some institutional programs, such as the medical surveillance and radiation protection programs. Further, ANL has not adequately established expectations for full compliance with radiation protection and nuclear safety system requirements and established feedback and improvement systems that are sufficient to ensure full compliance and effective performance in these areas.

D.4 RATING

Core Function #5 – Feedback and Continuous Improvement......................... SIGNIFICANT WEAKNESS

D.5 OPPORTUNITIES FOR IMPROVEMENT

SC

1. **Consistent with ongoing One SC Project re-engineering efforts to evaluate SC management systems and processes, determine whether sufficient SC Headquarter processes and mechanisms have been established to periodically ensure that SC sites offices have fully established and effectively implemented all of the feedback and improvement elements and criteria of DOE Order 414.1B**. Specific actions to consider include:

   - Ensure that all SC site offices have developed and submitted to SC for approval site office QA plans that fully address and implement the QA criteria in DOE Order 414.1B.

   - Ensure that SC has established sufficient mechanisms that periodically and formally assess the adequacy and effectiveness of SC site offices' management systems and processes for implementing their QA plan, as required by DOE Order 414.1B.

2. **Ensure that annual management self-assessments of the ECP program are identified and scheduled as required by DOE Order 442.1A.**

3. **Evaluate options for providing additional ES&H support to site offices in the area of nuclear safety and other ES&H areas as appropriate.** Consider using service center expertise and other expertise within SC as well as external expertise.

ASO

1. **Strengthen ASO processes and oversight activities for formal documentation, communication, and tracking the resolution of ANL performance deficiencies identified through ASO operational awareness activities.** Specific actions to consider include:

    - Increase ASO management involvement in the development of the new FR database system. Clearly set expectations and requirements for system use; set the necessary minimal data entry requirements; and ensure that management report requirements have been factored into its development.

    - Ensure expectations for documenting and reporting FR/SME activities for verification and closure of effectiveness of laboratory actions to address findings listed in ORPS and that deficiencies/findings from external and ASO reviews are clearly established in ASO procedures and captured in tracking systems such that they are readily identifiable and retrievable.

    - Re-evaluate all informal and formal (FR monthly reports, ASO issues and priorities listing) reporting mechanisms to ASO and ANL and ensure that performance information is appropriately captured and effectively communicated to both ASO and ANL management.

2. **Strengthen ASO performance and management involvement in line management oversight activities.** Specific actions to consider include:

    - Set minimal performance expectations on the number of formal documented surveillances of work activities to be performed in a given time period. Ensure that the results of the surveillances are clearly documented in FR databases and clearly reported in FR monthly reports.

    - Increase the rigor and effectiveness of ASO FR/SME functional area review activities by establishing expectations for development and *supervisory review* of formal written evaluation plans as part of the functional area review process.

    - Ensure that functional area reviews always include a sample of appropriate contractor corrective actions for follow-up and evaluation of effectiveness of corrective action and evaluation of the laboratory's self-assessment program as an integral part of the scope of the area being reviewed.

    - Consider formally scheduling ASO direct observation of selected laboratory assessments, with formal ASP reports developed and issued to the laboratory, critiquing the rigor, depth, and breadth of the laboratory's assessment.

    - Conduct training and/or establish mentoring of ASO FRs/SMEs in techniques in performance-based observation of work activities.

    - Consider performing a review of APS ES&H during normal operations to ensure that operational ES&H concerns similar to those identified in this OA inspection are identified and addressed.

3. **Develop site-office-wide policy and implementing procedures that address the essential elements of an effective corrective action/issues management program.** Specific actions to consider include:

   - Ensure that the following items are addressed: reporting vehicles and tracking tools; a process for determination of priority, determination of extent of condition, and causal analysis; assignment of ownership; expectations for developing corrective actions that prevent recurrence; corrective action plan (CAP) and closure approval requirements (supervisory review); timeframes for executing process steps and for extending due dates; closure, and verification; and expectations for conduct of effectiveness reviews, consistent with DOE Order 414.1B.

   - Ensure that ASO corrective action management systems are coordinated with ANL/EQO issues management systems to ensure consistency and eliminate unnecessary redundancy.

   - Develop a mechanism for routinely reporting and updating ASO management on the status of actions.

4. **Increase ASO management involvement in the issues management processes.** Specific actions to consider include:

   - Increase ASO involvement and oversight of ANL reviews in CAP verification and closure actions. Clearly set expectations that effectiveness of corrective actions has just as much overall importance as meeting or completing schedule commitments.

   - Ensure that CAPs for safety issues submitted by the Laboratory contain appropriate effectiveness elements and mechanisms throughout the implementation of the CAP management to provide opportunities for midcourse changes/direction as well as for final verification of overall effectiveness of actions at closure of the overall CAP.

   - Ensure that the root cause analyses required of the laboratory as part of the CAP development process were appropriate, and in particular, for cases where previous actions were determined to be ineffective and/or repetitive performance concerns were identified.

   - Consider developing a checklist for ASO staff to use when reviewing CAP submittals by ANL to ensure the consistency, quality, and completeness of the reviews.

ANL

1. **Strengthen the self-assessment program to ensure that safety programs, processes, and performance are being appropriately and rigorously evaluated based on a structured analysis of activities, conditions, and risks.** Specific actions to consider include:

   - Designate an institutional-level owner of the ANL self-assessment program with specified responsibilities and authorities to monitor, evaluate, and ensure effective implementation of the program at all levels.

   - Expand the purpose and scope of the QAPP procedures on assessments and management walkthroughs to address Laboratory-wide requirements, or re-name and transfer the existing limited scope, institutional-level procedures to another document. Ensure that detailed implementation procedures specifying the processes for conducting self-assessments are either established at the institutional level or within Laboratory organizations. Conduct rigorous evaluations of the adequacy of formal organizational processes.

- Further clarify requirements for identifying areas for self-assessment and developing self-assessment schedules.

- Provide training and mentoring for team leaders, supervisors, and workers on assessment and job observation techniques to improve the effectiveness of self-assessments and surveillance activities.

- Develop mechanisms to ensure that assessments mandated by external organizations and regulations and internal documents are being performed, are rigorous, and comply with requirements.

- Provide mandatory training and mentoring to the divisions and departments in the planning, conduct, and documentation of assessments and job observations. Consider developing workshops where required processes and practical techniques are taught to organizational assessment teams through the conduct of actual self-assessments as part of the workshop.

- Establish control mechanisms and perform formal, rigorous monitoring of line performance of self-assessment until continuing, effective implementation has been demonstrated and verified.

2. **Ensure that a cohesive, comprehensive corrective action program is formally established and implemented that includes the essential elements of an effective issues management program.** Specific actions to consider include:

    - Establish an institutional owner for issues management with the specified responsibility and authority to monitor and ensure effective implementation of the program.

    - Establish a single process and tracking system for ES&H deficiencies and corrective actions regardless of the source of the issues to ensure consistent evaluation and disposition of safety deficiencies based on the substance of the issue rather than its source.

    - Further clarify and strengthen the requirements for the management of resolution of safety deficiencies in the QAPP and implementing procedures. Ensure that the following program elements are addressed: reporting vehicles and tracking tools (including a general deficiency or problem report); a process for determination of risk/significance/priority (application of a graded approach) and determination of extent of condition and institutional issues; causal analysis, including root and contributing causes (applied to all items, but with rigor based on a graded approach); reporting in accordance with PAAA and ORPS; assignment/reassignment of ownership; expectations for developing corrective actions that prevent recurrence; CAP and closure approval requirements (supervisory review); timeframes for executing process steps and a process for extending due dates; closure and verification (on a graded approach and/or sampling basis); and including effectiveness reviews in CAPs for significant issues and for trending and analysis of issues.

    - Conduct formal training for line organizations in the requirements and effective techniques for issues management.

    - Develop mechanisms for routinely communicating the status of corrective actions to senior management and for holding management accountable for performance.

- Strengthen the process and rigor applied to verifying and validating the adequacy of closure of corrective actions for institutional-level weaknesses and issues.

- Strengthen the institutional process for conducting incident investigations to ensure that incidents that do not meet the thresholds for reportability to the ORPS are consistently documented and investigated, with appropriate corrective and preventive actions identified and implemented (tracked in a formal corrective action system). Ensure that line organizations develop implementing instructions as appropriate. Include mechanisms to conduct the collective analysis and trending required by DOE reporting standards.

- Strengthen construction safety processes to ensure subcontractor management engagement and ownership of performance deficiencies by establishing guidance and thresholds requiring formal responses from subcontractor management to incidents.

- Develop and issue an implementation plan for the planned incident investigation program enhancements.

3. **Significantly strengthen the occupational injury and exposure investigation and reporting processes to ensure that these events are thoroughly documented and analyzed, with causes determined and appropriate preventive actions identified and implemented.** Specific actions to consider include:

   - Revise ES&H Manual Chapter 1.7 to more fully detail the requirements for rigorous documentation and investigation of occupational injuries and exposures to address the core functions of ISM, analysis of the causes of the event, and implementation of effective recurrence controls. Consider revisions to the investigation form ANL-240 to better support documentation of the investigation and additional requirements.

   - Formally designate a program owner with ES&H expertise, and specify in institutional documents their responsibilities and authorities to monitor and ensure rigorous and effective implementation of this program.

   - Establish formal oversight processes and controls to ensure that incident description and investigation reports are completed by line supervisors, meet requirements for completeness and quality, and are approved by the appropriate level of line management.

   - Document deficiencies identified by injury and illness investigations and resulting corrective and preventive actions in formal corrective action tracking systems.

   - Clarify policies and requirements for the thresholds for prompt reporting of all injuries and exposures or potential exposures, regardless of perceived severity, and for obtaining prompt evaluation by medical staff. Include discussion of these policies in visitor, employee, and subcontractor ES&H orientation training and re-training.

   - Consider clarifying the criteria or perceptions for engaging emergency services (dialing 911) for all injuries and exposures, especially for subcontractors. Permit and encourage going directly to the medical clinic without the aid of emergency services for non-emergency injuries and exposures.

4. **Strengthen the lessons-learned program to provide assurance that lessons learned are consistently screened for applicability and needed actions for application and that formal feedback is formally solicited from workers.** Specific actions to consider include:

   - Incorporate more rigor into the lessons-learned processes, to include documentation of lessons-learned applicability reviews by SMEs and line organizations that ensures that any necessary actions are identified, tailored to the conditions and processes at ANL, and implemented as required. Accelerate the approval, incorporation into Laboratory documents, and application of the database for documenting and tracking lessons-learned reviews.

   - Incorporate explicit expectations into institutional documents and procedures for training plan development and work planning that lessons learned are to be reviewed and applied to these activities. Include controls to document that lessons learned (e.g., what lessons learned) were reviewed during development of training and work documents.

   - Establish processes for formal documentation and resolution of post-job reviews for maintenance work packages and construction project and experimental activities to promote direct worker feedback and procedure improvement.

APPENDIX E

Essential System Functionality

E.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) evaluated essential system functionality (ESF) at Argonne National Laboratory (ANL). The ESF evaluation focused on two facilities at ANL: the Alpha-Gamma Hot Cell Facility (AGHCF) in Building 212, and the G and K Wing Laboratories in Building 205. OA also performed a limited review of ANL's compliance with DOE Order 420.1, *Facility Safety*. OA also assessed nuclear facility safety systems oversight and the unreviewed safety question (USQ) program. The safety system oversight review examined DOE oversight by the Argonne Site Office (ASO) and the ANL nuclear safety organization and internal feedback and improvement systems as applied to safety systems in nuclear facilities at ANL. The safety system oversight review is discussed in this appendix to better present insights relevant to the observed weaknesses in safety systems at ANL; however, the evaluation of safety system oversight is reflected in the evaluation of feedback and improvement systems in Appendix D.

AGHCF is operated by the Energy Technology Division. Building 205 G and K Wing Laboratories are operated by the Chemical Engineering Division. The review of AGHCF examined selected safety-significant systems, including the fire protection system, the hot cell structure, the nitrogen inerting system, the pressure relief vents, and the exhaust ventilation systems, including their engineering design, configuration management, surveillance testing, maintenance, and operations. The review of G and K Wing Laboratories focused on the documented safety analysis (DSA) aspects of their engineering design.

The purpose of an ESF assessment is to evaluate the functionality and operability of selected structures, systems, and/or components (SSCs) in a facility that are essential to safe operation. The review criteria are similar to the criteria for the Defense Nuclear Facilities Safety Board Recommendation 2000-2 implementation plan reviews; however, the OA reviews also include technical evaluations of the selected SSCs' design, operation, maintenance, testing, and other technical disciplines. These reviews also address a facility's authorization bases, its configuration management program, and other related programs, such as the USQ program. The reviews included analysis of system calculations, drawings and specifications, vendor documents, facility-specific technical procedures, facility walkdowns, and interviews with system engineers, design engineers, maintenance and testing engineers, operators, technical managers, and other technical support personnel.

E.2 RESULTS

E.2.1 Engineering Design and Compliance with DOE Order 420.1A, *Facility Safety*

ANL's nuclear facilities are subject to the DOE nuclear facility regulations of 10 CFR 830; thus, they are required to maintain an approved DOE DSA, which defines the authorization basis for operations. Representations made in these documents are considered legally binding as they function to implement the nuclear facility requirements of 10 CFR 830. ANL's nuclear facilities also must comply with DOE Order 420.1A, *Facility Safety*.

Compliance with DOE Order 420.1A. The OA team's review of ANL's implementation of DOE Order 420.1A identified various areas where ANL did not fully comply with the order. Specifically, natural phenomena hazards mitigation, the cognizant system engineer program, and elements of the fire protection design requirements were not fully compliant.

- **The AGHCF and the G and K Wing Laboratories did not implement all of the natural phenomena hazard requirements of DOE Order 420.1A.** The DOE order requires SSCs to be capable of withstanding the effects of natural phenomena to ensure life safety and confinement of hazardous material. It also requires the site to consider potential damage and failure of SSCs and interactions from failures of other SSCs. The DOE order additionally states that for existing sites, a review of the natural phenomena hazards assessment is to be conducted at least every 10 years. The AGHCF's natural phenomena hazards assessment was performed in 1994 and is overdue for the 10-year review. In addition, the 1994 assessment was a preliminary assessment and did not receive an independent review. This order further requires facilities or sites with hazardous materials to have instrumentation or other means to detect and record the occurrence and severity of seismic events. It requires facilities or sites with hazardous materials to have procedures that include inspecting the facility for damage caused by severe natural phenomena and placing the facility into a safe configuration if such damage occurs. Neither the AGHCF nor the G and K Wing Laboratories had implemented these requirements. The OA team's review of SSC failures and interactions as a result of natural phenomena hazards for these facilities is further discussed later in this section.

- **ANL did not implement some of the cognizant system engineer program requirements of DOE Order 420.1A.** ANL has not established expectations for the program and defined and implemented the required training. The order requires the application of configuration management to ensure consistency among system requirements, performance criteria, system documentation, and physical configuration and assigns the cognizant system engineer as the responsible individual. The Building 205 system engineer was unaware of this responsibility but had independently started this task. The Building 212 system engineer was aware of this requirement and had started this task; however, little progress has been made. The order also requires system engineers to ensure that condition assessment surveys are performed that include periodic review of system operability, reliability, and material condition during facility inspections required by DOE Order 433.1, *Maintenance Management Program for DOE Facilities*. The Building 205 system engineer had not determined the results of the latest condition assessment surveys. (See Section E.2.6 for further discussion of the cognizant system engineer program.)

- **The AGHCF is not fully compliant with fire protection design requirements as specified in DOE Order 420.1A.** Although most elements of the DOE order for the design of fire protection systems had been implemented, certain attributes were absent or not completely compliant. Contrary to the order requirement, there is an inadequate water supply for fire suppression in areas immediately adjacent to the hot cell for the AGHCF. Additionally, a means of containment to prevent the release of significant quantities of fire fighting water to the environment or other areas of the facility, as recommended in the fire hazards analysis (FHA), was not present. Further, there were no plans for taking actions to prevent or mitigate a release. Water containment is a requirement of the order when required by the FHA or safety analysis report (SAR) in conjunction with other facility and site environmental protection measures.

A contributing factor to the non compliances is that the ANL compliance action plan for DOE Order 420.1A was deficient. It did not identify any actions required for natural phenomena hazards, did not provide an effective flowdown of the required actions for the cognizant system engineer program, and did not incorporate all of the fire protection design requirements.

Finding #17. ANL has not fully implemented the requirements of DOE Order 420.1A for the natural phenomena hazards, cognizant system engineer, and fire protection programs.

AGHCF Engineering Design. The AGHCF has been operating since 1964. The facility conducts analysis of highly irradiated, alpha-emitting samples, such as plutonium-bearing fuel elements. The AGHCF consists of a multi-curie, nitrogen-atmosphere hot cell, the Electron Beam Laboratory, and other small laboratories and ancillary rooms. AGHCF is designated as a Hazard Category 2 nuclear facility.

The original SAR and technical safety requirements (TSRs) for the AGHCF were developed in the early 1990s. They were periodically updated as requirements changed. The current version is dated October 2001. The OA team review of the SAR and TSRs identified deficiencies in the SAR content and supporting documentation and a number of non-conservative assumptions, errors, omissions, and inconsistencies, which are discussed below. These deficiencies indicate that ASO and ANL did not thoroughly review the SAR and TSRs to validate compliance with 10 CFR 830 when the regulation was put into effect, and the current SAR does not meet 10 CFR 830 requirements.

During the review of the SAR and TSR, the OA team generated a number of questions about the supporting basis for the conclusions or assumptions documented in the SAR for most of the design basis events (DBEs). ANL was not able to produce formal documentation (e.g., analyses and rigorous calculations that are independently verified) to support the SAR conclusions/assumptions. ANL also indicated that the archived information was in draft form, and there was little or no evidence of an independent review. ANL subsequently determined that a detailed analysis was warranted and decided that a potentially inadequate safety analysis (PISA) existed. Currently, corrective actions are being planned that will include revising the SAR and TSRs to ensure that they are 10 CFR 830-compliant.

A number of non-conservative assumptions, errors, omissions, and inconsistencies were identified in the SAR. ANL plans to address some of these deficiencies as a part of the preparation of the 10 CFR 830-compliant DSA. It has issued an occurrence report stating that the PISA process has been entered in response to these deficiencies. Specific examples include:

- From the SAR discussion of the worst DBE case fire, that is, the “in-cell fire” as a result of an airplane crash, it is clear that the airborne release fraction (ARF) values did not consider the additional combustible material in the cells from the airplane’s fuel. Although the supporting analysis for this event was unavailable, discussions with the facility staff indicated that the ARF times release fraction (RF) value used for this analysis was the same as for the seismic event, 1E-3. However, DOE Handbook (HDBK)-3010 normally used for such analyses indicates that the ARF times RF values applicable to this DBE should be 1E-2. The handbook recommended this value for the scenario “Airborne release of particles from disturbed molten metal surfaces (i.e., flowing metal, actions resulting in continual surface renewal), high turbulence at surface.” This scenario most closely correlates to a jet fuel induced in-cell fire, which could involve molten metal and high turbulence at the surface due to the fire-induced rapid air flow. The tenfold increase of ARF times RF value would result in a tenfold increase in the offsite consequences, which would be significantly in excess of the 25 roentgen equivalent man (rem) evaluation guideline limit. This would then require the mitigation SSCs to be safety-class rather than their current safety-significant classification.

- The material at risk (MAR) used in the DBE analyses is significantly less than the allowable inventory values in TSR Section 5.3.1. The DBE analyses are based on the criticality limit values, which are significantly less than the allowable inventory, and on some finite nuclear fuel burn-up prior to its entry into AGHCF, which is also a non-conservative assumption with respect to potential exposure consequences. However, there are no procedures in place to assure that these DBE assumptions would not be exceeded. The contractor stated that an operations order would be issued to address these issues. However, this measure may not adequately resolve the issues, since it is based on the assumption that materials stored in Area 2 would not be included in the MAR. The storage in Area 2, although robust, is not in DOE-approved containers, and there is no analysis to demonstrate that this material would not be affected by the evaluation basis earthquake or the aircraft impact with the ensuing fire.

- The assumptions for the earthquake DBE are non-conservative. The material at risk for an in-cell seismically induced fire was considered to be 0.5 percent of the maximum hot cell inventory from cutting losses; all other cell inventory was assumed to be contained. The analysis did not consider the uncontained material (e.g., material being machined or otherwise out of the containers), or that containers might be breached due to impact from other equipment that is not seismically qualified or secured or from the fire itself.

- For the same event, SAR Table 3-10 lists the frequency as extremely unlikely (1E-6). This value is considerably lower than the frequency for a design basis earthquake, 2E-3, which apparently is based on the additional factor of the probability of the loss of the hot cell integrity based on loss of the windows/seal integrity. However, the analysis did not address the numerous other cell penetrations, such as for the ventilation system and the nitrogen system, that are not seismically analyzed and whose failure could essentially eliminate that second factor and thereby increase the overall frequency.

- The FHA is incorporated into the SAR by a Chapter 4 reference and does not conform to the current facility configuration. The Chapter 4 paragraphs (4.4.10.2 and 4.4.10.3) covering the fire suppression system refer to the Building 212 FHA report for specific details of the system description and the system functional requirements, respectively. As such, the FHA is part of the SAR. There are inaccuracies in the FHA and it does not conform to the current facility configuration. For example, it does not reflect significant fire protection modifications performed since issuance of the SAR. Specifically, the addition of sprinklers to certain areas, such as adjacent to the hot cells, is not reflected in the FHA system description. Also, a significant upgrade to the fire detection system is not reflected. Additionally, the FHA inaccurately refers to the nitrogen and ventilation systems as safety-class (at the time the FHA was written it was unknown what safety classification these systems were required to be). As part of the safety-class system discussion, the FHA references the system requirements and makes recommendations that do not apply to these systems as currently classified.

- The SAR probability classification of a fire external to the hot cell is not conservative. The DBE for fires or explosions external to the hot cell leading to loss of a window tank are classified as extremely unlikely. This probability is non-conservative because the FHA states that most areas contiguous to the hot cell have limited amounts of combustibles present but identifies exceptions for Rooms F-105, 106, and 113. Room F-105 is used for combustible storage, Room F-106 contains a storage cabinet for flammable liquids, and Room F-113 contains such combustibles as wiring insulation, paper, and plastic, which can be from light to moderate in quantity. Additionally, Room F-110 contains such combustibles as a trash can for the collection of plastic shoe covers, shelves with shoe covers, laboratory coats on racks, and various electrical devices. All these areas are either adjacent to or in close proximity to the hot cell windows. Procedure HFS-Policy-404, “General Fire Safety,” is general in nature and does not provide the combustible control necessary for these areas. The FHA concludes that an exposure fire (fire outside the hot cell) is postulated as being the greatest fire threat to the Alpha-Gamma Hot Cell. The implications of the change in the probability are significant. The consequences limit for the unlikely events provided in the evaluation guideline is 5 rem. The analyzed consequences for this event are in excess of 6 rem; thus, the safety-significant systems for the AGHCF should have been designated safety-class.

- The tornado DBE consequences are not conservative. This DBE only considered the consequences associated with the release of the contaminated filter. The DBE considered the loss of nitrogen piping and ventilation fans but did not address implications of the cell boundary envelope breach. Therefore, this DBE could lead to the pyrophoric reaction similar to the seismic event. Thus, the consequences would be significantly higher than the SAR description.

10 CFR 830.205 requires contractors to develop TSRs derived from the SAR. Significant deficiencies were identified in the completeness and adequacy of the AGHCF's translation of the SAR-identified important-to-safety performance requirements for SSCs into the TSRs.

- There is no TSR requirement that the inerting nitrogen solenoid cut-off valves be tested. These normally open valves must close for conditions where loss of negative pressure may compromise confinement. No procedure or normal operating practice verified this function.

- There are no TSR controls on the liquid nitrogen supply tank levels. These tanks provide nitrogen for cell inerting and preventing the entry of air near penetrations for shielding windows and manipulators. Level controls are necessary to assure an adequate supply for all normal and off-normal conditions, such as the unavailability of normal delivery. Such controls are typically carried out through operator rounds procedures requiring periodic tank-level checks and documentation.

- There is no TSR administrative limit on cell pressure. For confinement, TSR 3.2.1 requires cell pressure to be maintained negative relative to the surrounding areas. There is no TSR administrative limit, which accounts for instrument uncertainty, to ensure that this requirement is met.

- The TSR requirement to monitor cell pressure is ambiguous. TSR 4.2.1.5 simply requires continuous monitoring of the cell pressures. Although a chart recorder continuously *records* cell pressures, there is no TSR or procedural requirement that someone periodically observe and note the pressures to ensure that they are within the TSR limit and not trending adversely. Such a requirement is typically contained in the TSRs and executed through the operator rounds procedures.

- The TSRs contain no formal controls for the charcoal filters. The charcoal filters in the cell exhaust system are an element of the cell confinement system and their function is to remove radioactive gases and volatiles not removed by the high efficiency particulate air (HEPA) filters. Although current facility practice is to replace the charcoal filters approximately every six months (informally based on antimony-125 levels), there are no TSR criteria for their replacement or testing.

- The fire suppression system TSR limiting condition of operation (LCO) is deficient. It includes establishing a fire watch within one hour in the event of non-operable fire suppression but does not define limits for how long this condition can be maintained before the facility must enter a limited operation condition.

- The TSRs' LCO "ACTION" statement logic is not consistently defined in terms of completing an "ACTION" statement. One statement for the TSR LCO logic is that if the first "ACTION" cannot be satisfied, the next listed "ACTION" should be taken. Another requires "ACTIONS" to be met by the completion time interval but does not define when the time interval starts (e.g., at the start of the LCO or when the previous "ACTION" statement has not been completed and the next "ACTION" statement is started). Another part of the TSRs states the failure to meet an LCO "ACTION" is a violation of the TSRs.

The OA review identified several examples where requirements related to design in the SAR were not properly incorporated into the function of the SSCs supporting the hot cell.

- The safety-significant AGHCF fire suppression system design is inadequate to perform its SAR-defined safety function. It has insufficient water pressure in areas adjacent to the hot cells to be operable. The FHA, which by reference is a part of the SAR, states that an exposure fire (fire outside the hot cell) is the greatest fire threat to the Alpha Gamma Hot Cells. Per the SAR, the fire suppression system is the first line of defense against such a fire. The required design flow for the areas adjacent to hot cells, based on the current ordinary hazard classification, is 370 gallons per minute. Current hydraulic calculations indicate that a residual supply header pressure of 98 pounds per square inch gauge (psig) is required to achieve this flow. A static pressure of greater than 100 psig is estimated to be required to provide this level of residual pressure. Current typical static pressures are in the range of 70 psig to 75 psig. The design requirements, therefore, are not met with the currently designed and installed system and the available static pressure. Therefore, the current system design is inadequate and the system is considered to be inoperable by the OA team. Operability embodies the principle that an SSC can perform its SAR safety function. DOE Guide 423.1-1, *Implementation Guide for Use in Developing Technical Safety Requirements*, states: "A system is considered operable as long as there exists assurance that it is capable of performing its specified safety function(s)." To perform its safety function, the suppression system must be able to deliver 370 gpm through the currently installed suppression system piping configuration; this would require a water pressure of 98 psig. Contrary to these requirements, the actual system pressure is significantly less than this (70 to 75 psig); therefore, this assurance does not exist. The SAR clearly takes credit for the operability of this system in numerous locations, and the SAR is an extension of the regulation, and thus its provisions are enforceable as written. If the fire suppression system is not as critical as represented in the SAR, a modification needs to be made to the DSA using approved processes and must be DOE-approved. As a result of the current condition, workers may be placed in greater danger than is currently analyzed as a result of a fire that could compromise the hot cell confinement. This condition was originally identified in the 1993 FHA and again in the 2002 OA assessment. As a result of OA's observations, the facility staff has decided to aggressively remove combustibles and flammable liquids from the facility.

- The current fire suppression system TSR-required minimum static header pressure of 40 psig is inadequate for system operability. This condition was first identified in the 2002 OA assessment. In response to the OA finding, the facility imposed, through a procedure and without changing the TSR, a higher administrative pressure limit of 65 psig, which was also inadequate for system operability. The administrative limit was not based on analysis but rather an estimate of what is typically an adequate pressure for suppression systems. The facility also generated two unreviewed safety question determinations (USQDs), as described in the USQ section of this report, both of which incorrectly determined that no USQ was involved with this discovery (see Section E.2.2).

Finding #18. The safety-significant AGHCF fire suppression system is inoperable, and therefore a fire outside a hot cell could compromise cell confinement and shielding and could result in greater worker exposure than is currently analyzed.

- The cell high-pressure alarm setpoint is non-conservative. The current setpoint of +0.05 inches water column (in. w.c.) provides an alarm only *after* the cell negative pressure TSR limit has been violated. An appropriate setpoint would be at some margin below the TSR limit such that for a slow acting loss of negative pressure condition, the operator has reasonable opportunity to take corrective action *before* the TSR limit is violated.

- The range of the cell pressure monitoring instruments is inadequate. Their range is ±1.0 in. w.c.; the full normal and abnormal operating pressure range of the cells is +0.12 in. w.c. to - 2.1 in. w.c.

Finding #19. The AGHCF safety analysis report (Chapter 4, "Safety SSC"; Chapter 3, "Hazard and Accident Analysis"; and Chapter 5, "Derivation of TSR Requirements"), the G and K Wing Laboratories' DSA, the technical safety requirements document, and supporting records contain numerous omissions, inconsistencies, and non-conservative statements and do not fully meet the requirements of 10 CFR 830.

G and K Wing Laboratories Engineering Design. G and K Wing Laboratories are situated on the ground floor of Building 205. The facility consists of two segments. One segment is a complex of seven laboratories in G Wing. The second segment is in K Wing and consists of three shielded cells, an operating room, and a laboratory/support-service area. For more than 45 years, these laboratories have been used mainly for experimental work with radioactive materials. The G and K Wing Laboratories facility is designated as a Hazard Category 3 nuclear facility based upon the inventory of radionuclides present.

The current DSA is dated January 2005. The OA team review determined that the DSA meets the format requirements of the DOE Standard (STD)-3009, but the DSA was not thoroughly reviewed to validate compliance with all aspects of 10 CFR 830. As described below, the OA team identified deficiencies in the DSA's supporting documentation. Also, the DSA contains a number of non-conservative assumptions, errors, omissions, and inconsistencies (see Finding #19). Specific examples include:

- Contrary to the requirements provided in DOE-STD-3009, the DSA did not provide a radiation exposure estimate of the bounding analysis. In response to this deficiency, the contractor performed a preliminary evaluation. This preliminary evaluation indicates that the unmitigated onsite releases to the co-located worker are less than 2 rem, using the maximum allowed inventory and ARF of 1.0. If this preliminary evaluation is correct and validated, then G and K Wing Laboratories may not need any safety-significant SSCs.

- The seismic analysis credited in the DSA for the ability of this facility to survive the evaluation basis earthquake with the reduced peak ground acceleration of 0.05 has not been developed.

- The DSA did not correctly address facility segmentation. The DSA did not address the requirement in DOE-STD-1027-92 for applying the concept of independent facility segments where facility features preclude bringing material together or causing harmful interaction from a common severe phenomenon.

- The K Wing hazards analysis did not evaluate and document fire and earthquake accidents.

- There is unexplained variation in the MAR used for the accident analysis in the G Wing, and the approach contradicts the requirements of DOE-STD-3009-94. Appendix A, Hazards Analysis Tables, provided further segmentation of the G Wing. The hazards addressed in the individual rooms, in most cases, assumed that MAR was the room's current fissionable material limit (except for Room G-

101). Application of the earthquake and fire hazards was not uniform. Some rooms considered fire and/or earthquake hazards; most did not. For the entire G Wing, only a fraction of the entire G Wing MAR was considered for the earthquake and fire hazards.

Summary. ANL does not fully comply with DOE Order 420.1A requirements in the areas of natural phenomena hazards, required actions for the cognizant system engineer program, and fire protection design requirements. The SSCs reviewed were not appropriately designed to perform their safety functions under design basis conditions. The safety-significant fire suppression system for the AGHCF is inoperable because of insufficient water pressure. The DSAs for both facilities contain several omissions, inconsistencies, and non-conservative statements and insufficient supporting information. For the AGHCF, not only do these deficiencies indicate that the SAR is not 10 CFR 830-compliant but the consequences may be significantly underestimated. ANL responded by declaring a PISA to provide an opportunity to address multiple questions identified by personnel.

E.2.2 Configuration Management

The AGHCF was reviewed for its implementation of configuration management programs. The AGHCF staff recently identified these areas as deficient and has taken the initial steps to make some improvements in a few configuration management areas. However, much work remains to be accomplished. Several current AGHCF practices and procedures were inadequate with respect to the rigor required for configuration management for a DOE Category 2 nuclear facility (see Finding #20). For example, the Facility Engineering and Construction Department and AGHCF have no engineering process procedures for such functions as preparation of design calculations, design modification packages, and other engineering processes. These procedures are necessary to ensure design consistency and compliance to the SAR and applicable codes and standards. In addition, many AGHCF procedures contain a common weakness in that data and sign-off sheets are not included in the procedure (see Section E.2.3). Further, there are a number of configuration control deficiencies in the maintenance program and practices. The AGHCF has no formal controls of replacement parts and does not have an adequate master equipment list. In addition, outside organizations' testing and maintenance procedures are not adequately reviewed. (See Section E.2.4 for further discussion of related maintenance deficiencies.)

USQ Program. The USQ program is an important element of configuration management. The OA team's assessment of the USQ program consisted of reviewing the site USQ procedure, the AGHCF USQ procedure, which defers to the site procedure for detailed directions, and a sampling of AGHCF USQ negative screenings (those which determined that a USQD was not required) and USQDs.

The site USQ procedure is inadequate to ensure that the requirements of 10 CFR 830 and the USQ guidance of DOE Guide 424.1-1 are effectively, reliably, and completely executed. The procedure contains the following discrepancies and weaknesses:

- It incorrectly allows screening out all facility modifications except those to important-to-safety systems, or those affecting such systems; the guide indicates that USQDs are to be performed on all changes to the facility as described in the SAR.

- It incorrectly allows screening out all procedure changes except those addressing "requirements *specifically* (emphasis added) identified in the safety-basis documents." The DOE guide indicates that USQDs are to be performed on changes to procedures *implied* in the safety basis as well.

- It provides inadequate directions for the PISA process.

- It provides ambiguous/incorrect wording of the rule's general requirements.

- It provides non-conservative wording and directions for the standard seven USQD questions and other requirements.

- It provides inadequate requirements for the training and qualifications of personnel performing, reviewing, and approving USQ evaluations and screenings.

- The USQ screening form does not have a location for describing the proposed change.

- The screening discussion incorrectly uses the words "should" and “may” for requirements statements where "shall" and “must” are the appropriate word, respectively.

- The screening questions incorrectly require evaluative considerations that properly should be made in the USQD itself.

The OA team's review of a sample of AGHCF USQ screenings and USQDs indicated an extensive breakdown of the USQ program in the AGHCF in carrying out 10 CFR 830 requirements. Of 18 screenings reviewed, 15 incorrectly screened the proposed changes or discoveries out of the USQD process. In some of these cases, the changes appeared to constitute USQs, which would require DOE approval.

In one case, discussed in Section E.2.3, the AGHCF staff failed to perform a TSR-required monthly surveillance test of the backup power system automatic start within the time limit. This occurred as a direct result of an incorrect change to surveillance procedure SR-201, which was incorrectly screened out. The prior version of this procedure, which was performed monthly, addressed the TSR monthly automatic start requirement and a 30-minute load test, which the TSRs required annually. Since both tests were not required monthly, the AGHCF staff decided to separate this procedure into two procedures, a monthly start test and a yearly 30-minute load test. However, in making these revisions, the automatic starting was moved to the yearly 30-minute load test, and the monthly test procedure was changed to only require manually starting the backup power system, without changing the TSRs. The staff indicated that they pursued these changes to lessen the wear and tear on equipment that resulted from the automatic start test. As a result of these changes, the new monthly test procedure did not satisfy the existing TSR requirement to verify automatic start-up capability.

Of five USQDs reviewed, four incorrectly concluded that the changes or discoveries did not involve a USQ. The only USQD that correctly concluded that no USQ was involved addressed the fact that the 2002 OA inspection had identified that 115 pounds of mercury, a substance with potential environmental and personnel hazards, were stored in the cells and not identified in the SAR. Because mercury storage is not a nuclear safety hazard per se, ANL correctly determined that it did not constitute a USQ; however, the SAR still should have identified this potential environmental or personnel hazard along with any other significant non-nuclear hazard in the facility.

Three of the four incorrect USQDs arrived at incorrect, non-conservative conclusions about the operability of safety SSCs (i.e., the SSCs had either been inadequately demonstrated to be operable per TSR requirements or SAR statements, or there was evidence that they were not operable). The fourth incorrect USQD of a modification contained an incorrect evaluation of the probability of malfunction of equipment. The following paragraphs provide the details for these four cases.

Two of the four USQDs, which addressed the inoperability of the fire protection sprinkler system, incorrectly determined that this condition was not a USQ. As detailed in Section E.2.1, the TSR-required static header pressure, the currently imposed administrative limit pressure, and the actual observed pressures are inadequate for the system to be operable, and this condition had been previously identified in the 2002 OA inspection. In response to that observation, two USQDs were generated, USQD-2002-2 and USQD-2003-0005, both of which incorrectly determined that no USQ was involved with this discovery. OA's conclusion that these two USQDs were incorrect was based on the following information from the USQD documents and subsequent conversations with the facility staff:

- The USQD incorrectly contended that the sprinkler system was not taken credit for in the SAR. Questions 2, 3, and 6 of the seven USQD questions, which address potential increases in accident consequences, the probability of malfunction of equipment important to safety, and the possibility of malfunction of a different type than previously evaluated, respectively, were all incorrectly answered "no" based on this rationale, that the SAR does not take credit for the system being operable. AGHCF staff indicated that these USQD statements were based on inferences from events other than a fire outside the cell windows – the event of most concern with regard to the sprinklers. However, there are at least 13 explicit statements in the SAR that the sprinklers were credited.

- The USQD incorrectly contended that because the consequences of a fire in the cell enveloped a fire outside a cell window, then it was not necessary to have protection from a fire outside a window, therefore the sprinklers outside the windows were not required to be operable. This rationale did not account for the fact that a fire outside a cell window had the potential to *cause* window failure and in turn an in-cell fire as a result of exposure of the pyrophoric materials in the cells to oxygen.

- Although not documented in the USQD, discussions with ANL personnel, including the SAR author, indicated that ANL improperly relied on invalid assumptions about the probability of equipment malfunctions. The SAR author indicated he knew at the time the SAR was written that the system could not meet the design pressure requirements for operability, even though the SAR and the TSRs state that it must be operable. Based on this, ANL indicated that this discovery did not constitute a condition where the probability of malfunction of equipment important to safety was increased, because it had been known to be inoperable since the SAR was written. This reasoning is not valid and not consistent with regulatory requirements and DOE expectations for handling nuclear issues; it demonstrated insufficient understanding of the rigor required in establishing the SAR, the TSRs, and related procedures intended to execute SAR and TSR requirements, and in evaluating observed conditions that deviate from these requirements. In this case, the standard for developing a TSR clearly states that the assumptions used in the accident analysis related to a safety system should be clearly stated in the DSA. If the accident analysis assumed that the fire system was degraded, and this was an acceptable condition, then this fact should have been documented in the SAR.

- Although not discussed in the USQD, ANL personnel also indicated that the SAR took credit for the fire department, which would be automatically notified by the fire detectors, and therefore, the sprinklers were not actually required. However, this argument relied on the ability of the fire department to arrive and take appropriate action in time to save the windows, without operation of an effective sprinkler system, and it ignored the basic principle that the loss of operability of one defense-in-depth SSC or feature is not allowed based on the presence of another; they must all be maintained operable as described in the SAR and required by the TSRs.

The third incorrect USQD determined that an invalid seismic analysis of the cell structures was not a USQ. SAR Section 3.4.2.6.1 stated, "It is anticipated that no structural failure of the cave walls, floor or ceiling will occur under the specified seismic loading; however, it is possible that structural failure of the

Building 212 outer walls or other internal walls will occur." The 2002 OA inspection identified that the seismic analysis of the AGHCF cells incorrectly assumes that the cells were not physically connected to the unqualified Building 212. In fact, the block wall building is physically connected to the cells in many locations and surrounds the cells in such a way that its failures could potentially cause failures of the cells. USQD 2002-3 was generated to address this observation. This USQD incorrectly evaluated this discovery as not being a USQ based on an incorrect "no" answer to USQD Question 3 about an increase in the probability of a malfunction of equipment important to safety. The supporting rationale was that the SAR took no credit for the cell structures as a safety-related mitigating feature even though they are explicitly identified in numerous SAR statements as safety-significant structures credited in the accident analyses.

Similar USQ procedure and execution discrepancies were identified in the 2002 OA assessment. Thus, the above observations indicate that corrective actions were ineffective. In December 2004, ASO conducted a functional area review of the USQ process at ANL, which included a review of the USQ procedures, and sampling of USQs at the AGHCF, G and K Wings, and Waste Management Operations nuclear facilities and found no findings or concerns with program implementation. As discussed in Section E.2.6, the ASO nuclear facility safety system oversight is not sufficiently effective and, in their December 2004 review, ASO missed an opportunity to identify and correct the deficient USQ processes.

Finding #20. Contrary to the requirements of 10 CFR 830, ANL has not instituted a functional configuration management and USQ process for its nuclear facilities, has not established an adequate USQ procedure, and has not adequately performed USQ screenings and determinations.

Summary. Although some elements of configuration management were beginning to be established, the overall configuration management program at AGHCF is not yet effective. Procedures for some fundamental configuration management activities have not been developed. The USQ procedure is not adequate and many of the USQ screens and USQDs are incorrect. ANL facility management and personnel who perform and review USQ screens and USQDs did not demonstrate a full understanding of DOE expectations for an effective configuration management program at a DOE nuclear facility. ASO has not performed an adequate review and evaluation of the processes to identify and correct deficiencies in the configuration management and USQ programs.

E.2.3 Surveillance and Testing

10 CFR 830 requires that surveillances and tests be defined in the TSRs. The TSRs must ensure that safety SSCs and their support systems required for safe operation are maintained, that the facility is operated within safety limits, and that limiting control settings and limiting conditions for operations are met.

In the 2002 OA inspection, a significant number of TSR-required surveillances were found to have not been performed within the required time intervals specified in the TSRs. A number of appropriate corrective actions were taken, including the institution and use of a computer-based tickler system, as described in Section E.2.4. In this OA assessment, a review of the TSR surveillance records showed that ANL performance in conducting timely surveillances had improved and that there was no longer a systemic failure to perform TSRs on time. However, one TSR surveillance had not been performed on time at AGHCF, and there was one identified failure to perform a TSR surveillance at the G and K Wing Laboratories (discussed below). Failure to perform even a small number of TSRs on time is a significant concern (see the finding below), and indicates the corrective actions have not been fully effective and need to be further evaluated. In addition, the missed TSRs were not identified by the ASO Facility Representative or any ANL feedback mechanisms.

Notwithstanding the improvements in timeliness, a significant number of testing and surveillance practices, procedures, or related devices were inadequate to ensure that safety-related SSCs were capable of performing their SAR-established safety functions. The following indicate a general concern with testing and surveillance (see Finding #21):

- The fire protection system TSR surveillance test acceptance criterion for minimum header pressure static pressure, 40 psig, the currently imposed administrative limit, 65 psig, and the current actual observed system pressures, in the range of 70 to 75 psig, are significantly non-conservative with respect to the analyzed required pressure for operability, 98 psig. The system is, therefore, inoperable (see Sections E.2.1 and E.2.2).

- The backup power supply TSR surveillance procedure contains pre-conditioning steps. Such enhancement steps on the equipment before it is tested, such as adjusting wiring, connections, switches, and belts, checking that the crankcase heater is operating, and checking that the starting battery is charged and the terminals are clean, increase the success probability beyond the as-found condition. Such preconditioning invalidates the intent of the test.

- The charcoal filter replacement procedure contains no post-replacement test requirement. Such testing is needed to verify the integrity of the replacement (i.e., the filters' efficiencies and the absence of bypass leakage), such as the testing performed on the HEPA filters after their replacement.

- The backup air compressor TSR surveillance test procedure's minimum starting pressure acceptance criterion, 40 psig, is non-conservative with respect to the SAR-stated minimum of 60 psig.

- None of the installed facility safety-related instrumentation is required to be calibrated. Therefore, inadequate measures are applied to ensure that they can perform their safety functions. An example is the differential pressure (dp) instruments across the second stage HEPA and charcoal filters in the main hot cell exhaust, which are used to satisfy the TSR Table 1-1 requirement to continuously monitor the dp across these filters. The facility staff's response was to formulate a plan to purchase new instruments to replace old instruments every time a calibration was due to avoid having to institute all the measures necessary to establish a valid calibration program. However, this plan had not been placed into effect, and additionally, it would not have the desired effect, because even new instruments would still require post-installation calibration to ensure operability within their uncertainty tolerances after shipping and installation. Therefore, the corrective actions have been inadequate (also see Appendix D and Finding #14).

- The nitrogen supply manifold valves are not exercised. In addition to the poor material condition of the safety-significant nitrogen supply manifold valves (see Section E.2.4), there was no procedure to verify, by periodic exercising, that these valves could be repositioned to realign the system to the backup nitrogen tank, as described in the SAR.

- The TSR surveillance procedure for zeroing and spanning the cell pressure sensors is inadequate to assure their accuracy and reliability. The following discrepancies were identified:

  - As-found readings (e.g., indicated outputs versus inputs) are not required to be recorded, and acceptance limits for the as-found values are not specified.

  - The instrument checks address only half of the full operating range.

- Insufficient data points are addressed to ensure the instrument integrity.

- No normal operating range data points are checked.

- The procedure directions and terminology are unclear and ambiguous with respect to the included diagram.

- The diagram incorrectly shows instrument root valves as normally closed.

- The instruments are normally connected to the potentially contaminated cell atmospheres with the instrument lines that contain HEPA filters; however, the potential for contamination release still exists and the procedure identifies no potential radiological hazards.

- AGHCF procedures contain a common weakness in that data and sign-off sheets are not included in the procedures. This practice provides greater opportunity for procedure changes to not be reflected in the sheets, and vice versa, and for the required reviews, such as USQDs, to not be fully implemented or documented on the sheets. Including them with the procedures also provides greater assurance that changes to the sheets are properly recognized and treated as procedure changes, and therefore appropriately reviewed.

Finding #21. Many surveillance, testing, maintenance, and operating procedures and practices in the AGHCF are not adequate to ensure that safety structures, systems, and/or components remain within the limits and capabilities required by the SAR and the TSRs and comply with the requirements of applicable regulations, rules, orders, codes, and standards.

In addition to the above weaknesses, weaknesses in surveillance procedures contributed to two instances of TSR violations.

- The AGHCF was found to be in violation of TSR Surveillance SR 4.4.1.1, which requires monthly testing of the automatic start of the backup power supply. The TSRs allow up to 25 percent extension of the required monthly frequency (a maximum of 39 days between surveillances). As of May 4, 2005, the last surveillance that satisfied this TSR requirement had been performed on March 17, 2005, 48 days before. This TSR violation occurred as a direct result of an incorrect change to the corresponding surveillance procedure, SR-201, and an incorrect USQ screening out of this change from the USQD process, which are discussed further in the USQ program section of this report. This condition was also not reported in accordance with the requirements of DOE Manual 231.1-2 at the time of discovery.

- The G and K Wing Laboratories were found in violation of TSR 5.3.1.1, which requires monthly validation of the material inventory. Although the facility tracks and documents all material movement to ensure that the criticality limits and the Hazard Category 2 limit are not exceeded, it does not have a surveillance procedure to implement the TSR requirement; it does, however, have a procedure requiring that a form be completed to document completion of the surveillance. A review of the last completed surveillances revealed that the March 2005 surveillance was not performed. Additional deficiencies include: the form used for surveillance does not have an acceptance criterion to satisfy the TSR requirement, the form is not dated when the surveillance is being performed, and the form is not printed and retained. This condition was also not reported in accordance with the requirements of DOE Manual 231.1-2 at the time of discovery.

Finding #22. ANL failed to perform a TSR-required monthly test of the backup power system automatic start function within the maximum allowed interval at AGHCF and a TSR-required monthly validation of the material inventory in the facility at the G and K Wing Laboratories.

Summary. ANL has made improvements in performing TSR surveillances on time. However, a number of inadequate testing and surveillance practices, procedures, or related devices were identified, reducing the assurance that the safety-related SSCs were capable of performing their SAR-established safety functions. In the 2002 OA inspection, similar concerns were raised regarding the adequacy of implementing procedures to ensure that TSR surveillance requirements are consistently performed and documented in a manner commensurate with their importance to safety.

E.2.4 Maintenance

OA's review of maintenance focused on the adequacy of maintenance procedures, the documentation of performed maintenance activities, and the facility's material condition. It included observation of maintenance activities, interviews with personnel responsible for maintenance activities, review of training requirements and records, review of the maintenance procedures and practices performed by outside organizations in the AGHCF, and the agreements with outside organizations.

The maintenance procedures typically used in the AGHCF were generally found to be adequate, with the appropriate levels of detail for required equipment, precautions, prerequisites, and procedure steps. Maintenance personnel training and qualifications requirements were appropriately specified in a facility policy, and individual training profiles were maintained detailing required and suggested training courses, when they were last completed, and the next due dates.

Maintenance and testing activities required to be performed on a periodic basis by the TSRs were appropriately tracked by a computer-based tickler system that records the data and sign-off of completed activities, dates completed, and the next due dates. It also was equipped with a feature that automatically sent out electronic mail reminders with attached work tickets to the persons responsible for these activities.

Some maintenance and testing activities performed in the AGHCF are performed by other ANL groups, such as the Plant Facilities and Services Division. A formal written agreement is established between the Energy Technology Division, of which AGHCF is a part, and the Plant Facilities and Services Division groups that adequately details the respective requirements, responsibilities, and authorities.

Inspections of the material condition and housekeeping of the facility and systems and for personnel safety hazards are routinely performed by facility personnel. These internal inspections are made on a monthly to bi-monthly basis, with observations documented, numbered, and tracked, and responsibilities for closure assigned by name. Additionally, assessments of the material condition of the building and infrastructure are performed by ANL's Facilities Engineering and Construction's Strategic Planning and Programs Group, typically every five years.

The Energy Technology Division performed an inspection in 2002 of the condition of major components of the facility infrastructure, such as shielding windows, gloveboxes, and manipulators. The following items with safety significance had conditions that were identified as "marginal": shielding windows, shielding doors, exhaust systems including HEPA filters, fire protection systems, monitoring and alarm systems, and storage of radioactive materials. The most recent such report in January 2004 indicated progress in correcting several of these deficiencies, including replacement of four of the six shield windows, upgrades to the fire protection system (addressed in other sections of this report), and installation of a new monitoring and alarm system.

The maintenance backlog was very small and typically numbered around 10 items, usually with low safety significance. Items with higher safety significance were usually addressed and resolved immediately.

OA team walkdowns indicate the facility's material condition was generally improved as compared to the 2002 OA inspection. For example, most of the relatively heavy combustible loading previously located near the cell shield windows had been removed. However, the material condition of some SSCs was less than optimal. For example, the safety-significant cell inerting and sealing nitrogen supply manifold valves at the liquid nitrogen tanks were rusty and in poor condition, and a second floor storage area containing some large, heavy equipment located approximately five feet from safety-significant nitrogen piping presented an unnecessary seismic hazard.

Several discrepancies were also identified in the facility's maintenance program, practices, and procedures (see Finding #21):

- The AGHCF has no formal control of replacement parts. ANL does not have a procedure that addresses replacement facility components for repairs or maintenance to ensure that the components are exact like-for-like replacements, or if not, that provides the formal requirements to ensure that such components are equivalent to or better than the original in all technical respects relevant to the performance of their safety functions.

- The AGHCF does not have an adequate master equipment list. DOE Order 433.1 requires that the contractor develop a maintenance implementation plan, including a master equipment list, which DOE Guide 433.1-1 defines as "A detailed master list of equipment, components, and structures to be included in the maintenance program. This list includes both safety-related and non-safety-related systems and equipment." Although the AGHCF maintenance implementation plan addresses the master equipment list and states that "A list of both safety and non-safety equipment that is included in the maintenance program has been developed…," this list is not a detailed list of equipment, components, and structures as defined by the guide and generally accepted practice for Category 2 nuclear facilities. It simply lists the vital safety systems, with little detail at the equipment or component levels, such as detailed descriptions, manufacturer identifications, part numbers, sizes, materials, and special requirements. Therefore, this list does not conform to the intent of the order and accepted practice. As a result, quality controls normally applied to safety-related SSCs through such lists may not necessarily be rigorously, reliably, and uniformly applied.

- Outside organizations' testing and maintenance procedures are not adequately reviewed. Procedures for such activities as exhaust fan maintenance and HEPA filter testing and change-out are routinely performed on safety-related SSCs in the AGHCF by outside organizations, using these organizations' generic procedures (also used in non-nuclear, laboratory facilities) without any formal, documented procedure reviews by the AGHCF staff. Additionally, contrary to 10 CFR 830, no USQ reviews are performed of these procedures or their revisions (see Section E.2.2).

- A potential radiation hazard associated with the cell exhaust charcoal filter replacement procedure was not identified in the procedure. The cell exhaust charcoal filter replacement procedure does not identify a radiological hazard that may be associated with these filters that is not normally present; specifically, they may be contaminated with iodine-131, tritium, or other gaseous or vapor constituents that are not normally concentrated elsewhere.

- The AGHCF maintenance implementation plan does not adequately identify and document how to correct/improve weaknesses in maintenance. The plan developed for the facility and approved by DOE does not adequately detail how the organization currently deviates from applicable maintenance-related directives and regulations, and how it intends to remedy these conditions. The plan consists primarily of a compilation of arguments as to why the status quo is adequate. Most of these arguments cite the facility's limited staffing resources, contend that current practices are good enough, or contend that the benefits of full implementation do not justify the costs. ASO did not identify or correct deficiencies in the maintenance implementation plan.

The maintenance deficiencies described above are encompassed by Finding #21 and indicate that the maintenance program does not meet the requirements of DOE Order 433.1 for nuclear safety systems. Without a master equipment list and a process for like-for-like replacement, ANL does not have an adequate foundation for the quality assurance program for nuclear grade components.

Summary. Some aspects of the maintenance program were adequate, including some maintenance procedures, training, activity tracking, agreements with outside organizations, facility material condition, corrective maintenance, and the small maintenance backlog. However, weaknesses were identified with the maintenance condition of outside valves for the nitrogen system, lack of formal control of replacement parts, lack of an effective master equipment list, lack of facility review of maintenance procedures performed by outside organizations, and an inadequate maintenance implementation plan.

E.2.5 Operations

The OA team evaluated operating procedures and operator training for the safety-significant components as well as the knowledge and capability of the operators and facility supervisor(s) to operate the AGHCF under normal conditions and to take appropriate actions in the case of abnormal and accident conditions.

The hot cell facility manager and assistant facility manager were knowledgeable of the operations and controls of the safety-significant AGHCF systems, and facility operators were knowledgeable on the systems on which they have completed qualifications. Several system walkdowns were conducted with the hot cell facility manager, assistant facility manager, and facility operators on such safety systems as the oxygen analyzer system and the annunciator alarm system. The individuals demonstrated adequate system knowledge and were especially knowledgeable on the capabilities and operation of the annunciator alarm system because its design includes displays throughout the facility and automatic notification of the facility staff both locally and remotely when an alarm condition occurs.

One walkdown included an examination of facility operator response to a loss of nitrogen supply. The nitrogen primary source (tank 30) can be connected to the alternate source (tank 32) via different cross-connect valve lineups. One cross-connect is outside the facility near the nitrogen supply tanks and another is in Room 202. It consists of a 2-foot-long pipe that can be connected to the main supply from a line that is supplied by the alternate nitrogen supply tank. The operator was knowledgeable of the nitrogen system and how to respond to a loss of primary nitrogen supply. The response to a loss of the primary nitrogen system has not been included in an operations procedure; however, a draft procedure has been developed. Other abnormal and accident conditions were discussed with the facility staff, who demonstrated appropriate knowledge about the response to such conditions.

An adequate training and qualification program has been defined for the various workers at the AGHCF. Training courses have been developed and conducted in support of the training program. The training program has been adequately defined in Policy 300, “Training and Qualification Personnel.” It defines the training organization and qualification requirements for operating personnel, technical staff/support staff, electron beam instrument operators, temporary employees, technical support personnel, and subcontractor personnel. Training completed at AGHCF is tracked in the ANL sitewide training management system, and training status is conveniently available. A review of a selection of hot cell staff individual training profiles indicates that the qualification program has been adequately implemented, with the exception of on-the-job training (OJT), as noted below.

The training and qualification requires significant OJT, and the processes to conduct OJT, including documenting satisfactory completion of OJT, have not been defined or rigorously implemented. Operator training requirements related to safety-significant systems is based on their assigned systems, and the training is composed of classroom instruction and OJT. For a given system, a significant amount of OJT must be performed to complete qualifications. However, the OJT process has not been formally defined, and completion of OJT was informally documented in a logbook. The information in the book was limited to a list of participants and the hours spent on OJT.

AGHCF has established some operating procedures to define, in some cases, how operations and the facility support equipment will be operated (e.g., “Auxiliary Ventilation System,” “Cell Entry,” “Emergency Response to an In-Cell Fire,” “High-Gamma Alarm Response,” and “Positioning the AGHCF Movable Gamma Shield”). These procedures have been reviewed by the AGHCF staff and approved by the hot cell facility manager. This small set of procedures is adequately written, technically accurate, and can be followed verbatim.

However, AGHCF has not developed and implemented operating procedures for some of its safety-significant systems, including the nitrogen, backup instrument air, and ventilation systems. In addition, the nitrogen and backup instrument air systems do not have approved valve lineup checklists. The operations of these systems is currently based on a piping drawing posted in the area and valve labeling that includes the valve number, and a separate label identifies the normal position of the valve. This method of operation in which formal operating procedures are not used is not acceptable for safety-significant systems in a Hazard Category 2 nuclear facility. In addition, the detailed response to abnormal conditions for these systems is not defined in a system procedure. In some cases, the annunciator alarm response procedure provides some general response steps for abnormal conditions (e.g., for the nitrogen system in the event of low nitrogen pressure or receipt of a high cell pressure alarm) but does not satisfy the need for detailed response steps in a system procedure. Further, the emergency procedure for a cell shield window leak was inadequate. This procedure requires inserting special sand to replace the leaking zinc bromide. Although a supply of this special sand was on hand in the facility, the requirement to use special sand, its availability in the facility, and its special characteristics were not adequately documented in the procedure or elsewhere. (See Finding #21.)

The AGHCF policy documents do not define the various types of operating procedures, how to use these procedures, and how to ensure the latest version of a procedure is used. AGHCF has not defined a policy on defining the type of procedures (i.e., routine or step-by-step) and the expectations for how the procedures will be used for each case. There are no criteria to determine whether a procedure should be in hand or can be referenced if needed. In addition, there is no site policy ensuring that facility operators use the latest version. During the facility operator walkdown for the oxygen analyzer alarm test, the operator printed the procedure from the file server but was unable to show that this was the location for the latest procedures. There is a lack of guidance on what source to check prior to using a procedure to verify it is the latest version (e.g., table of contents of the policy document or a specific procedure directory). (See Finding #21.)

Summary. The AGHCF manager and assistant facility manager were knowledgeable of the operations and controls of the safety-significant AGHCF systems, and the facility operators were also knowledgeable on the systems for which they have completed qualifications. With the exception of an informal OJT process, an adequate training and qualification program has been defined and implemented. For a few systems/activities, operating procedures have been developed and are adequate. However, operating procedures have not been developed for the majority of the safety-significant systems.

E.2.6 Nuclear Facility Safety System Oversight

OA evaluated the effectiveness of SC/ASO processes for monitoring and assessing ANL programs for ensuring effective design, configuration management, maintenance, and operation of essential safety systems, and for reviewing and approving nuclear facility DSAs. OA also evaluated ANL's self-assessment of nuclear facility safety systems and the cognizant system engineering program. Because of the broad and recurring deficiencies identified in safety system oversight and implementation at ANL, OA also considered the nuclear safety expertise and organizational structures as potential causal factors.

SC/ASO. A review of the ASO documented assessments on the nuclear facilities revealed that detailed technical reviews had not been conducted in such areas as engineering design, configuration management, testing, surveillance, maintenance, or operations. ASO performed a few, limited surveillances/reviews in the areas of the USQ process, maintenance, and occurrence reporting. However, these ASO reviews did not identify any major deficiencies in the reviewed areas.

DOE is responsible for reviewing and approving a facility DSA when a new or modified DSA is submitted. ANL submitted the SAR for the AGHCF in 2001 in response to the new requirements defined in 10 CFR 830. The SC/ASO evaluation and associated safety evaluation report was not rigorously performed per DOE Standard 1104, which provides the methods for reviewing a DSA to determine compliance with 10 CFR 830. The review of the AGHCF DSA was limited in scope and only evaluated changes from the previous SAR (rather than the required thorough review of the entire SAR). This limited review was a significant missed opportunity to identify many of the deficiencies with the AGHCF SAR.

SC/ASO nuclear safety oversight has not been effective in identifying weaknesses in key areas, including the USQ process, TSR implementation, surveillance and testing, DSA accident analysis, and configuration management. Many of the deficiencies identified by the OA team in this appendix were not identified by DOE line management.

Several factors may contribute to the ineffective DOE nuclear safety oversight. First, the ASO has only one Facility Representative assigned to the ANL nuclear facilities, although other Facility Representatives occasionally participate in oversight activities at the nuclear facilities. It is difficult for one individual to keep abreast of all the different activities/operations at the multiple nuclear facilities at ANL. Second, the assigned Facility Representative has not had the opportunity to attend training related to nuclear safety oversight, such as courses associated with the structure of a DSA per DOE Standard 3009, elements of an adequate TSR, and the USQ process. Third, management has not established and enforced clear expectations for ASO Facility Representatives to perform rigorous surveillances of work evolutions and implementation of procedures.

Finding #23. SC and ASO have not provided effective line management oversight of the ANL nuclear facility safety systems.

ANL. The ANL Nuclear Safety Review Committee performed some limited reviews of the various nuclear safety documents submitted to the committee for approval. In general, it had not conducted or sponsored any independent reviews of the ANL nuclear facilities related to facility operations and DSA/TSR document quality and implementation over the last several years. Based on a review of the meeting minutes, the committee, in accordance with its charter, performed management-level reviews of submitted DSA/TSRs and other nuclear safety documents. It did not conduct or charter independent technical reviews of nuclear safety documents related to the AGHCF. The committee relied on the Energy Technology Division to provide their own reviews prior to submitting the document. The Nuclear Safety Review Committee was recently replaced by the Nuclear Safety Committee. The Nuclear Safety Committee has not had its first meeting. This committee's charter implies that the new committee will reinstitute independent technical reviews and biennial facility assessments. These activities are needed to improve compliance with nuclear safety requirements at ANL.

One nuclear safety element – criticality safety – has received extensive review by ANL. These reviews were sponsored by the Criticality Safety Committee, and several criticality reviews were performed at the AGHCF.

OA reviewed the self-assessments that were performed at the AGHCF over the last few years. Most self-assessments were limited to a review of some administrative control programs identified in the SAR (radiological protection program, criticality safety program, integrated safety management, procurement process, laser safety, and maintenance) and did not identify any significant weaknesses in the areas reviewed. Two assessments provided some review of nuclear safety processes. The first was an April 2004 TSR surveillance that determined that the TSR surveillance documentation and safety system configuration were in compliance with the TSR requirements and identified no deficiencies (see Finding #23, which indicates that the April 2004 self-assessment did not adequately ensure that deficiencies were identified and corrected). The second was a recent self-assessment of the facility that identified needed improvements in calibration of gauges used in safety-significant systems, testing of high cell pressure alarms, and cell exhaust system drawings.

Although some processes are in place, ANL has not defined and implemented a systematic approach to nuclear safety oversight. Some nuclear safety areas are receiving limited reviews, but most areas are not being assessed. The significant weaknesses identified by this OA inspection in many of the fundamental nuclear safety areas indicate a need for more robust feedback and improvement in the areas of ANL nuclear safety. (Appendix D provides a broader perspective on ANL feedback and improvement processes.)

DOE Order 420.1A requires contractors to establish a cognizant system engineer program for its nuclear facilities. ANL has partially implemented some of the elements of this program, including the identification and assignment of system engineers, and has started to establish a configuration management program at Building 212. The systems to be covered by this program have been appropriately identified for Buildings 212 and 205 and a system engineer was assigned to each vital safety system. The assigned system engineers, who are also the facility manager or the building service manager, are knowledgeable of the systems and the nuclear safety documentation. For Buildings 205 and 212, the system engineers serve as the point of contact for the facility for maintenance. The system engineers receive and review the completed preventive maintenance documentation. Any out-of-specification conditions are noted and addressed. The Building 212 system engineer has started implementing corrective actions to establish configuration management on several safety-significant systems in response to a recent self-assessment.

However, several elements of a cognizant system engineer program have not been defined or implemented including documented roles and responsibilities, training, and configuration management. No formal guidance has been provided by ANL to define roles, responsibilities and expectations for the cognizant system engineers. In addition, no guidance is provided in the Nuclear Safety Procedure Manual about roles, responsibilities, and expectations. Further, the interviewed system engineers were not aware of the requirements in DOE Order 420.1A for the program.

The training for the system engineers was based on completing training for their existing positions (i.e., facility manager or building service manager). No additional training was identified to become a system engineer. The currently completed training for the system engineers does not address the requirement to be knowledgeable of codes and standards for their assigned systems. The system engineers are assigned several systems that perform different functions and invoke different codes and standards. The list of applicable codes and standards for each system has not been established to determine what training would be required. In addition, the ANL subject matter experts for these various codes and standards are not identified as a technical resource for the system engineers.

In accordance with DOE Order 420.1A requirements, the system engineer is responsible for ensuring that the necessary configuration management documents for each assigned system are established. As discussed in Section E.2.1, the Building 205 system engineer was unaware of this responsibility, but has started this task. He has ensured that the required condition assessment surveys were performed but has not reviewed the results. The Building 212 system engineer has only recently started to perform configuration management requirements.

The unusually broad-ranging and numerous cases identified in this report where the AGHCF staff did not comply with applicable requirements, and the failure of both ANL and ASO to identify and correct the deficiencies, indicates insufficient understanding of the level of quality, rigor, and compliance expected at a DOE Category 2 nuclear facility. A nuclear facility organization requires attributes typically not required of non-nuclear organizations, such as organizational and individual commitments to literal compliance with requirements, generating quality SARs and flowdown documents (e.g., TSRs and procedures that completely, accurately, and correctly reflect the SARs' requirements), performing work to such documents by strict conduct of operations standards, applying enhanced discipline and rigor to virtually all activities involving nuclear safety, unrelenting attention to detail, and a conservative attitude regarding nuclear safety and in evaluating observed safety lapses. These attributes were not generally present in these two organizations, as evidenced by the following examples:

- The generation and approval of an SAR and TSRs with numerous discrepancies and deficiencies in the safety-related SSCs, with the descriptions and requirements for these SSCs in these documents, and with the supporting analyses for these documents.

- The decision to not rigorously implement numerous programmatic requirements associated with the maintenance implementation plan.

- The decision to not comply with the TSR requirement for monthly testing of the automatic start of the backup power system.

- The numerous cases of not testing or inadequately or incorrectly testing the functions of safety SSCs or features described in the SAR.

- The numerous cases of inadequate or incorrect procedures for testing safety-related SSCs.

- Multiple cases of failure to take effective corrective actions for discrepancies identified with safety SSCs and procedures.

- A USQ procedure that failed to correctly reflect the requirements of 10 CFR 830 by promulgating screening criteria that allowed screening out virtually all changes and discoveries, USQD evaluation criteria that were very non-conservative with respect to the rule, and little direction with regard to the PISA process.

- Numerous USQDs for discoveries that were incorrectly determined not to be USQs based on inadequate arguments not consistent with the literal SAR statements.

- Several formal reviews/assessments, dating back to 1993, indicated that the fire suppression system was inoperable, and the current facility manager requested to have modifications made to address the concern. However, timely and sufficient corrective or mitigating actions were not implemented.

Several factors may contribute to the ineffective ANL nuclear safety programs. First, although observations and discussions with the AGHCF manager and staff and the ASO Facility Representative indicated that these individuals were dedicated, conscientious, capable, and generally well qualified, none of these individuals had extensive nuclear experience outside ANL. Further, there were few individuals in ASO or ANL management positions with extensive nuclear experience outside ANL. In addition, ASO and ANL did not demonstrate sufficient understanding of DOE expectations for operations at a nuclear facility in accordance with 10 CFR 830 requirements. The insufficient experience and management direction resulted in a situation where individuals performing nuclear safety functions had little firsthand knowledge of what an acceptable nuclear safety program looked like and the expected degree of rigor and formality. Second, ANL does not have a nuclear safety infrastructure adequate to support operation of a nuclear facility. Operation of a nuclear facility in accordance with 10 CFR 830 requires a broad range of expertise in a wide range of technical disciplines and in nuclear regulations, rules, orders, codes, and standards. The range of expertise needed indicates a minimum "critical mass" of adequate numbers of appropriately qualified people that even a small nuclear facility, such as ANL, must have to implement the required functions. ANL does not currently have a sufficient nuclear safety infrastructure to support a nuclear facility operation and does not currently have access to external organizations with such expertise.

Finding #24. ANL feedback and improvement systems (such as self-assessments and the Nuclear Safety Review Committee) and nuclear safety organization are not adequate to ensure that ANL nuclear facilities and safety systems comply with 10 CFR 830 requirements and DOE expectations for operation of a Category 2 nuclear facility.

Summary. ASO and ANL have some processes in place in the safety system oversight area. However, ANL feedback and improvement systems and nuclear safety organization are not adequate to identify deficiencies and ensure compliance with nuclear facility and safety system requirements. ANL has not formally defined and implemented a cognizant engineer program as required by DOE Order 420.1A, including defining roles and responsibilities, defining and implementing training, and establishing configuration management. In addition, SC and ASO nuclear safety oversight has not been effective in identifying weaknesses in key areas, including the USQ process, TSR implementation, surveillance and testing, DSA accident analysis, and configuration management. Many of the deficiencies identified by the OA team in this appendix are longstanding or recurring and were not identified and corrected by DOE. The weaknesses in ASO and ANL nuclear experience and the nuclear safety infrastructure are contributing factors to the weaknesses in safety systems at ANL.

E.3 CONCLUSIONS

Some progress has been made in a few areas, such as efforts to establish configuration management and a systems engineer program. However, AGHCF safety systems and DSAs did not fully comply with 10 CFR 830 requirements, and the systems were not adequately designed and analyzed to ensure that they perform their safety functions under design basis accident conditions. The fire protection system was determined to be inoperable.

ANL did not adequately evaluate and implement many of the requirements of DOE Order 420.1A. Weaknesses were found in several aspects of engineering design and DSAs. In addition to the inoperable fire protection system, the DSAs for both facilities contain omissions, inconsistencies, and non-conservative statements. In the case of the AGHCF, the extent of these deficiencies led OA to conclude that the SAR was not 10 CFR 830-compliant. Additionally, there was no formal documentation to support the analytical information presented in the AGHCF SAR. Indications are that the SAR-described consequences for the limiting design basis earthquake were non-conservative, and that they could be significantly in excess of the 25 rem dose established by the evaluation guideline.

ANL has not instituted a functional configuration management program and USQ process for its nuclear facilities. The USQ procedure does not reflect the requirements of 10 CFR 830, and many AGHCF USQ screenings and determinations were inadequately supported or incorrect.

Several important aspects of maintenance, testing and surveillance practices, and operating procedures were inadequate. Additionally, several of the TSR controls for monitoring and surveillance testing of AGHCF safety SSCs are incorrect, incomplete, or inadequate to provide the required assurance that they can perform their safety functions. Further, a significant number of surveillance and testing procedures have incorrectly or inadequately translated the SAR and TSR requirements.

Although day-to-day maintenance of the facility appears to be performed adequately, maintenance programs do not meet several important DOE Order 433.1 requirements for formal control of replacement parts, a master equipment list, and review of outside organizations' work procedures for the facility.

The AGHCF manager and assistant facility manager were knowledgeable of the operations and controls of the safety-significant AGHCF systems, and the facility operators were also knowledgeable on the systems on which they have completed qualifications. With the exception of an informal OJT process, an adequate training and qualification program has been defined and implemented. Although a few, adequate operating procedures are in place, important operating procedures have not been established for the majority of the safety-significant systems.

Many of the discrepancies that were identified appear to be fundamentally attributable to inadequate nuclear safety system oversight by ASO, and ANL's ineffective feedback and improvement and cognizant system engineer programs. An ineffective nuclear safety infrastructure and limited ASO and ANL management experience with rigorous and formal nuclear safety organizations outside ANL appear to be root causes. (See Appendix D.)

E.4 RATING

Engineering Design and Compliance with DOE Order 420.1A .... SIGNIFICANT WEAKNESS
Configuration Management .... SIGNIFICANT WEAKNESS
Surveillance and Testing .... SIGNIFICANT WEAKNESS
Maintenance .... NEEDS IMPROVEMENT
Operations .... NEEDS IMPROVEMENT

E.5 OPPORTUNITIES FOR IMPROVEMENT

This OA inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site to be reviewed and evaluated by the responsible line management, and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

SC

1. **Ensure that site offices and laboratories have the necessary resources and capabilities to perform required nuclear safety functions and safety system oversight.** Specific actions to consider include:

    - Perform a baseline review of missions, facilities, resource needs, and current staffing and expertise within SC; determine how best to utilize existing resources and identify any gaps and shortages of needed expertise.

    - Consider innovative options for better sharing of and using available resources. Consider creating a virtual centralized organization of experienced nuclear professionals or using expertise from within SC, within DOE, or external to DOE to assist small nuclear operations and site office staff. These professionals need not be full-time nor reside in any specific location. In addition to directly benefiting small nuclear facilities and their site offices, such an assist organization could stimulate improvements in the rigor and formality of nuclear safety operations and provide a base of engineers with nuclear safety experience.

ASO

1. **Enhance safety system oversight.** Specific actions to consider include (in addition to those in Appendix D):

    - Re-evaluate application of ASO resources at nuclear facilities. Add staff with significant nuclear experience outside ANL and reprioritize efforts as needed to ensure adequate Facility Representative coverage and sufficient technical assessments of ANL nuclear safety functions.

    - Establish and enforce expectations for Facility Representatives to perform surveillance and evaluate performance.

ANL

1. **Evaluate and implement compensatory measures for the inoperable fire suppression system**. At minimum, the TSR action of instituting an hourly walkthrough of the facility should be implemented. A fire watch in the area adjacent to the hot cells should also be considered.

2. **Improve the DSAs and TSRs.** Specific actions to consider include:

    - Develop a compliant DSA for the AGHCF. Establish a schedule and resources to develop a compliant DSA and associated TSRs and supporting documentation in a timely manner.

    - Review the SAR and identify all statements that describe active and passive mitigation functions/capabilities.

        – Include event frequency, consequences magnitude, etc.

        – Verify that the statements can be supported by existing analyses; if existing analyses are not available, develop new ones.

        – Independently verify either the new or the existing analysis.

- Review all of these statements to assure that they have an appropriate degree of conservatism.
  - Consider all consequential failures when developing scenarios.
  - Review the boundaries of the safety-significant/safety-class SSCs.
  - Review the interactions between the safety-significant/safety-class SSCs with the non-qualified SSCs.
  - Do not credit non-qualified SSCs for mitigation of the DBEs.
- Review TSRs to verify that they contain surveillance requirements for all important-to-safety SSCs.
- Add the following specific TSR requirements to perform the periodic surveillances to verify the associated safety functional capabilities or conditions:
  - Require that the inerting nitrogen solenoid cut-off valves close automatically when cell negative pressure is being lost.
  - Require that the liquid nitrogen supply tank levels are adequate to provide nitrogen for cell inerting and sealing for the maximum credible period under DBE conditions that normal delivery could be interrupted.
  - Establish a cell pressure administrative limit, accounting for instrument uncertainty and other relevant factors, that assures that cell pressures remain negative for all indicated pressures less than 0 psig.
  - Revise TSR 4.2.1.5 to clearly require a qualified person to actually periodically observe cell pressures and verify that they are negative and not trending adversely.
  - Institute formal controls for the change-out of the charcoal filters based on meaningful acceptance criteria that relate to their capability, worker exposure, or whatever is technically more limiting. Establish post-installation testing requirements and acceptance criteria, similar in form to the HEPA filters, to verify that they are properly installed and functional.
- Review the design and the installed configuration of the safety-significant/safety-class SSCs against the SAR and TSR requirements.

3. **Improve the facility design.** Specific actions to consider include:

- Perform an evaluation of the fire water supply system with regard to providing a reliable water supply to safety-significant SSCs.
- Perform a fire hydrant flow test for the AGHCF to obtain a current/updated baseline water supply capability.
- Perform a review of facility calculations and other design basis documentation and revise as necessary to be consistent with current facility configuration and the SAR. Where design basis calculations do not exist, perform a design reconstitution and prepare calculations as necessary.

- Revise the FHA report to reflect the current facility configuration. The current FHA pre-dates the issuance of the AGHCF SAR. Initiate modifications as appropriate based on recommendations in the FHA.

- Ensure that the Fire Protection Engineering Department prepares design basis hydraulic calculations on a facility basis that reflect the most current hydrant flow tests. Distribute such calculations to each facility so that facility margin can be determined.

- Change the setpoint for the cell loss of negative pressure alarms to a negative value close to 0 psig, but with sufficient margin to provide operators with sufficient time for typical off-normal conditions to take corrective action before the cell pressure can go positive.

- Change the cell pressure sensing and recording instrumentation to a wider range that covers the entire normal operating and off-normal range of pressures that can be experienced in the cells, so that for such off-normal conditions a record will be preserved of how the condition developed and progressed.

- Make changes as required to provide a fully functional fire protection sprinkler system in the AGHCF, and change the TSRs acceptance criteria for system operability to reflect these changes.

- For the AGHCF, consider using the DOE-approved containers to provide a positive means to maintain MAR below the limit.

4. **Improve configuration management.** Specific actions to consider include:

   - Prepare procedures for design engineering processes, such as preparation of design calculations and design modifications to ensure consistency and compliance to SAR and code requirements.

   - Revise Procedure HFS-Policy-404, "General Fire Safety," to be more prescriptive concerning combustible loading in the AGHCF, especially in areas in close proximity to the hot cells and the hot cell windows.

   - Develop and implement a formal replacement parts procedure that prohibits the installation of any parts in important-to-safety SSCs except for exact like-for-like replacements or equivalent, and which provides directions on a formal process for determining and documenting such equivalence in ability to perform the required safety functions.

   - Develop a viable master equipment list for the AGHCF.

   - Institute procedures and practices to review all procedures used by outside organizations in the AGHCF for safety and verification that the USQ process has been performed on all original and revised versions.

   - Revise all facility procedures to include the data recording, checkoff, and sign-off sheets as part of the procedures to assure that they receive the same reviews for safety, consistency, and USQs as the bodies of the procedures.

5. **Improve surveillance and testing.** Specific actions to consider include:

   - Revise the monthly surveillance test of the backup power supply to include verification of the automatic start-up as required by the TSR. Consider measures, such as modifications to the circuits, to allow such testing in a manner that provides for a valid test without causing actual power outages to the facility.

   - Revise the backup power supply automatic start-up surveillance procedure to remove all pre-conditioning steps before the test start-up. Make all such adjustments where indicated by the test or for routine maintenance after the test is performed. Review all similar surveillances and remove all similar pre-conditioning steps. Assure that all data for all surveillances is recorded for the as-found conditions before any adjustments are made.

   - Revise the charcoal filter replacement procedure; add appropriate post-installation testing to verify the integrity of the installation and the performance of the filter.

   - Revise the design of the backup air compressor or the SAR statement, or both, with regard to its starting pressure to reflect an acceptable design with a consistent SAR statement. Revise the TSR and the TSR surveillance procedure accordingly.

   - Institute an instrument and device calibration program that assures that permanently installed and temporary instrumentation and devices used for controlling or monitoring of important-to-safety functions is formally identified and appropriately calibrated and documented.

   - Institute a formal surveillance to verify that nitrogen can be supplied to the cell inerting and sealing systems from either liquid nitrogen storage tank by exercising the manual cross-connect valves at the tanks.

   - Revise the TSR surveillance procedure for zeroing and spanning the cell pressure sensors to correct the discrepancies identified in this report.

6. **Improve maintenance.** Specific actions to consider include:

   - Improve the condition of the manual cross-connect valves and associated piping and fittings at the nitrogen tanks.

   - Remove or secure the large, unsecured, heavy equipment from the second floor storage area immediately in front of the nitrogen supply manifold to remove this unnecessary seismic threat to the system.

   - Add a warning to the cell exhaust charcoal filter replacement procedure that a potential radiation hazard may exist from concentrations of iodine-131, tritium, or other gaseous or vapor constituents not concentrated in other facility components.

   - Revisit the AGHCF maintenance implementation plan to determine where it should be revised to be more in line with the requirements of DOE Order 433.1.

7. **Improve operations.** Specific actions to consider at the AGHCF include:

   - Develop and approve operating procedures for all safety-significant systems. The procedures should cover both normal and abnormal operations.

   - Develop and approve the necessary guidance to define the type of procedures, how to use these procedures, and how to verify the latest version is utilized.

   - Develop and implement a rigorous OJT program as defined in DOE HDBK 1206-98, *Guide to Good Practices for On-the-Job Training.*

8. **Improve the USQ program.** Specific actions to consider include:

   - Generate and issue a new USQ procedure that is fully compliant with the requirements of 10 CFR 830 and the guidelines of DOE Guide 424.1-1 (pending draft revision) considering the discrepancies identified in this report. Enlist the consultation of a recognized outside subject matter expert on this process. Establish as a goal completion, review, approval, and issuance of this procedure within two months.

   - Institute formal training on this new procedure using outside training resources, with the goal that all generators, reviewers, and approvers of USQ documents will be requalified within six months of issuance of the new procedure.

   - Using the new procedure, review all USQ documentation generated within the last three years to determine whether any USQDs were not performed that should have been, and whether any undetected USQs exist.

9. **Improve the nuclear safety organization and infrastructure.** Specific actions to consider include:

   - Perform baseline evaluations of resources and staffing levels, to include the full range of expertise, needed to perform nuclear safety functions.

   - Perform benchmarking at other DOE and non-DOE sites to gather information about the resource needs and expectations for operating a Category 2 nuclear facility.

   - Add senior-level personnel with substantial nuclear experience outside ANL to provide consultation for transforming the AGHCF to a fully compliant Category 2 nuclear facility.

   - Identify short-term opportunities for using external expertise from other DOE sites or commercial or government organizations to provide insights and guidance on managing a nuclear facility in accordance with 10 CFR 830.

   - Develop a long-term program to establish management expectations for rigor and formality. Provide training to staff, and ensure that expectations are understood and enforced.

   - For G and K Wing Laboratories, upgrade the existent procedure for material movement to make this procedure serve as surveillance for TSR 5.3.1.1. Revise TSR 5.3.1.1 to reflect the material control implementation.

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APPENDIX F

Management of Selected Focus Areas

F.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) inspection of environment, safety, and health (ES&H) at Argonne National Laboratory (ANL) included an evaluation of the effectiveness of the Argonne Site Office (ASO) and the contractor in managing selected focus areas. Based on previous DOE-wide assessment results, OA identified a number of focus areas that warrant increased management attention because of performance problems at several sites. During the planning phase of each inspection, OA selects applicable focus areas for review based on the site mission, activities, and past ES&H performance. In addition to providing feedback to the DOE Office of Science (SC), ASO, and ANL, OA uses the results of the review of the focus areas to gain DOE-wide perspectives on the effectiveness of DOE policy and programs. Such information is periodically analyzed and disseminated to appropriate DOE program offices, sites, and policy organizations.

Focus areas selected for review at ANL and discussed in this appendix were:

- Implementation of an environmental management system (EMS) in accordance with DOE Order 450.1, *Environmental Protection Program* (see Section F.2.1)
- Hoisting and rigging (see Section F.2.2)
- Chronic beryllium disease prevention program, or CBDPP (see Section F.2.3).

OA has also identified corrective action management and safety system oversight as focus areas. Corrective action management systems, as implemented by ASO and ANL, are discussed in Appendix D as part of the overall feedback and improvement process. Safety system oversight is discussed in Appendix E as part of essential system functionality.

The scope of the review activities for each of these areas is further discussed in the respective subsections in Section F.2. Where applicable, the results of the review of these focus areas are considered in the evaluation of the core functions and feedback and improvement systems.

F.2 RESULTS

F.2.1 Environmental Management System and Pollution Prevention Program

OA identified the EMS as a focus area across the complex in response to DOE Order 450.1, which requires implementation of EMS at DOE facilities by December 31, 2005. At ANL, the EMS and pollution prevention (P2) program are part of ANL's integrated safety management system (ISMS). OA reviewed ASO and ANL implementation activities for EMS, focusing on the requirements of DOE Order 450.1.

ASO. The ASO ES&H program plan assigns responsibility to the Environmental and Emergency Management Team for ensuring that the ANL integrated safety management (ISM) system includes an EMS. This ASO team provides effective direction to and oversight of ANL for the development and implementation of an EMS. ASO has used contractual performance measures to drive improved ANL performance in achieving EMS milestones. As the ANL program has developed, ASO has refined these EMS performance measures to focus on specific expectations. For example, the 2005 performance measures are to develop and obtain ASO concurrence for P2 and wildlife habitat objectives and targets.

DOE Order 450.1 requires the local DOE office to validate implementation of the EMS and then report to DOE Headquarters that EMS has been implemented. ASO has discussed several processes for performing this validation but has not yet selected a process to use.

ANL.   ANL has established a detailed environmental policy as part of the EMS requirement. This policy specifies that ANL will ensure that environmental protection is achieved and that activities are conducted according to all applicable Federal, state, and local regulations and DOE requirements. ANL is also committed to integrating environmental protection accountability into day-to-day activities and long-term planning processes.

ANL is implementing an EMS as part of their ISM systematic approach to managing continuous ES&H improvement. Responsibilities for leading the EMS development effort have been appropriately assigned to the ANL Environment, Safety, and Health/Quality Assurance Oversight (EQO) division. In developing the EMS, EQO has used the ISM guiding principles and core functions and the environmental program requirements in the ES&H Manual to define EMS within the ANL ISM description document.

To facilitate implementation of the EMS, all ANL employees are required to complete a P2 training course that increases their awareness of ANL's environmental policy. Another course, DOE Order 450.1 Environmental Management System Training, has been developed and is suggested for key line personnel, including ES&H coordinators, environmental compliance representatives, and managers, to increase their awareness of the EMS and associated objectives and targets. Other actions to increase EMS awareness include presentations to the line environmental compliance representatives at their quarterly meetings, and presentations to external stake holders.

ASO and ANL environmental personnel who have been assigned EMS responsibility are well qualified and have made considerable progress in implementing the EMS to date. While the implementation, certification, and validation of EMS as required by DOE Order 450.1 are achievable, considerable work remains to be accomplished by the December 31, 2005, milestone. The EMS implementation actions are still being developed, and there is no formal EMS implementation plan to guide implementation. ANL EMS objectives and targets are not prioritized for implementation based on their regulatory, environmental, social, and economical impacts, and manpower and budgetary constraints. In addition, these objectives and targets for the first year only identify actions to be completed within EQO and other support organizations. While actions to increase awareness are occurring, no formal communication plan has been prepared to describe how to conduct these actions to enhance the overall EMS awareness.

ANL continues to implement a P2 program that includes recycling programs for such materials as paper, glass, batteries, fluorescent bulbs, and excess chemicals. ANL received a White House Closing the Circle Award for Noteworthy Practice for its reuse of nuclear targets. Some P2 actions were impacted because of funding reductions, which occurred when funding responsibility transitioned from the DOE Office of Environmental Management (EM) to SC. Under EM funding, ANL had a dedicated P2 staff and a P2 committee that met regularly. With the transition to SC funding, the P2 staff was eliminated, support for P2 opportunity assessments was reduced, and the P2 committee meetings became irregular.

In part in response to ASO's establishment of a P2 contract performance measure, ANL has recently taken actions to invigorate the P2 program, including assigning a P2 coordinator within EQO. Actions are currently being taken to complete a planned P2 opportunity assessment, to re-establish regular meetings of the P2 committee, and to increase support to ongoing P2 activities, such as the recycling programs. A draft ANL waste minimization and P2 management plan has been prepared as the framework for developing P2 goals and depicts the strategy for carrying out the P2 management plan in four fundamental steps. However, a more specific, detailed plan to conduct these four fundamental strategy steps has not yet been developed.

Summary. ASO provides effective direction to and oversight of ANL for the development and implementation of an EMS, and ASO has driven enhanced performance by ANL in achieving EMS milestones by using performance measures specific to these milestones. ANL has developed an EMS within the ISM description document; however, the EMS implementation actions are still being developed and additional efforts are needed to develop detailed planning documents. Despite these challenges, the EMS is on schedule to be implemented and verified in accordance with DOE Order 450.1. ANL continues to implement a P2 program and, with ASO performance measure incentives, is taking actions to reinvigorate the program following changes in waste management funding.

F.2.2 Hoisting and Rigging

Previous OA inspection results and site occurrence reports from the past several years demonstrate that a number of sites have experienced events, near misses, and injuries during hoisting and rigging activities. As a result, OA designated hoisting and rigging as a focus area for calendar year (CY) 2005 OA evaluations. During this evaluation, OA sampled hoisting and rigging activities performed by ANL during programmatic and maintenance work and by subcontractors during construction activities. The review of the ANL hoisting and rigging program included observation of lifting activities and crane maintenance, review of hoisting and rigging procedures, and inspections of hoists, slings, lifting fixtures, and cranes in shop areas, work sites, and construction sites to a limited extent. ANL Plant Facilities and Services (PFS) has overall responsibility for hoisting and rigging activities at ANL. PFS is responsible for ensuring that hoisting and rigging requirements are adequately identified in ANL program documents. The ANL hoisting and rigging subject matter experts and a dedicated and qualified rigging crew also reside within PFS.

PFS has been diligent in maintaining the ANL hoisting and rigging program current with changing DOE regulations and standards. ANL has developed an extensive hoisting and rigging manual based on the 2001 version of the DOE Hoisting and Rigging Manual. PFS is currently incorporating the requirements of the recent 2004 DOE Hoisting and Rigging Standard (i.e., DOE-STD-1090-2004, formerly the DOE Hoisting and Rigging Manual) into the site's hoisting and rigging manual. A desktop assessment on the ANL Hoisting and Rigging Manual was conducted in October 2004.

In general, ANL operators of aerial work platforms were current in their required training and certification requirements. For example, PFS building maintenance workers at the Advanced Photon Source (APS) were properly certified to operate the manlift they were using to replace the elevated APS air filters. In addition, the workers used the appropriate fall protection and personal protective equipment (PPE), as required for operating the manlift. APS subcontractors constructing a modular beamline enclosure were also current with respect to training requirements for the fork trucks and scissors lifts they were operating. Current operator licenses were posted at the work site and were readily available for inspection.

During recent years, PFS has used a third-party contractor to perform annual inspections of a variety of hoisting and rigging equipment (e.g., manlifts, hoists, fork trucks, gantry cranes). For annual inspections, this process has been effective; all hoisting and rigging equipment observed by the OA team was current with respect to annual inspections. In general, annual inspections of hoisting and rigging equipment appear to be rigorous and well documented.

Construction field representatives are actively involved in the oversight of hoisting and rigging work activities at construction sites. For example, at the APS modular beamline enclosure construction activity, Occupational Safety and Health Administration (OSHA) construction requirements for hoisting and rigging equipment were documented in the subcontractor's health and safety plan and job safety analysis. Initial and routine equipment inspections were performed by the APS construction field representative. OA observations confirmed that the hoisting and rigging equipment, including slings, fork trucks and scissors lifts, were maintained in good condition. Daily inspections of this equipment were being performed by the subcontractor. PFS construction field representatives have also been effective in ensuring that hoisting and rigging equipment used by subcontractors is in good working condition. For example, in Building 362, two subcontractor nylon harnesses inspected by the construction field representative had illegible load rating markings, and the subcontractor was subsequently instructed by the construction field representative to remove the slings from the site.

Although annual inspections and inspections performed by construction field representatives have been effective in identifying defective personnel and material handling devices and/or hoisting and rigging equipment, the OA team observed a number of cases where ANL had not performed pre-use and monthly inspections of hoisting and rigging equipment as required by the ANL ES&H Manual or ANL Hoisting and Rigging Manual, and some defective equipment was either in use or not appropriately tagged out. For example, in the Building 368 maintenance room, one of the three hydraulic boom sling cranes (engine hoists) was missing its hydraulic piston and had not been tagged out of service. Also in the Building 368 maintenance room, two manlifts were annually certified, but the pre-use inspections were not being performed. Two mobile bridge cranes (M-Crane-H1 and H2) in Building 212 had appropriate annual certifications. However, there was a discrepancy on the records of monthly inspections. Specifically, on April 26, 2005, the OA team observed that the records indicated that monthly inspections had been completed on May 1, 2005. In another example, several slings and wire ropes in Building 212 had exceeded their periodic inspections by two months. In addition, a pear ring which had been used recently for a hoisting and rigging activity had no discernable design load markings; the facility-designated inspector for rigging could not determine either the load rating for the ring or the manufacturer. As a result, the ring was removed from service until such information could be determined. In another example, building maintenance used a 4-ton boom lift with a leaking hydraulic relief hose to remove and replace a manhole cover. The pre-use inspection did not identify this defective condition, which should have resulted in tagging this lift out of service. Furthermore, in Building 206, several lifting hooks with missing hook latches were inappropriately tagged as inspected and approved. (See Finding #1.)

The ANL feedback and improvement processes were not effective in ensuring that the July 2004 lessons-learned actions on hoisting and rigging incidents developed by SC were implemented for all ANL construction subcontractors. In response to an SC July 2004 lessons-learned memorandum, ANL developed a hoisting and rigging safety improvement plan, which was submitted to ASO in September 2004. The improvement plan stated that hoisting and rigging requirements, as defined in various ANL policy and procedure manuals, had been implemented in ANL construction projects through inclusion of DOE and ANL hoisting and rigging requirements into construction subcontractor contracts and safety plans. Although these actions may have been performed for PFS construction subcontractors, the actions were not completed for some construction subcontractors managed by other ANL divisions. For example, the current modular beam-enclosure construction project at APS, which is being managed by APS, requires only that the construction subcontractor meet the requirements of OSHA construction standard 29 CFR 1926, as evidenced by the subcontractor's ES&H plan. There are no requirements in the subcontractor's contract with ANL or the subcontractor's ES&H plan, or expectations from the subcontractor, that they are required to comply with any DOE or ANL ES&H hoisting and rigging requirements other than those requirements identified within their contract. Although the hoisting and rigging activities for this APS construction contract were limited to the operation of a forklift truck and a scissors lift, some DOE and ANL hoisting and rigging requirements (such as documented pre-use inspections) were not met, and it was unclear whether the hoisting and rigging requirements of 29 CFR 1910 were applicable. This situation is in conflict with the ANL hoisting and rigging safety improvement plan. The open EQO track corrective action plan for the hoisting and rigging improvement plan does not include a corrective action to address this concern. (See Finding #1 and Appendix D, Findings #14 and #16.)

Summary. The PFS hoisting and rigging program is being updated to remain current with changing DOE regulations. Equipment operators are current in their training and have current licenses, and hoisting and rigging equipment is adequately inspected on an annual basis. However, in a number of cases, pre-use and monthly inspections are not being performed as required, and some equipment was defective. In addition, ANL hoisting and rigging requirements have not been adequately incorporated in some ANL construction subcontractors' contracts, ES&H plans, or job safety analyses.

F.2.3 Chronic Beryllium Disease Prevention Program (CBDPP)

DOE has established regulatory requirements for the CBDPP in 10 CFR 850. The rule is intended to protect workers and prevent exposure to beryllium, establishes voluntary medical surveillance requirements to ensure early detection of chronic beryllium disease, and requires a reduction in the number of workers currently exposed to beryllium in the workplace. DOE also developed guidance (DOE Order 440.1-7A) to assist line management in meeting their responsibilities for implementing the beryllium prevention program. This OA review focused on ASO and ANL implementation of the CBDPP rule and the effectiveness of the ANL implementation of the CBDPP.

There are no active beryllium operations at ANL. In the past, beryllium was used at ANL in various forms, typically in crucibles, neutron reflectors, and neutron beam filters and x-ray windows. A beryllium machine shop was established in the east area of ANL in the 1950s. Considerable beryllium machining was performed in this shop through the 1970s. The machine shop was closed in 1980 and has since been decontaminated and removed. Since the 1980s, beryllium work has been limited to cleanup of legacy materials, and limited use of beryllium articles and beryllium components in research equipment. Current activities involving beryllium at ANL are limited to occasional repair of instrumentation containing beryllium components (e.g., x-ray windows at APS).

The ANL beryllium program is described in ES&H Manual Chapter 4.6, "Beryllium," and ANL Medical Department procedures. Sitewide beryllium characterization has been conducted by the ANL Industrial Hygiene organization in accordance with the requirements of the DOE beryllium rule (10 CFR 850). During the beryllium characterization campaign, seventy locations in eleven buildings were identified and sampled for beryllium contamination. Of those locations sampled, 27 percent had detectable surface contamination of beryllium in excess of the DOE free release limit (0.2 micrograms/100 square centimeters [cm^2]), but all locations had less than the levels currently permitted in designated beryllium work areas (3 micrograms/100 cm^2). In addition to surface sampling, general workroom air samples were collected in areas where surface contamination was above 0.2 micrograms/100cm^2. All air samples were below the limit of detection and well below workplace exposure standards. There were no detectable airborne concentrations of beryllium identified during the characterization campaign.

Of the 19 beryllium-contaminated areas that were identified at ANL during the initial site beryllium characterization, about half have been abated. No beryllium legacy abatement projects have been conducted at ANL during the past two years, although beryllium abatement work is pending in Building 314. Some of the remaining beryllium-contaminated legacy areas are in occupied facilities, but the beryllium contamination levels are low, and the contamination is in areas that normally are not accessible (e.g., above seven feet). In a few cases, the beryllium contamination is at elevated heights and above normally occupied areas. Limited funding has been allocated for cleanup of these remaining contaminated areas. Until the remaining beryllium contamination is abated, workers in facilities with beryllium contamination are at some risk of being exposed to low concentrations of beryllium dust, particularly if the dust becomes airborne or is re-suspended as a result of maintenance, housekeeping, or inadvertent contact.

Some ANL divisions (e.g., APS) have developed procedures for beryllium cleanup that do not adequately incorporate all the applicable requirements of the ES&H Manual (see Appendix C, Section C.2.1). Typically, these divisional procedures address focused, infrequent, and limited beryllium cleanup (e.g., removal of shattered beryllium windows). However, some of these procedures do not adequately describe the beryllium hazard, are not reviewed by Industrial Hygiene personnel, and do not provide clear and unambiguous requirements for hazard controls (e.g., posting, PPE, waste cleanup, medical surveillance, and training). The requirements for hazard controls are, in some cases, inconsistent and less conservative than hazard controls provided in the Waste Management Organization beryllium abatement procedure for comparable hazards. (See Finding #1.)

ANL has established a centralized group of beryllium workers within the PFS Waste Management Organization to perform beryllium cleanup across the site. This centralized abatement function has facilitated the development of procedures and ensured that qualified and experienced workers consistently perform abatement activities. Beryllium abatement procedures have been developed that define abatement activities and establish controls that are tailored to varying levels of beryllium contamination. Each beryllium abatement project is performed using the beryllium abatement procedures, supplemented by job safety assessments and WCPs. Abatement workers are appropriately enrolled in medical surveillance programs.

Medical procedures for beryllium are detailed and well-written. Since the 1960s, the ANL Medical staff has been accumulating data on beryllium exposures across the site. The beryllium medical data for current and former ANL workers is extensive. ANL Medical has developed several comprehensive databases for identifying individuals potentially exposed to beryllium, which includes medical exam notes, air monitoring data, and exposure routes. While the beryllium database contains a significant volume of beryllium data, the data is often difficult to retrieve.

The current ANL beryllium database lists 1,991 current and former ANL workers potentially exposed to beryllium, of which 360 are identified as current workers. Of the current workers, only one has tested positive for beryllium sensitization and was later deemed to be normal. There are no cases of chronic beryllium disease among current ANL workers. Because the data for a number of former beryllium workers may have been transferred to the Oak Ridge Institute for Science and Energy (ORISE) beryllium database for future tracking by ORISE, it is uncertain whether there are any former ANL workers who are beryllium-sensitized or who have been diagnosed with chronic beryllium disease.

During the late 1990s, current and former workers were informed on the DOE beryllium rule, and many completed a beryllium questionnaire or job hazard questionnaire to self-identify their involvement with beryllium. During this period, the ANL Medical Department developed a computer-based inventory of current workers who may have been exposed to beryllium, and workers have been entered into this database through a variety of mechanisms since its conception. Some workers were entered based on responses to their job hazard questionnaire. Others were entered by line managers or the Industrial Hygiene organization based on their work activities. In some cases, workers enrolled themselves, or were entered by ANL Medical.

Currently, the medical beryllium database lists 360 current ANL workers who have had varying levels of potential exposure to beryllium. According to ANL Medical Department records, many of these current ANL workers have never been offered or evaluated for medical surveillance as required by the DOE beryllium rule, 10 CFR 850; only 104 have been offered medical surveillance, and 75 accepted enrollment. The remaining 256 current workers had not been interviewed by ANL medical and offered medical surveillance. Furthermore, of the 28 current workers who answered "yes" to the potential for beryllium exposure on their beryllium questionnaire, only 11 have been interviewed by ANL Medical to date. The ES&H Manual states that all beryllium-associated workers will be offered the opportunity to participate in the beryllium surveillance program. Offering voluntary screening with a beryllium-specific blood lymphocyte proliferation test is also required under 10 CFR 850.34. (See Finding #3 on Medical surveillance.)

The ANL Medical Director recognizes the significance of the deficiencies in beryllium medical surveillance that were raised by the OA team and has made it a priority to correct the situation. However, some challenges need to be addressed, including the recent departure of two of the three ANL physicians, which limits the resources for performing medical surveillance screening for beryllium and other toxic metals, such as lead. An additional concern is that of the current workers listed in the beryllium database, there is not a clear designation of which workers are beryllium workers, beryllium-associated workers, or other. This designation is important in determining the type and frequency of medical surveillance to be offered.

Because no beryllium abatement projects have been performed in the past two years, there has been minimal involvement and oversight of the ANL beryllium program by ASO. A review of ANL and ASO assessment records could not identify any formal assessments of the ANL beryllium program having ever been conducted. 10 CFR 850.40, *Performance Feedback*, requires that the "employer conduct periodic analysis and assessments of monitoring activities, hazards, medical surveillance, exposure reduction and minimization and occurrence reporting data." Furthermore, the DOE implementation guide states that a DOE/local review of the CBDPP should be conducted at least annually. (See Finding #1 and Appendix D, Findings #10 and #13.)

Summary. There are currently no active beryllium activities at ANL, although beryllium has been used in past ANL operations. Beryllium characterization of the ANL site facilities is complete, but only half of the beryllium-contaminated areas identified during the characterization campaign have been remediated. There have been no confirmed cases of beryllium sensitization or chronic beryllium disease reported to date. The medical data on current and former employees is robust; however, a number of workers in the current beryllium database have not been offered medical surveillance or been evaluated by the Medical Department, as required by the ES&H Manual and 10 CFR 850. Furthermore, recent ASO oversight of the ANL beryllium program has been minimal, and no formal assessments of the beryllium program have been conducted by either ANL or ASO.

F.3 CONCLUSIONS

The ANL efforts to implement the EMS are generally adequate, and ANL is on schedule to implement its EMS in accordance with established milestones. Most aspects of hoisting and rigging are adequately implemented, although some inspections were not performed, some equipment was defective, and some hoisting and rigging requirements did not adequately flow down to subcontractors. SC and/or ASO have focused line management attention on EMS and hosting and rigging activities and have driven improvements. Many aspects of the CBDPP at ANL are adequate and some improvements have been made, but medical surveillance for beryllium workers has some deficiencies. In addition, while corrective actions are being initiated, ANL does not currently comply with medical surveillance requirements for beryllium workers. A contributing factor is that neither ASO nor ANL have performed assessments of the CBDPP as required.

F.4 OPPORTUNITIES FOR IMPROVEMENT

This OA inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site to be reviewed and evaluated by the responsible line management, and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

ASO

1. **Select a process to be used for validating that the EMS has been implemented, using independent DOE personnel to execute the process.** Because several SC laboratories will be validating EMS implementation, the need to coordinate with other SC organizations requires that the process be selected quickly so that arrangements can be made to ensure that appropriate personnel are available.

2. **Conduct periodic assessments of ANL's implementation of the CBDPP.** Review the status of ANL implementation of each of the 40 elements of the CBDPP, as applicable, and periodically assess the CBDPP program annually thereafter.

ANL

1. **Enhance EMS and P2 plans to formalize and refine actions, expectations, and objectives.** Specific actions to consider include:

    - Prepare an EMS implementation plan to ensure that the remaining required actions are completed in a systematic manner and with sufficient time remaining for EMS validation by ASO.

    - Develop an EMS communication plan to enhance EMS awareness through formal training (such as adopting a mandatory ANL employee EMS awareness training), posters, and articles in ANL employee publications.

    - Prioritize the EMS objectives and targets for implementation based on their impacts and manpower and budgetary constraints, and develop objectives and targets for line organizations as appropriate.

    - Develop a P2 program plan to complement the waste minimization and P2 management plan (currently in draft form) to timely evaluate, incorporate, and implement P2 opportunities at ANL as part of ongoing efforts to reinvigorate P2.

2. **Ensure that operators of hoisting and rigging equipment are performing and documenting periodic safety inspections of their equipment.** Specific actions to consider include:

    - Review the periodic inspection and documentation requirements with current operators of hoisting and rigging equipment and line managers.

- Conduct a sitewide assessment on hoisting and rigging equipment inspections. Tagout and remove from service any equipment that is not required for near-term use.

- Increase the emphasis on inspection requirements in ANL hoisting and rigging training.

3. **Improve the process for identifying and incorporating applicable hoisting and rigging requirements into ANL construction subcontracts.** Specific actions to consider include:

   - Define the hoisting and rigging requirements from DOE orders and ANL site requirements for inclusion into construction subcontracts.

   - Reassess the corrective actions from the ANL hoisting and rigging safety improvement plan to include rolldown of requirements for construction subcontractors under Improvement Opportunity (IO)-1, "Policies, Procedures, and Requirements."

   - Use divisional designated construction field representatives and ES&H coordinators to ensure that the applicable hoisting and rigging requirements are integrated into construction subcontractors' ES&H plans and job safety analyses.

   - Include hoisting and rigging safety requirements in site construction subcontractor training.

   - Incorporate OSHA and American National Standards Institute (ANSI) standard requirements for aerial work platforms into institutional procedures and manuals.

4. **Develop plans, goals, and budgets for the abatement of the remaining beryllium legacy areas.** Specific actions to consider include:

   - Risk-rank the remaining beryllium contamination areas.

   - Establish goals, budgets, and schedules for the Waste Management Operations organization to complete the abatement of the remaining beryllium contamination areas.

5. **Expedite the screening of ANL workers for entry into the beryllium medical surveillance program**. Specific actions to consider include:

   - Ensure that sufficient industrial hygiene, medical, and administrative resources are available to expedite the screening of the remaining workers identified in the beryllium database for entry into the beryllium medical surveillance program.

   - Categorize workers currently listed in the beryllium database as beryllium workers or beryllium-associated workers.

6. **Incorporate periodic assessments of the CBDPP in ANL ES&H topical assessments.**

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