Volume I

Inspection of Environment, Safety, and Health Management at the

Argonne National Laboratory - East

May 2002

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

INDEPENDENT OVERSIGHT
INSPECTION OF
ENVIRONMENT, SAFETY, AND HEALTH MANAGEMENT
AT THE
ARGONNE NATIONAL LABORATORY – EAST

Volume I

May 2002

INDEPENDENT OVERSIGHT
INSPECTION OF
ENVIRONMENT, SAFETY, AND HEALTH MANAGEMENT
AT THE
ARGONNE NATIONAL LABORATORY – EAST

Volume I

Table of Contents

Acronyms

AAO	Argonne Area Office
ALARA	As Low As Reasonably Achievable
ALD	Associate Laboratory Director
AGHCF	Alpha Gamma Hot Cell Facility
ANL	Argonne National Laboratory
CFR	Code of Federal Regulations
CH	Chicago Operations Office
CMT	Chemical Technology Division
CY	Calendar Year
CRD	Contract Requirement Document
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy
EQO	Office of Environment, Safety, and Health/Quality Assurance Oversight
ES&H	Environment, Safety, and Health
ESH&I	ES&H and Infrastructure
ET	Energy Technology Division
FR	Facility Representative
FRAM	Function, Responsibilities, and Requirements Manual
FY	Fiscal Year
HEPA	High Efficiency Particulate Air
HP	Health Physics
ISM	Integrated Safety Management
JHA	Job Hazard Analysis
JHQ	Job Hazard Questionnaire
JSA	Job Safety Analysis
MOVER	Mobile Visual Examination and Repackaging System
MOU	Memoranda of Understanding
OA	Office of Independent Oversight and Performance Assurance
ORPS	Occurrence Reporting and Processing System
OSHA	Occupational Safety and Health Administration
PFS	Plant Facilities and Services Division
PPE	Personal Protective Equipment
QA	Quality Assurance
QAPP	Quality Assurance Program Plan
R&D	Research and Development
RWP	Radiation Work Permit
SC	DOE Office of Science
TQP	Technical Qualification Program
TSR	Technical Safety Requirements
UC	University of Chicago
USQ	Unreviewed Safety Question
WCP	Work Clearance Permit

INDEPENDENT OVERSIGHT INSPECTION OF ENVIRONMENT, SAFETY, AND HEALTH MANAGEMENT AT THE ARGONNE NATIONAL LABORATORY – EAST

VOLUME I

1.0 INTRODUCTION

The Secretary of Energy's Office of Independent Oversight and Performance Assurance (OA) conducted an inspection of environment, safety, and health (ES&H) programs and emergency management programs at the U. S. Department of Energy (DOE) Argonne National Laboratory (ANL) in April and May 2002. The inspection was performed as a joint effort by the OA Office of Environment, Safety and Health Evaluations and the Office of Emergency Management Oversight. This volume discusses the results of the review of ANL ES&H programs. The results of the review of the ANL emergency management programs are discussed in Volume II of this report and the combined results are discussed in a summary report.

The DOE Office of Science (SC) is the lead program secretarial office for ANL. As such, it has overall Headquarters responsibility for programmatic direction, funding of activities, and safety at the site. Line management responsibility for the operation of ANL falls under the Chicago Operations Office (CH), which has delegated most responsibilities to its subordinate Argonne Area Office (AAO). ANL is managed and operated by the University of Chicago (UC) under contract to DOE. Contract management functions have been delegated to AAO.

Throughout the evaluation of ES&H programs, OA reviews the role of DOE organizations in providing direction to contractors and conducting line management oversight of the contractor activities. OA is placing more emphasis on the review of contractor self-assessments and DOE line management oversight in ensuring effective ES&H programs. In reviewing DOE line management oversight, OA focused on the effectiveness of SC and CH/AAO in managing the ANL contractor, including such management functions as setting expectations, providing implementation guidance, allocating resources, monitoring and assessing contractor performance, and monitoring/evaluating contractor self-assessment. Similarly, OA focuses on the effectiveness of the contractor self-assessment programs, which DOE expects to provide comprehensive reviews of performance in all aspects of ES&H.

ANL is a multiprogram laboratory that includes several major facilities used by DOE and other sponsors from industry, academia, and other nations for research and development. The primary ANL site is situated about 22 miles southwest of downtown Chicago, Illinois, and is surrounded by a forest preserve (ANL also operates a site near Idaho Falls, Idaho, under the same contract with DOE; the Idaho site was not included in the scope of this inspection). ANL performs research and development for DOE and non-DOE sponsors in many areas, including materials science, physics, chemistry, biology, high-energy physics, mathematics, computer science, energy research, and environmental management. To support these activities, ANL operates numerous laboratories, test facilities, and support facilities and performs such activities as facility maintenance and waste management. ANL activities involve various potential hazards that need to be effectively controlled, including exposure to external radiation, radiological contamination, hazardous chemicals, and various physical hazards associated with facility operations (e.g., machine operations, high-voltage electrical equipment, pressurized systems, noise, and construction/maintenance activities). Radioactive materials are present in various forms at ANL.

The purpose of the ES&H portion of this inspection was to assess the effectiveness of selected aspects of ES&H management as implemented by ANL under the direction of SC and CH/AAO. The ES&H portion of the inspection was organized to evaluate three related aspects of the integrated safety management (ISM) program:

- Implementation of the guiding principles of ISM by CH/AAO and ANL
- CH/AAO and ANL feedback and continuous improvement systems
- Implementation of the core functions of safety management for various work activities, including research and development activities (e.g., experiments), maintenance, waste management operations, and subcontracted work.

The OA inspection team used a selective sampling approach to determine the effectiveness of SC, CH/AAO, and ANL in implementing DOE requirements. The sampling approach involves examining selected institutional programs that support the ISM program, such as CH/AAO and ANL assessment programs and programs for identifying and implementing applicable requirements. To determine the effectiveness of the institutional programs, the OA team examined implementation of requirements by selected ANL organizations and facilities. Specific organizations and facilities reviewed included:

- The Plant Facilities and Services Division (PFS), reporting to the ANL Chief Operations Officer, with a focus on the PFS Waste Operations Department, Building Maintenance and Crafts group, and elements of the Safety and Emergency Systems Department. Activities at the Waste Management Complex (Building 306 complex and Building 331) and PFS maintenance support at other facilities were reviewed.
- The Chemical Technology Division (CMT) reporting to the Associate Laboratory Director (ALD) for Engineering Research, with a focus on activities in Building 205. Building 205 houses various laboratories for research activities in the areas of nuclear technology, chemical and electrometallurgical engineering, radioactive and mixed waste treatment technology, nuclear facility decontamination and decommissioning, and nuclear reactor and fuel cycle research.
- The Energy Technology Division (ET) under the ALD for Energy and Environmental Sciences and Technology, with a focus on activities in Building 212. The ET Division's Alpha Gamma Hot Cell Facility (AGHCF), which is a Category 2 nuclear facility, is located in Building 212. Various laboratories and laser facilities are also located in Building 212 to support research in energy systems, environmental technology, transportation system efficiency, information sciences, and infrastructure technology.

Work at ANL can be divided into two categories—experimental and non-experimental. Experimental work consists of the experiments conducted in support of ANL's research and development mission. Non-experimental work, which makes up a significant part of the work performed at ANL, is all the other work associated with operation of the laboratory, such as facility and equipment maintenance, laboratory and equipment installation and refurbishment, waste management, and service and construction by subcontractors. Some ongoing work, such as experimental research, includes a formally defined process for work planning and control, while other work observed by the OA team, such as maintenance, has relatively few formal or systematic requirements.

As discussed in this report, some aspects of ISM are effectively implemented at ANL, including institutional roles and responsibilities, training and qualification programs, and processes for incorporating ES&H needs into the planning and budgeting processes. In addition, CH/AAO and ANL have been effective in establishing rigorous processes for reviewing experiment safety. However, performance weaknesses are evident in several areas, including work planning and control processes, radiation protection, and some aspects of management of the AGHCF (including nuclear safety requirements). Weaknesses in management systems, such as CH/AAO and ANL feedback and continuous improvement systems and requirements management systems, contribute to the observed performance deficiencies.

Section 2 of this volume provides an overall discussion of the results of the review of the ANL ISM program, including positive aspects, findings, and other items requiring management attention. Section 3 provides OA's conclusions regarding the overall effectiveness of CH and ANL management of the ES&H programs. Section 4 presents the ratings assigned as a result of this review. Appendix A provides supplemental information, including team member composition. Appendix B identifies the specific findings that require corrective actions and follow-up. Appendix C presents the results of the review of the guiding principles of ISM. Appendix D presents the results of the review of the CH and ANL feedback and continuous improvement processes. The results of the review of the application of the core functions of ISM at the selected ANL facilities are discussed in Appendix E.

2.0 STATUS AND RESULTS

The results of this review indicate that the ISM program at ANL has several positive attributes (see Section 2.1). However, several weaknesses were also identified (see Section 2.2).

2.1 Positive Program Attributes

CH/AAO actions have led to improvements in ISM at ANL. CH/AAO has established an adequate set of ES&H requirements for ANL and appropriately identified directives for inclusion in the DOE/UC contract. ISM-related performance measures have been established to promote improvements in safety (e.g., recordable injuries and environmental incidents). The contract also provides incentives to incorporate environmental management systems within the ANL ISM program. In addition, the contract requires progress reports on specific ES&H objectives, such as improved radiological performance, and implementation of the Chronic Beryllium rule (i.e., Chronic Beryllium Disease Prevention Program, 10 CFR 850). CH/AAO is effectively using the contract to drive further improvement and accountability in contractor ES&H performance. For example, CH/AAO has established contractual performance measures that address previously identified performance weaknesses, such as radiological contamination events and employee compliance with required ES&H training. In addition, the contract establishes requirements for self-assessments of specific ISM areas, including experiment safety review processes. The increased management attention and monitoring of performance measures has contributed to improvements in contractor performance in these areas. The CH ISM verification reviews resulted in improvements by ANL, including strengthening the institutional experiment safety review protocols.

ANL senior managers have been actively involved in promoting safety at ANL. Senior management attention has been instrumental in responding to the CH ISM verification and establishing an effective institutional experiment safety review protocol. Senior management has also focused significant attention on important ISM institutional program elements, such as roles and responsibilities and training and qualifications, and has generally established effective management systems in these areas. For example, the ANL ES&H Manual clearly defines responsibilities and authorities in most areas and establishes appropriate requirements for control of workplace and environmental hazards. ANL has also established an effective training management system that identifies and tracks training for each employee. ANL management has taken actions to ensure that ANL personnel are aware of the importance of safety and senior management's expectations for effective safety performance. For example, ANL conducts weekly Management Council meetings, which are chaired by the ANL Director, and discusses safety events and issues as a first order of business. Various safety committees and employee concerns programs are also effective and provide appropriate management support. The ANL Director performs periodic walkthroughs of facilities, and all ALDs and division managers are expected to perform similar walkthroughs. ANL management actions have contributed to improvements in safety management at ANL. Performance measure data indicates that injury rates are significantly less than industry averages and comparable to many other DOE laboratories. Most performance measures reflect improving trends over the past several years.

ANL has established an effective system for experiment safety reviews. As a research laboratory, ANL performs a wide range of experiments, some of which involve hazardous materials or conditions. ANL's institutional experiment safety review protocol applies to all experimental activities and is well designed. Each division conducts reviews of experiments and other activities using a process established by the division in accordance with requirements. ET and CMT further defined the process in division-specific procedures. In some cases, a facility or apparatus safety review is performed to document apparatus-specific hazards and controls. For experiments involving non-routine hazards, approval by an experiment safety review committee is required before beginning the experiment. Following final approval, the laboratory workers are required to perform the experiment(s) in accordance with established controls. The establishment of an institutional process and a comprehensive set of division-level processes for reviewing experiments is a significant accomplishment at ANL, considering its numerous organizations and diverse facilities and hazards. OA reviews of CMT and ET indicated that the experiment review procedures were appropriately designed and effective in identifying hazards and controls. The experiment safety review process, in conjunction with the strong interest and involvement in safety demonstrated by the managers, experimenters, technicians, and safety officers, has resulted in effective controls for experiments. For example, ET experiments involving high-pressure steam incorporated multiple layers of protection from the high-pressure hazards, including physical barriers, area access control, and procedural controls. Some controls, such as locking out energy sources for the equipment when not in use, were a result of comments from the experiment safety review committee during walkdowns of the experiment apparatus. In another ET example, experimenters researching the characteristics of irradiated commercial nuclear fuel cladding conducted multiple dry runs of a procedure with unirradiated material to ensure that the procedure was effective, the health physics (HP) coverage and radiation work permit (RWP) were appropriate, and the personal protective equipment was appropriate for the job.

2.2 Program Weaknesses

For non-experimental work, ANL has not implemented systematic mechanisms that define how the core safety management functions are performed to ensure that hazards are adequately identified and appropriately characterized and analyzed, and to ensure that tailored controls are implemented Although ANL effectively addressed experimental work, there are significant process deficiencies in the ISM core functions for other types of work (e.g., maintenance), contributing to situations where worker hazards are not adequately controlled. Most of the problems can be traced to the lack of a systematic approach to work control for maintenance and maintenance-like activities. For many types of work, ANL managers and supervisors rely too much on individual expertise and knowledge as the primary source of hazard information and analysis (whereas DOE requirements call for a standards-based approach to hazard analysis and controls). Identification and implementation of controls were dependent on individuals' knowledge of the hazards at a site, rather than documented work location surveys and walkdowns. ANL's informal approach does not ensure that adequate controls exist for more complicated, more hazardous, or non-routine work. The ANL ES&H Manual contains many specific requirements for specialized hazards that, when implemented correctly in conjunction with a systematic work control process, provide adequate controls to protect workers' health and safety. The ANL organizations that were reviewed had not implemented specific work control processes that would ensure that work planners, supervisors, managers, and workers incorporate the applicable sitewide requirements into their work activities, thereby potentially placing workers at risk.

Important elements of the ANL radiation protection program are not effectively implemented, and the corrective actions taken to date have not resolved the recognized deficiencies. The ANL radiation protection program has weaknesses in such key areas as RWPs and radiological surveys and sampling, which are needed to accurately identify and control workplace hazards. For example, one RWP did not include a requirement for neutron dosimetry or neutron surveys in areas where neutron radiation fields were as high as 100 mrem/hr on contact and in the tens of mrem/hr for general area neutron exposure. Other RWPs were not effective because they were not sufficiently specific to the work, or controls were not provided for all known hazards or lacked sufficient detail. Some areas in which respiratory protection is in use are not posted as airborne radioactivity areas, and specific air sampling is not performed to determine the actual airborne concentration, which is needed to meet posting requirements. Some surveys were not conducted and documented in an appropriate technically defensible manner. Bioassay results for 2001 indicate that a few workers received unexpected intakes of radioactive materials, which cannot be traced to specific workplace conditions or events. In addition, the radiation protection program lacks adequate procedures for implementing requirements. Senior ANL management has recognized problems in radiation protection and has taken some action, including reorganizing ANL HP personnel and establishing a committee to provide radiation protection standards. However, performance problems have not been resolved, as evidenced by performance deficiencies, and little progress has been made in developing the needed procedures in the past year. Neither senior ANL management nor the standards committee has established clear direction (e.g., responsible individuals and milestones) for completion of the necessary implementing procedures. Institutional responsibility for the radiation protection program has not been clearly assigned and is not being effectively executed. Senior ANL managers recognize continuing performance problems related to radiation protection and have announced plans to hire a site radiation safety officer to provide program leadership and to use outside experts to evaluate the ANL radiation protection program.

Some aspects of nuclear safety requirements are not effectively implemented at the AGHCF. The AGHCF is used to handle and analyze irradiated nuclear fuel and other radioactive materials and has been designated as a Category 2 nuclear facility because of the potential for significant onsite radiological consequences. Some important nuclear safety requirements have not been adequately implemented at the AGHCF in a manner that ensures that the DOE-approved safety envelope is verified and maintained. Deficiencies were identified in some aspects of the authorization basis and unreviewed safety question (USQ) process and in many aspects of technical safety requirements (TSRs) implementation. In one case, the AGHCF safety analysis report included a derivation of a TSR surveillance requirement that established a non-conservative value for the minimum pressure of the fire protection system. Consequently, the TSR surveillance requirement does not verify that the pressure in the fire protection system is sufficient to meet its design specifications. In addition, some TSR procedures had not been developed or they contained inadequate surveillance requirements or acceptance criteria. For example, OA's review of TSR surveillances indicated that several surveillances were not performed at the required intervals; ANL management did not recognize that requirements were not being met and had not established processes to ensure and verify compliance with surveillance requirements. Some aspects of the deficiencies in implementation of nuclear safety requirements at the AGHCF are partially attributable to resource constraints and/or insufficient levels of management attention. Although ANL resource allocation and prioritization processes adequately consider ES&H and infrastructure needs in most cases, the AGHCF is a notable exception that falls outside the normal prioritization process. As revenues have declined, management attention and funding for the AGHCF have not been sufficient to ensure that its operation and maintenance are consistent with DOE requirements. AGHCF has not devoted sufficient attention and resources to developing and verifying the adequacy of technical surveillance procedures, contributing to non-compliance with TSRs. Experienced personnel who retired or were reassigned were not replaced because of resource constraints. Required condition assessments were not performed. Deficiencies in the facility condition are contributing to a loss of efficiency and unnecessary radiation exposures. The OA review did not identify degraded facility conditions that represented an immediate safety concern. However, some DOE requirements are not being met, and further degradation of facility conditions, maintenance, staffing, and operations could impact safety. In their line management role, SC, CH/AAO, and ANL are responsible for ensuring safety at the AGHCF but have not yet adequately analyzed the impact of funding issues on current or future facility operations and ES&H programs.

Weaknesses in requirements management systems contribute to deficiencies in ANL ISM performance. CH/AAO and ANL procedures governing requirements management are not always current and are not sufficiently specific in some cases. Current ANL requirements management processes are not sufficient to ensure that contractual requirements consistently flow down to appropriate implementing procedures and that requirements are adequately communicated to workers. Weaknesses in the requirements management processes contributed to TSR non-compliances, deficient USQ screens, inadequate RWPs, failure to identify and implement controls, and inconsistent implementation of radiation protection requirements.

CH/AAO and ANL feedback and improvement programs are not fully effective in ensuring that ISM process and performance deficiencies are identified and resolved in a timely manner. Although CH/AAO has elements of an effective program, several weaknesses are limiting the effectiveness of the CH/AAO line management oversight programs in identifying and correcting performance deficiencies at ANL facilities. For example, surveillance activities, such as observation of work activities, are not being performed as described in CH/AAO Facility Representative (FR) program documents. Also, CH/AAO evaluations are often based on insufficient assessment of work performance. CH/AAO is not consistently and effectively tracking findings and ensuring that ANL is resolving issues effectively and promptly. Although ANL conducts numerous assessments and identifies many individual deficiencies, the ANL assessment programs are not consistently effective in ensuring that corrective actions are effective and timely. Many ANL assessments examine program plans but do not adequately evaluate actual ISM performance by observing actual work. Some required assessments are not being performed and often are not being documented, and the assessments have not rigorously examined important ES&H areas, such as beryllium control, USQs, and TSRs. Documentation, evaluation, and resolution of ES&H deficiencies and issues are not being managed in a structured, consistent, risk-based, and effective manner that supports continuous improvement. Many corrective action plans and corrective actions for findings from calendar year 2001 independent assessments were significantly overdue. While many aspects of lessons-learned programs are effective, consistent identification, evaluation, and implementation of applicable lessons learned to prevent events and deviations from requirements cannot be assured because of the lack of a structured, documented, and consistently applied process.

CH/AAO and ANL line managers have not provided sufficient attention and leadership to ensure that all aspects of DOE ISM expectations are effectively implemented. As discussed above, CH/AAO and ANL have been effective in many areas. However, there are significant weaknesses in several important ISM areas, including work control processes for non-experimental work activities, nuclear safety requirements, radiation protection, and CH/AAO and ANL feedback and improvement systems. A primary reason such weaknesses are occurring is that line management has not established and/or enforced clear and sufficient performance expectations in these areas. For example, ANL managers have not devoted sufficient attention to developing systematic work control systems for non-experimental work. Additionally, CH/AAO and ANL management did not recognize the need for or establish an expectation for an implementation plan to ensure that the AGHCF could effectively transition to the new set of TSRs. CH/AAO and ANL management have established broad objectives for feedback and improvement programs, but have not established clear expectations and sufficiently detailed guidance for implementing effective feedback and improvement processes, resulting in weaknesses in performing assessments, correcting identified deficiencies, and applying lessons learned.

3.0 CONCLUSIONS

CH/AAO and ANL have worked cooperatively to establish and implement an ISM program. Their primary focus to date has been on establishing the framework of roles and responsibilities for ISM implementation and ensuring that individuals are trained and qualified to implement their safety responsibilities. For the most part, CH/AAO and ANL have established effective systems in these areas. In addition, appropriate ISM institutional policies and requirements have been established and communicated, and workers and stakeholders have multiple avenues to express ES&H concerns. Resource allocation processes reflect facility ES&H and infrastructure needs (with isolated exceptions). Safety-related performance objectives and measurable criteria with financial incentives have been built into the contract.

Many aspects of the ISM program are effectively implemented by CH/AAO and ANL. The safe conduct of experiments has received considerable attention from CH/AAO and ANL, resulting in an institutional experiment safety review process system that is being effectively implemented at the division level. Workers are involved in the work planning process and have been empowered to identify and stop unsafe work. CH/AAO has established and is implementing a formal oversight program for contractor safety management that, with some notable exceptions, is adequately defined and provides for operational awareness, functional area assessments, and the application of contractual performance measures and incentives. Similarly, ANL performs numerous assessments, and some aspects of its lessons-learned program are effective.

Although the ISM framework is in place, several significant process and implementation deficiencies were identified during the OA review:

- For non-experimental work, which constitutes a significant fraction of the potentially hazardous work at ANL, the work control and hazard analysis processes have received less management attention and are not fully effective. Weaknesses in work planning and hazard analysis and controls have sometimes resulted in elevated risks to workers and have resulted in several work stoppages to address safety concerns, including potential exposures to hazardous materials.

- In a number of cases, nuclear safety requirements were not effectively implemented at the AGHCF—a Category 2 nuclear facility. The facility has several deficiencies in TSR implementation and some deficiencies in USQs and safety analyses. These resulted in TSR non-compliances and reportable occurrences.

- Several important aspects of radiation protection programs are not effectively implemented, including RWPs and radiological surveys and sampling. As a result, the site's ability to consistently maintain all radiation exposures as low as reasonably achievable may be hindered.

Weaknesses in some ANL management systems contribute to the observed performance deficiencies, particularly those associated with non-experimental work, and management has not established clear expectations for a rigorous implementation of nuclear safety requirements. Additionally, the requirements management systems are not fully effective in ensuring that requirements flow down from the contract to the working level and are understood by the workers, resulting in situations where requirements were not implemented, creating an increased potential for exposures, events, or injuries. Further, as a result of weaknesses in CH/AAO and ANL feedback and improvement systems, the significant deficiencies in important aspects of ISM, including the nuclear safety, radiation protection, and work controls, were not fully identified and communicated to management.

Increased management attention is needed to ensure that the weaknesses identified during this OA inspection are addressed in a timely manner. In addition, CH/AAO and ANL management need to determine whether similar weaknesses are evident at ANL organizations and facilities that were not reviewed during this inspection.

4.0 RATINGS

The ratings reflect the current status of the reviewed elements of the ANL ISM programs:

Safety Management System Ratings

Guiding Principle #1 – Line Management Responsibility for Safety.................NEEDS IMPROVEMENT
Guiding Principle #2 – Clear Roles and Responsibilities ....EFFECTIVE PERFORMANCE
Guiding Principle #3 – Competence Commensurate with Responsibility..EFFECTIVE PERFORMANCE
Guiding Principle #4 – Balanced Priorities...EFFECTIVE PERFORMANCE
Guiding Principle #5 – Identification of Standards and Requirements...............NEEDS IMPROVEMENT

Feedback and Improvement

Core Function #5 –Feedback and Continuous Improvement ....NEEDS IMPROVEMENT

ANL Work Activities in Facility Operations, Maintenance, and Research and Development

Core Function #1 – Define the Scope of Work..NEEDS IMPROVEMENT
Core Function #2 – Analyze the Hazards..NEEDS IMPROVEMENT
Core Function #3 – Establish Controls ....SIGNIFICANT WEAKNESS
Core Function #4 – Perform Work Within Controls ....NEEDS IMPROVEMENT

APPENDIX A

Supplemental Information

A.1 Dates of Review

	Beginning	Ending
Scoping Visit	February 26, 2002	February 28, 2002
Onsite Evaluation	April 29, 2002	May 10, 2002
Report Validation and Closeout	May 20, 2002	May 22, 2002

A.2 Review Team Composition

A.2.1 Management

Glenn S. Podonsky, Director, Office of Independent Oversight and Performance Assurance
Michael A. Kilpatrick, Deputy Director, Office of Independent Oversight and Performance Assurance
Patricia Worthington, Director, Office of Environment, Safety and Health Evaluations
Charles Lewis, Director, Office of Emergency Management Evaluations (Team Leader)

A.2.2 Quality Review Board

Michael Kilpatrick
Charles Lewis
Robert Nelson
Patricia Worthington
Dean Hickman

A.2.3 Review Team

Charles Lewis, Team Leader

Safety Management Systems
William Eckroade, Lead
Robert Freeman
Al Gibson
Mark Good
Robert Compton (Feedback and Improvement)

Work Activities/Core Function Implementation
Bradley Davy, Lead
Ronald Stolberg
Ching-San Huang
Jim Lockridge
Joe Lischinsky
Don Prevatte
Edward Stafford
Mario Vigliani

A.2.4 Administrative Support

Sandra Pate
Tom Davis

This page intentionally left blank.

APPENDIX B

Site-Specific Findings

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

FINDING STATEMENT	REFER TO PAGES
1. The level of management priority and funding provided by the DOE Office of Science (SC), the Chicago Operations Office (CH), the Argonne Area Office (AAO), and Argonne National Laboratory (ANL) for operation and maintenance of the Alpha Gamma Hot Cell Facility (AGHCF) has not been commensurate with the hazards associated with this facility. Funding provided by program secretarial offices and outside organizations that sponsor work in the AGHCF is not sufficient to support facility operations.	27
2. ANL requirements management systems have not ensured that all applicable U. S. Department of Energy (DOE), Occupational Safety and Health Administration (OSHA), and ANL requirements flow down to institutional, division, and departmental implementing procedures and subcontractors, and that requirements are clearly and accurately reflected in activity-level work instructions.	30
3. CH/AAO has not established and implemented a fully effective and efficient oversight program, as specified in DOE Policy 450.5, *Line Environment, Safety and Health Oversight,* that ensures that ANL is effectively implementing integrated safety management (ISM).	37
4. Weaknesses in ANL line management assessment processes and performance are limiting continuous improvement in safety performance.	39
5. ANL processes and performance for analyzing environment, safety, and health (ES&H) program and performance deficiencies, developing corrective actions, and tracking actions to completion have not been fully effective in resolving many issues, preventing recurrence, and effecting continuous improvement.	41
6. Consistent identification, evaluation, and implementation of applicable lessons learned to prevent events and deviations from requirements cannot be assured because of the lack of a structured, documented, and consistently applied process.	42
7. The unreviewed safety question (USQ) screening, evaluation, and determination process at the AGHCF does not ensure that modifications to the facility are adequately analyzed and within the existing facility safety envelope.	50
8. Radiological surveys and sampling are not always performed as required to characterize all radiation hazards, and some types of surveys are not being conducted in an appropriate and technically defensible manner.	52

9. Radiation work permits (RWPs) are not always clear, sufficiently detailed, and tailored to the work being performed to ensure that necessary controls are reliably and rigorously implemented.	57
10. Technical safety requirements (TSRs) for the AGHCF have not been adequately implemented in a manner that ensures that the DOE-approved safety envelope is verified and maintained.	58
11. For non-experimental work, ANL has not implemented systematic mechanisms that define how the core safety management functions are performed to ensure that hazards are adequately identified and appropriately characterized and analyzed, and to ensure that tailored controls are implemented in accordance with DOE Policy 450.4, *Safety Management System Policy.*	61

APPENDIX C

Guiding Principles of Safety Management Implementation

C.1 INTRODUCTION

The Office of Independent Oversight and Performance Assurance (OA) evaluation of safety management systems focused on the seven guiding principles of integrated safety management (ISM) as applied at the Chicago Operations Office (CH), the Argonne Area Office (AAO), and Argonne National Laboratory (ANL). This appendix discusses the results of the first five of those:

- Guiding Principle #1 – Line Management Responsibility for Safety
- Guiding Principle #2 – Clear Roles and Responsibilities
- Guiding Principle #3 – Competence Commensurate with Responsibility
- Guiding Principle #4 – Balanced Priorities
- Guiding Principle #5 – Identification of Standards and Requirements

The other two guiding principles (Guiding Principle #6—Hazard Controls Tailored to Work Being Performed and Guiding Principle #7—Operations Authorization) significantly overlap the core functions of safety management, which are discussed in Appendix E.

The OA team reviewed various documents and records, including the ANL ISM system description and the ANL site environment, safety, and health (ES&H) plan. In the evaluation of the guiding principles, OA considered the results of their review of the core functions. CH/AAO and ANL personnel were interviewed to determine their understanding of the ISM program and their responsibilities as well as the status of ongoing initiatives and corrective actions.

C.2 RESULTS

C.2.1 Line Management Responsibility for Safety

Guiding Principle #1: Line management is directly responsible for the protection of the public, workers, and the environment.

DOE Office of Science (SC) and CH/AAO Policies, Expectations, and Leadership

DOE line management—SC and CH/AAO—have worked with ANL to establish an adequate set of ES&H policies for management of ANL. SC and CH/AAO ES&H policies and plans appropriately reflect DOE ISM expectations. DOE ISM expectations and ES&H directives are established in the DOE/University of Chicago (UC) contract.

DOE line managers have used the DOE/UC contract to reinforce ES&H expectations. ISM-related performance measures have been established to promote improvements in safety (e.g., recordable injuries and environmental incidents). The contract also provides incentives to incorporate an environmental management system within the ANL ISM mechanism. In addition, the contract requires progress reports on specific ES&H objectives, such as improved radiological performance, implementation of the Chronic Beryllium rule (i.e., Chronic Beryllium Disease Prevention Program, 10 CFR 850), and assessments to be performed to promote continuous improvement in specific areas (e.g., improving ISM systems and implementation).

Over the last several years, CH/AAO managers have taken important actions to promote the establishment of ISM systems at ANL. The ISM verification reviews identified significant issues and resulted in improvements by ANL, including revisions to the ISM system description and strengthening of some ANL management systems (e.g., an institutional experiment safety review protocol applicable to all laboratory experimental work).

CH/AAO managers have recognized a need for continued attention and improvement in ISM. CH/AAO recently prepared a *Program for Maintaining and Improving the ISM Program at AAO and ANL*, which lists the necessary CH/AAO activities to assess ISM elements. To ensure appropriate and timely communications on operational activities and issues, including ES&H, CH/AAO managers have established routine meetings with ANL counterparts (e.g., weekly meetings between the AAO Area Office Manager and the ANL Director).

Although CH/AAO has provided effective leadership in many areas, sufficient management attention has not been devoted to a number of important ISM areas, including adequacy of work control systems, radiation protection, and nuclear safety. In addition, CH/AAO management has not provided sufficiently clear and detailed expectations to ensure that CH/AAO feedback and improvement mechanisms are implemented in a manner that provides for effective evaluations of ES&H program effectiveness and includes sufficient observations of work activities to verify effective performance (see Appendix D).

Also, the CH ISM verification processes did not identify or resolve weaknesses in work planning and control systems or weaknesses in the site radiation protection program. As a result, CH/AAO senior management did not receive a comprehensive and accurate assessment of ANL ISM performance.

ANL Policy, Expectations, and Leadership

ANL has established an appropriate institutional policy accepting and reinforcing ISM guiding principles and core functions for ANL operations. ANL research divisions and the Plant Facilities and Services Division (PFS) have appropriately incorporated the ISM policy into division operating manuals and safety charters. Specific policies have also been established in technical ES&H areas, including waste minimization/pollution prevention and radiation protection. Expectations for line management accountability for safety and environmental protection have been reinforced through senior management actions and institutionalized in the ANL ES&H Manual.

Senior ANL management invests significant levels of attention to safety issues. Senior management attention has been instrumental in responding to the CH ISM verification and establishing an effective institutional experiment safety review protocol that applies to all experimental activities, which is a significant accomplishment for ANL, considering its numerous organizations and diverse facilities and hazards. Each ANL research division is required to establish processes consistent with expectations and tailored to the hazards of the research being performed. OA reviews of the Chemical Technology Division (CMT) and the Energy Technology Division (ET) indicated that the experiment review procedures were appropriately designed and effective in identifying hazards and controls.

Senior management has also focused significant attention on important ISM institutional program elements, such as roles and responsibilities (see Guiding Principle #2) and training and qualifications (see Guiding Principle #3), and has generally been effective in establishing effective management systems in these areas. For example, the ANL ES&H Manual clearly defines responsibilities and authorities in most areas, and establishes appropriate requirements for control of workplace and environmental hazards.

ANL has also established an effective training management system that identifies and tracks training for each employee and is tailored to workplace hazards. Additionally, ANL has established an infrastructure funding prioritization system that appropriately incorporates ES&H considerations (see Guiding Principle #4).

ANL management has taken actions to ensure that ANL personnel are aware of the importance of safety and senior management's expectations for effective safety performance. For example, ANL has weekly Management Council meetings, which are chaired by the ANL Director and include participation of the ANL Chief Operations Officer, the Office of Environment, Safety, and Health/ Quality Assurance Oversight (EQO) Manager, and associate laboratory directors (ALDs). These meetings discuss safety events and issues as a first order of business. Additionally, senior ANL management established the ANL Environment, Safety, Security, and Health Committee to explore and resolve ES&H issues. These committees serve as a senior management forum to discuss emerging concerns, evaluate policy issues, and review ANL performance. Significant management attention is provided in these forums to serious workplace injuries and operational events.

ANL management has also established and reinforced expectations for line management responsibility for safety. For example, the ANL Director performs periodic walkthroughs of facilities, and all ALDs and division managers are expected to perform similar walkthroughs.

Collectively, ANL management actions have contributed to improvements in safety management at ANL. Performance measure data indicates that workplace injuries are significantly less than industry averages and comparable to many other DOE laboratories. Most performance measures reflect improving trends over the past several years.

Notwithstanding these achievements and successes, ANL line managers have not provided sufficient attention to ensure that DOE ES&H expectations are effectively implemented in some areas. As discussed in Appendices D and E, systemic weaknesses in ISM program elements and implementation were identified in four important ISM areas: work control processes for non-experimental work, nuclear safety requirements, radiation protection, and feedback and improvement systems. Although the specific problems and reasons for those problems vary for each of the four areas of weakness, a common thread is that ANL has not provided sufficient management attention, established sufficiently clear expectations, or ensured that expectations were understood and implemented (see Appendices D and E for more detailed discussion of the specific deficiencies).

- **Insufficient expectations for some work control processes**. For non-experimental work (e.g., maintenance, waste operations, and maintenance-like support to research and development [R&D] programs), ANL has not implemented systematic mechanisms that define how the core safety management functions are implemented to ensure that hazards are adequately identified and appropriately characterized and analyzed, and to ensure that tailored controls are implemented in accordance with DOE Policy 450.4, *Safety Management System Policy*. Significant deficiencies were identified by OA in the performance of maintenance and waste operations work activities, including situations where hazards were not appropriately identified or controlled. A primary reason for these weaknesses is that ANL managers have not established sufficiently high expectations for the development of systematic work control systems for non-experimental work. Currently, most work management processes are fragmented and expert based, relying too much on the experience and training of foremen and workers to identify and control job-specific hazards.

- **Insufficient expectations for rigor in implementation of nuclear safety requirements at the Alpha Gamma Hot Cell Facility (AGHCF)**. Some important nuclear safety requirements have not been adequately implemented at the AGHCF (a Category 2 nuclear facility) in a manner that ensures that the DOE-approved safety envelope is verified and maintained. Deficiencies were identified in some aspects of the authorization basis and unreviewed safety question (USQ) process, and in many aspects of technical safety requirements (TSRs) implementation (e.g., inadequate surveillance requirements and acceptance criteria, and numerous non-compliances with TSR provisions). For example, OA's review of TSR surveillances indicated that several surveillances were not performed at the required intervals; ANL management did not recognize that requirements were not being met and had not established processes to ensure and verify compliance with surveillance requirements. A major contributing factor is that CH/AAO and ANL management did not recognize the need for or establish an expectation for an implementation plan to ensure that the facility could effectively transition to new TSRs, resulting in a number of reportable TSR violations after AGHCF transitioned to the new TSRs in January 2002.

- **Insufficient actions to resolve deficiencies in the ANL radiation protection program.** The ANL radiation protection program has weaknesses in such key areas as the development and use of radiation work permits (RWPs) and the performance of radiological surveys and sampling, which are needed to accurately identify and control workplace hazards. These weaknesses are exacerbated by the lack of adequate written procedures for implementing the program. Senior ANL management recognized problems in radiation protection and took actions intended to reinforce line management responsibility and accountability for radiation protection performance, including a 2001 ANL reorganization in which staff from the former Environment, Safety, and Health (ESH) Division were deployed into ANL divisions, and subsequent establishment of the operational health physics standards committee, which was chartered to provide technical leadership and develop ANL policies and procedures. However, performance problems have not been resolved, as evidenced by performance deficiencies observed during this OA inspection, and little progress has been made in developing the needed procedures in the past year. Neither senior ANL management nor the standards committee has established clear expectations (e.g., responsible individuals and milestones) for completion of the implementing procedures needed for consistent implementation of ANL ES&H Manual Chapter 5 requirements. In the decentralized structure, division managers and their subordinate managers have appropriately been assigned line management responsibility for radiological safety, but their knowledge and understanding of radiation protection requirements and protection methods is limited in some cases. ANL management has not established processes for timely resolution of technical disputes among line managers and/or responsible health physicists, which are contributing to delays in establishing the needed procedures. Senior ANL managers recognize continuing performance problems related to radiation protection and have announced plans to hire a site radiation safety officer to provide program leadership and to use outside experts to evaluate the ANL radiation protection program.

- **Insufficient management expectations for implementation of ANL feedback and improvement systems.** While many aspects of ANL feedback and improvement systems are established and functioning, they have not been fully effective in identifying and correcting performance deficiencies. ANL management has established broad objectives for the division managers to implement assessment, corrective action, and lessons-learned processes as part of the site quality assurance (QA) program. However, ANL management has not established clear expectations and sufficiently detailed guidance for implementing ES&H feedback and improvement processes that will adequately evaluate the effectiveness of application of ISM implementation during work activities. In the absence of clear institutional expectations, most ANL divisions have not developed effective processes in QA plans or procedures, resulting in weaknesses in performing assessments, correcting identified deficiencies, and applying lessons learned. Many ANL assessments do not evaluate the implementation of requirements during the performance of work activities or focus on ISM work planning and control processes. In addition, ANL assessments have not consistently identified and resolved management system weaknesses, technical program weaknesses, and performance problems in such areas as radiation protection and implementation of nuclear safety requirements.

Worker Participation and Empowerment

CH/AAO and ANL have established mechanisms to involve employees in the safety of their work and to empower them to stop work if safety concerns are identified. Workers actively participate in safety reviews and awareness activities through a variety of safety committees, forums, and routine information meetings on safety topics. For example, PFS holds safety discussions at the beginning of each day.

CH/AAO and ANL have established and effectively communicated stop work authorities for employees. The ANL policy also specifically prohibits management retaliation for raising safety issues. During interviews, most ANL employees stated that they would feel comfortable in using their stop work authority if they observed unsafe work activity. When provided indications of potential safety concerns, ANL managers appropriately and promptly stopped work in several instances during this OA inspection.

ANL has established adequate mechanisms for employees to raise safety concerns. For example, ANL has established a Joint Labor Management committee to address ES&H issues and concerns raised by the represented labor organizations at ANL. Participants viewed this committee as an effective way to raise and resolve safety concerns. ANL has also established an employee concerns and suggestion program called "IMPACT," which includes periodic monetary awards for beneficial suggestions that are accepted and implemented. Most employees are aware of the program, which is described in the employee manual, and forms are widely available. However, the ANL IMPACT program is not governed by a current instruction/procedure that defines requirements (e.g., confidentiality measures, investigation and reporting time frames, disposition reviews, and feedback to the concerned individual) and ANL has not performed surveys of the users, conducted assessments of the implementation of the program, or actively advertised the program for at least five years.

Some workers indicated that they perform pre-job walkdowns. However, ANL has not established expectations that pre-job walkdowns or post-job critiques be used to identify ES&H issues and seek worker feedback as part of the ANL work planning and control processes.

Summary of Guiding Principle #1. SC, CH/AAO, and ANL line managers have established safety policies that are consistent with DOE ISM expectations and have communicated those policies within ANL divisions. ANL also has established appropriate avenues for employees to raise safety concerns and has clearly defined stop work authorities for all employees. CH/AAO has worked with ANL to establish contractual performance measures and to use contractual provisions to drive improvements in ISM. The ANL Director and some senior managers have visibly demonstrated support for ISM through facility walkdowns and participation in committees, contributing to increased awareness of the priority of ES&H among ANL personnel. CH/AAO and ANL have made significant improvements in areas where they have focused attention and resources, such as certain institutional ISM program elements (e.g., roles and responsibilities, training and qualifications, and systems for incorporating ES&H and infrastructure needs into budget and prioritization processes). ANL's establishment of an effective process for integrating safety into the experiment review processes is a significant accomplishment.

Notwithstanding the achievements and progress, CH/AAO and ANL line managers have not provided sufficient attention and leadership to ensure that all aspects of DOE ISM expectations are effectively implemented. ANL has significant gaps in several important ISM areas, including work control processes for non-experimental work activities, nuclear safety requirements, and radiation protection, and CH/AAO and ANL feedback and improvement systems are not fully effective in identifying and correcting deficient conditions. A primary reason such weaknesses are occurring is that line management has not established and enforced clear and sufficient performance expectations in these areas.

C.2.2 Clear Roles, Responsibilities, and Authorities

Guiding Principle #2: Clear and unambiguous lines of authority and responsibility for ensuring safety shall be established and maintained at all organizational levels within the Department and its contractors.

SC and CH/AAO

Consistent with SC's approach to empowerment of its field elements, SC and CH have delegated most safety management functions to AAO, including line management oversight and contract administration. The delegation is consistent with the SC and CH Functions, Responsibilities, and Requirements Manuals (FRAMs). CH provides support in some areas (e.g., technical, legal, and human resources). SC provides programmatic direction, establishes high-level goals (e.g., the six critical outcomes), and maintains awareness of the status of ANL through various means. SC also determines overall resource allocations for ANL and has approval authority for the budget. As discussed under Guiding Principle #4, some of the operational deficiencies identified at the AGHCF are related to insufficient management priority for this facility in the budget process.

Roles, responsibilities, and authorities for AAO organizations are clearly defined. The Unit Performance Plan clearly defines AAO's major functions, which are derived from the CH FRAM and Strategic Plan, and adequately reflects SC goals and expectations and CH strategic priorities. The responsibilities of individual AAO staff members are clearly defined in position descriptions and individual performance evaluations. The responsibilities are linked to SC goals and expectations through the Unit Performance Plan and AAO team charters. AAO individual performance evaluation plans and position descriptions provide an adequate basis for holding AAO staff accountable.

With few exceptions, CH/AAO has established program plans and standard operating procedures that adequately address essential CH/AAO functions, such as oversight of contractor ES&H performance, execution of contract officer and contractor officer technical representative functions, oversight of contractor ES&H and infrastructure (ESH&I) management, and ensuring the quality of CH/AAO operating procedures. For example, CH/AAO requires an annual review to ensure that functions assigned to CH/AAO are adequately addressed in CH/AAO procedures.

In some areas, CH/AAO is effectively using the AAO/UC contract to drive further improvement and accountability in contractor ES&H performance. For example, CH/AAO has established contractual performance measures that address previously identified performance weaknesses, such as contamination events and employee compliance with required ES&H training. In addition, the contract establishes requirements for self-assessments of specific ISM areas, including experiment safety review processes and the ESH&I process. The increased management attention and monitoring of performance measures has contributed to improvements in contractor performance in these areas.

Although most aspects are adequate, responsibilities in a few areas have not been clearly defined and effectively implemented. The process for reviewing and approving contractor exemptions to DOE directives has not been clearly defined in standard operating procedures. In addition, the AAO Operational Awareness Program Plan and standard operating procedures identify a set of general areas of responsibility for performing reviews of contractor performance but do not provide sufficiently detailed expectations on the expected degree of rigor and depth of the reviews (see Appendix D).

ANL

With some exceptions (discussed below), the roles, responsibilities, and authorities for ES&H-related positions have been clearly defined and documented. ANL institutional policy and procedure manuals (e.g., ANL ES&H Manual and ANL Policy Manual) adequately define responsibilities for key line management and ES&H safety functional positions. Division-level policy and procedures manuals adequately define and assign ES&H responsibilities to specific individuals. Most division-level managers and ES&H personnel were knowledgeable of their assigned ES&H functions.

With the exception of Nuclear Facility Managers, ANL position descriptions for division-level ES&H positions (e.g., safety officers, ES&H coordinators, building managers, and environmental compliance representatives) identify broad areas of assigned ES&H responsibilities and adequately reflect current job duties. Although not established in position descriptions, the broad ES&H responsibilities for Nuclear Facility Managers were delineated in other ANL documents, such as the Nuclear Safety Procedures Manual and facility-level documents.

In most cases, line management responsibilities and authorities for safe execution of experimental work and safety reviews have been adequately defined. The experiment review work process clearly identifies and appropriately assigns responsibility for safe operation of experiments to the principal investigator. However, line management review and approval requirements are not always clearly specified for all phases (e.g., setup, disassembly, equipment maintenance) of experimental/programmatic work.

ANL has established adequate mechanisms for establishing accountability for ES&H performance through the ANL Policy and ES&H Manuals and position descriptions. All supervisors are required to evaluate the effectiveness of their subordinates in meeting ES&H policies. OA interviews with managers and staff indicate that managers have been conscientious in implementing this requirement and holding personnel accountable for ES&H performance. Although senior management performance plans do not strongly link to the contract performance plan, the Laboratory Director considers ES&H in performance evaluations, promotions, and bonus pools.

Although broad areas of responsibility are defined for ANL managers, ANL ES&H documents often do not provide detailed expectations for implementing ES&H responsibilities, leaving the expectations for performance up to individuals (who have varying levels of experience and differing views on the expected degree of rigor and compliance in implementing ISM requirements). In a few areas, ANL has not adequately defined responsibilities or established sufficient management systems to ensure effective execution of line management and ES&H functions.

- ANL line management's responsibility to ensure rigorous and effective implementation of TSRs is not sufficiently defined in facility-level procedures, contributing to TSR inadequacies and violations.

- Institutional responsibility for the radiation protection program has not been clearly assigned and is not being effectively executed. The health physics standards committee is chartered to provide technical leadership in radiological protection, but is not functioning effectively in achieving its objectives and developing the necessary radiation protection program documents, in part, because of lack of time and/or priority. Further, there is no clear definition of responsibility for radiological concerns, such as RWP approval/concurrence, when the work activity involves workers and/or health physicists from different ANL divisions.

- Roles, responsibilities, and authorities are not sufficiently defined to ensure effective implementation of feedback and improvement processes. Some implementing-level QA plans and/or procedures are not specific enough to ensure effective program implementation.

In addition, the work control processes for non-R&D work (e.g., maintenance, facility operations, support for experiments) are not sufficiently defined. Correspondingly, the associated line management safety roles, responsibilities, and authorities are not clearly defined to ensure adequate implementation and accountability for performance.

ANL management is taking steps to better define organizational interfaces between support services organizations (e.g., PFS) and nuclear facility operations through additional training and establishment of memoranda of understanding (MOUs). Although recent MOUs more clearly define organizational interfaces, the ANL MOUs and associated training do not fully ensure that the review and approval authorities for TSR-related work are clearly defined and that the rigor of TSR-related work is commensurate with its importance to safety. In addition, quality controls (e.g., periodic reviews and change control) for maintaining and updating MOUs have not been established. Weaknesses associated with routine review and update of agreements were identified in emergency management (see Volume II, Appendix C).

Summary of Guiding Principle #2. With some exceptions, CH/AAO and ANL have established effective mechanisms for defining and assigning roles and responsibilities and holding organizations and individuals accountable for performance. The Unit Performance Plans and team charters provide an effective framework for defining and assigning ES&H roles, responsibilities, and authorities for CH/AAO personnel. Similarly, the roles, responsibilities, and authorities for ANL have been defined in the ANL Policy Manual and the ANL ES&H Manual. However, CH/AAO and ANL have not established sufficiently clear and detailed responsibilities in some important ISM areas (e.g., assessments and radiation protection) to ensure effective execution of line management functions. If current weaknesses in line management expectations, work control processes, and implementing procedures are addressed, the existing systems and processes provide an adequate framework for establishing and communicating clear responsibilities and accountability.

C.2.3 Competence Commensurate with Responsibility

Guiding Principle #3: Personnel shall possess the experience, knowledge, skills and abilities that are necessary to discharge their responsibilities.

CH/AAO

In general, CH/AAO is adequately staffed in the area of ES&H. All Facility Representative (FR) positions are filled. With the exception of radiation protection, AAO has sufficient numbers of technical staff in the relevant ES&H disciplines. CH and AAO have a longstanding need for additional staffing vacancies in the radiation protection area, and currently have only a single health physicist to serve AAO and all CH technical support needs. This level of staffing is not sufficient to provide effective monitoring and direction of the ANL radiation protection program, particularly in light of the weaknesses identified.

AAO has developed and retained a well-qualified cadre of FRs. The formal FR qualification program is generally adequate and includes written and oral examinations. However, some aspects of the qualification process are not fully documented. For example, qualification records do not demonstrate that supervisors have reviewed the education, experience, and training of staff members against the required competencies of the qualification standards as specified by DOE Standard 1063, and qualification cards are not detailed, do not specify facility specific competencies, and are not updated with new competency requirements to support requalification.

Other AAO technical staff members are well qualified based upon formal education and experience. CH voluntarily designated staff members to participate in the technical qualification program (TQP). The TQP is not mandatory for CH because it applies only for personnel with safety management responsibilities at Defense Nuclear Facilities. With the exception of FRs, the designated CH/AAO staff members have completed few TQP training and qualification requirements.

ANL

The ANL EQO is responsible for both ES&H support and oversight. The EQO staff have the requisite ES&H expertise for these areas of responsibility. However, the number of staff is marginal and may not be sufficient to achieve needed improvements. Similarly, the three ANL program divisions that were evaluated currently have sufficient ES&H staff assigned to facilities to perform their current functions (see discussion under Guiding Principle #4 for adequacy with regard to future needs). However, experienced ANL technical staff have retired and are not being replaced at AGHCF due to resource constraints (see Guiding Principle #4). Safety coordinators at the ALD and division levels facilitate the administration of safety programs in the divisions for most ES&H areas.

The ANL Training Management System provides an effective mechanism for control of training**.** Each ANL employee completes a Job Hazard Questionnaire (JHQ) and reviews it at least annually, and when hazards change. Data from these questionnaires is maintained in a centralized electronic database and reports generated from this database are used to notify employees of upcoming training needs, inform supervisors of employee training status, and monitor the status of program implementation. Reports from this database are readily available to line managers, supervisors, employees, and the training staff. A comparison of JHQs and work assignments for PFS, CMT, and ET indicated that JHQs were consistent with current assignments (with a few exceptions in ET). The completion status of required training is closely monitored by ANL management and is near 100 percent for all three divisions.

The training program for fissionable-material handlers is being conducted in accordance with the requirements of DOE Order 5480.20A, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities***.** The training programs for fissionable-material handlers assigned to Waste Management Operations (WMO) and the AGHCF were appropriately tailored and implemented in accordance with implementation matrices that were approved by CH/AAO.

As discussed under Guiding Principle #1 and in Appendix E, in 2001 ANL decentralized the health physics personnel by assigning health physicists and technicians from the former ESH Division to line divisions in an effort to provide greater responsibility and authority for radiation safety in the line organization and to improve radiation protection performance. The number of radiation protection positions transferred to each division was comparable to the number used by that division prior to the reorganization. However, training provided to health physics personnel has been reduced since the decentralization/reorganization. Monthly training on such topics as procedure changes, lessons learned, and good practices, as well as associated reading assignments, were discontinued when personnel were decentralized. ANL has recently identified the need for stronger central programmatic leadership in the area of radiation protection and plans to provide this leadership by establishing and filling a new radiation protection safety officer position in EQO.

WMO has initiated a program to cross-train health physics technicians as industrial hygiene technicians. WMO has worked with EQO to develop a list of required training and expects to complete cross-training of one technician this fiscal year. They intend to cross-train others who request this training.

Qualification requirements and responsibilities for cross-trained individuals are being developed. Establishment of qualification requirements and roles and responsibilities will be important to ensure that the desired level of qualification is achieved and that tasks assigned to qualified technicians are commensurate with their capability.

Subcontractor Training

ANL establishes adequate requirements for subcontractor training. Subcontract provisions require subcontractors to comply with applicable Federal, state, and local ES&H requirements, including associated training requirements. Subcontractors must also comply with additional training requirements specified by applicable job safety analyses (JSAs) and work permits. Detailed training requirements for construction work are also included in construction specifications, and PFS construction field representatives verify completion of required training. ANL provides site- and facility-specific safety orientations and radiation safety training (if required) to all subcontractors. No performance deficiencies attributed to inadequate subcontractor training were identified during this review. However, ANL processes for verifying that subcontractors have completed required training rely primarily on the subcontractor's declarations, with limited independent verification. ANL has not established mechanisms to ensure that subcontractor training requirements are clearly identified, consistent with the hazards of the work activity, and comparable to training required of ANL workers.

Summary of Guiding Principle #3. CH/AAO and ANL have devoted significant attention and resources to staffing and qualification efforts and have made significant improvements. CH/AAO has a sufficient number of staff who are well qualified to carry out assigned responsibilities in most ES&H areas. ANL also has well qualified, highly educated, and experienced ES&H personnel. ANL ES&H training programs meet applicable requirements and have been managed effectively through the ANL training management system. A high level of compliance with training requirements is indicative of management attention in this area. Requirements for subcontractor training are appropriate, but processes to verify training completion and effectiveness for subcontractors are limited in scope. While some areas for improvement are evident, staffing and qualification are adequate for most identified needs. CH/AAO and ANL management recognize the need to address shortages in CH/AAO health physics expertise and to hire an ANL radiation protection program manager. However, current staffing may need to be reassessed to determine adequacy for future needs, and weaknesses in ISM implementation are addressed.

C.2.4 Balanced Priorities

Guiding Principle #4: Resources shall be effectively allocated to address safety, programmatic, and operational considerations. Protecting the public, the workers, and the environment shall be a priority whenever activities are planned and performed.

SC and CH/AAO

SC and CH/AAO have assigned appropriate priority to safety performance measures specified by the DOE/UC contract. The importance of ES&H is reflected in strategic planning documents issued by CH/AAO. CH/AAO committed to steps for continuous ISM improvement in the AAO fiscal year (FY) 2002 Unit Performance Plan and in the AAO *Program for Maintaining and Improving the ISM Program* at AAO and ANL. The AAO manager maintains day-to-day focus on important environment and safety matters by including ES&H items requiring attention on an *AAO Issues and Priorities List,* which is distributed to the contractor. The CH/AAO staff and management are involved in the ANL process for review and prioritization of infrastructure needs and provide feedback to the contractor.

In most cases, SC and CH/AAO processes ensure that ES&H needs are appropriately considered in the budget allocation processes and project/program planning. However, SC and CH/AAO processes have not ensured that the ANL AGHCF—a Category 2 nuclear facility—has received a level of management attention and priority commensurate with the facility hazards (see discussion under ANL section).

ANL

With the exception of some aspects of the AGHCF, the buildings and supporting infrastructure evaluated during this inspection have been adequately maintained by PFS to provide for the safety of occupants and protection of the environment. However, many ANL facilities are aging and in need of modernization. The ANL Strategic Facilities Plan appropriately acknowledges challenges associated with aging buildings and infrastructure and identifies substantial needs for updating older facilities, but the plan does not address programmatic facilities, such as the AGHCF.

ANL uses a structured approach to ensure that facility and infrastructure conditions (e.g., condition of buildings, building ventilation, fire suppression, water, and power supplies) affecting ES&H are identified and prioritized. Facility conditions are assessed periodically through condition assessment surveys performed pursuant to DOE Order 430.1A, *Life Cycle Asset Management*, and through routine facility surveillance. Identified needs are prioritized based upon safety, environmental, safeguards and security, and mission considerations. Available funds are allocated to identified needs based upon their ranking. OA's review of the ranking processes and results indicates that ES&H requirements were appropriately considered. The risks associated with unfunded needs are adequately characterized to support risk-informed decisions. These processes are effective for facility conditions but are not applied to specialized programmatic equipment (e.g., the AGHCF or other specialized equipment used for R&D programs).

ANL has adequate processes for allocating funds for ES&H staffing in line divisions. Division directors are responsible for both mission and safety and are given the responsibility and authority for determining the necessary ES&H staffing levels. The cost of ES&H support is paid from divisional overhead, and division directors are expected to operate as efficiently as possible—minimizing overhead expenses to maximize funds available for program work. Staffing is adequate to implement current processes but changes in these processes are needed to address weaknesses in described in Appendix E of this report. Corrective actions, such as those to better define thresholds for involvement of ES&H personnel and to strengthen hazard analysis and control, may place increased demands on Divisional ES&H staff. Staffing needs should be reassessed after these corrective actions are formulated.

Although the ANL resource allocation and prioritization processes are adequate in most cases, ANL management attention and funding for the AGHCF have not been sufficient to ensure that its operation and maintenance are consistent with DOE expectations and requirements. The AGHCF is used to handle and analyze irradiated nuclear fuel and other radioactive materials and has been designated as a Category 2 nuclear facility because of the potential for significant onsite radiological consequences. As discussed under Guiding Principle #1 and in Appendix E, there are weaknesses in many aspects of ISM implementation at AGHCF. The most significant problems at AGHCF involve deficiencies in TSR implementation and USQs screening and are reflected in the evaluation of the core functions. However, some aspects of the performance problems at AGHCF are attributable to resource constraints and/or insufficient levels of management attention.

- **Operations.** The current level of rigor in facility operations does not meet DOE expectations or nuclear safety requirements. ANL management did not ensure that sufficient priority was devoted to establishing adequate TSR surveillance procedures and did not devote sufficient attention to planning for the recent (January 2002) transition to a new set of TSRs. CH/AAO approved TSRs that contained errors and did not identify significant deficiencies in the implementation of these requirements.

- **Staffing**. The operational expertise and historical knowledge of the AGHCF have declined over the past few years because of retirements and reassignment of experienced personnel. Due to budget constraints, there are no plans to replace most of these individuals. These losses, combined with increasing ES&H expectations, have placed an increasing burden on facility management.

- **Condition Assessment and Prioritization**. ANL has not established a process for periodic condition assessment surveys of the AGHCF or for prioritizing the needs of this facility as required by DOE Order 430.1A. The ANL process for prioritizing ANL infrastructure needs is not used to support funding allocation decisions for the AGHCF because the facility is not supported by infrastructure funds, and the PFS periodic condition assessment surveys do not encompass the AGHCF. ET has identified deficient conditions in the AGHCF from time to time but does not perform the required periodic condition assessment surveys.

- **Facility Condition and Maintenance.** Deficiencies in the material condition are contributing to a loss of efficiency and unnecessary radiation exposures. For example, old manipulators require constant maintenance, shielding windows need replacement to improve visibility and reliability, the legacy materials are accumulating inside the cells, and air conditioning condensate leaks are controlled with drip pans to prevent wetting of electrical panels.

The OA review did not identify facility degradation at AGHCF that represented an immediate safety concern. However, some DOE requirements are not being met, and further degradation of facility conditions, maintenance, staffing, and operations could hinder operational safety.

Some of the deficiencies in maintenance and operation of the AGHCF are attributed to resource constraints. Funding by DOE program offices sponsoring work in the AGHCF operations has declined in recent years. Currently, about 60 percent of operating revenue is sponsored research by the Nuclear Regulatory Commission. The FY 2003 budget is expected to be about 30 percent less than the FY 2002 budget. Regardless of the source of funding, DOE Order 430.1A requires DOE line management and ANL management to establish a budget and maintain the AGHCF in a condition suitable for its intended use. SC, CH/AAO, and ANL are aware of the revenue declines but have not adequately analyzed the impact of funding issues on current or future facility operations and ES&H performance. Various SC, CH/AAO, and ANL organizational elements have responsibility for funding and ensuring facility safety at AGHCF. SC is designated as the ANL landlord and has responsibility for safety and operations and maintenance of facilities at the site. This responsibility includes budgeting for the maintenance of real property, which normally includes permanently installed equipment, such as hot cells. However, SC does not specifically designate funds for the AGHCF operations, in part because SC sponsors little work in that facility and historically has expected the facility to generate sufficient operating revenue from sponsored research. CH/AAO has line management responsibility for safety at ANL facilities but has not resolved AGHCF funding issues. ANL policy assigns the PFS organization the responsibility for ANL general-purpose infrastructure maintenance, but categorizes the AGHCF as "*specialized equipment supporting programmatic activities*" and thus does not fund its maintenance through the ESH&I prioritization process. ET has historically funded operation and maintenance of AGCHF with revenue from organizations sponsoring research in the facility. However, this revenue is declining and may not be sufficient to fund future needs. Management and staff within SC-10 identified and communicated concerns regarding the maintenance of the AGHCF to CH/AAO and ANL; however, funding issues have not been resolved. A clear path forward is needed to ensure that future funding and resources are adequate to provide for facility safety.

Finding #1. The level of management priority and funding provided by SC, CH/AAO, and ANL for operation and maintenance of the AGHCF has not been commensurate with the hazards associated with this facility. Funding provided by program secretarial offices and outside organizations that sponsor work in the AGHCF is not sufficient to support facility operations.

Summary of Guiding Principle #4. With the exception of some aspects of AGHCF, ANL buildings and supporting infrastructure that were reviewed by OA during this inspection have been adequately maintained to provide for the safety of occupants and to protect the environment. The structured approach for prioritizing building and infrastructure needs has ensured appropriate consideration of ES&H in the allocation of funds to these areas.

However, the AGHCF is a significant but isolated exception. It has not received sufficient management attention or resources, commensurate with associated hazards. ANL's structured approach to prioritization, ranking, and allocation of funds for infrastructure needs normally screens out programmatic facilities, such as the AGHCF. SC, CH/AAO, and ANL need to devote increased management attention and line management oversight to the AGHCF to resolve funding issues and to ensure compliance with applicable requirements and effective TSR quality and implementation.

C.2.5 Identification of Safety Standards and Requirements

Guiding Principle #5: Before work is performed, the associated hazards shall be evaluated and an agreed-upon set of safety standards shall be established that, if properly implemented, will provide adequate assurance that the public, the workers, and the environment are protected from adverse consequences.

CH/AAO

The CH/AAO requirements management process results in the appropriate flowdown of directives and requirements into the ANL contract. The contracting officer regularly processes contract modifications to add new or changed requirements and to delete non-applicable requirements. CH/AAO clearly communicates contract requirements to ANL and includes applicable DOE orders, notices, and the change level of the effective orders. With few exceptions, new orders are promptly transmitted to the contractor for implementation. CH/AAO allows few exemptions and normally requires compliance with all aspects of applicable order requirements. This practice facilitates CH/AAO oversight and ensures clarity in expectations for ANL implementation because most contract requirement documents (CRDs) are used in their entirety, without modification.

CH/AAO has ensured that the two Category 2 and four Category 3 nuclear facilities have current, DOE-approved authorization basis documents, including DOE-approved safety evaluation reports. In addition, both of the Category 2 nuclear facilities have DOE-approved authorization agreements. DOE-approved USQ procedures are in place and are used to screen changes against the authorization basis documents (see Appendix E for discussion of deficiencies in USQ implementation at the AGHCF).

Although most new and changed requirements are promptly transmitted to ANL, DOE order flowdown to the contractor was not timely for the transmittal of DOE Order 433.1, *Maintenance Management Program for Nuclear Facilities*, to ANL until about eight months after the order was approved (June 2001). Since DOE Order 4330.4B, *Maintenance Management Program*, was removed from the contract in 1995, maintenance implementation plans for some ANL nuclear facilities, although still in effect, have not been regularly revised or updated. As a result, in some cases, the specified guidance for maintenance in some facilities has not kept pace with the practices of the facilities. CH/AAO's delay in incorporating DOE Order 433.1 maintenance requirements for nuclear facilities into the ANL contract exacerbated longstanding ANL weaknesses in updating maintenance implementation plans, some of which had not been updated since 1993 and did not accurately reflect current practices.

There are some deficiencies in the CH/AAO procedures governing requirements management and flowdown. The AAO procedure for *DOE Directives Distribution and Implementation* does not address some elements of the CH/AAO process, such as specific responsibilities within CH/AAO for timely review and implementation of requirements. The procedure does not address mechanisms or details for requirements tracking, internal CH/AAO reviews, distribution, and implementation time frames. Also, the *Chicago Operations Office Directive System* procedure is still in use but has not been updated, although it expired on September 30, 2000. CH/AAO staff indicated that CH still considered the order active, but had not extended the order. CH/AAO lacks procedural guidance for processing exemptions from DOE orders and order requirements**.** Although exemptions are not often granted, procedural guidance is not available to ensure consistent implementation of the CH/AAO internal review process, documentation of technical justifications for exemptions provided by ANL or allowed by CH/AAO, or transmittal of exemption requests to the appropriate office (AAO/CH or the program secretarial office) for approval.

ANL

ANL's requirements management system includes a hierarchy of requirements documents that provides a framework for flowdown of requirements from the contract to implementing procedures. ANL-wide policies are promulgated in a Tier 1 document (i.e., the ANL Policy Manual). Tier 2 manuals and procedures (e.g., ANL ES&H Manual) establish roles, responsibilities, and requirements that are to be implemented by a significant number of laboratory employees and/or multiple divisions/departments. Tier 3 procedures are intended to further define how the provision and requirements of Tier 2 manuals are to be implemented within divisions and departments.

The Tier 1 ANL Policy Manual and ANL policy for *DOE Directive Processing System* define the requirements management system, document hierarchy, and include some procedural guidance for implementing the requirements management program. However, some aspects of ANL requirements management policies and procedures warrant further improvement. There is no Tier 2 implementing procedure for the requirements management process. The Tier 1 ANL Policy Manual contains abbreviated procedural steps that would be more appropriate in a Tier 2 implementing procedure, consistent with the tier structure guidelines specified in the ANL Policy Manual. Also, the ANL policy for *DOE Directive Processing System* has not been updated to reflect current practices, and some provisions are not being implemented as stated. For example, the procedure requires the Office of the Chief Operations Officer to prepare and distribute a monthly summary of all DOE directives received to division directors and department heads, but this function is no longer being performed. A database required by the procedure is being maintained, but not as specified by the procedure. Additionally, the procedure does not address mechanisms for the submission and processing of exemptions to DOE contract requirements.

Although some improvements are needed, the top tiers of this process are effectively implemented in most cases. The contract, Tier 1 policies, and Tier 2 manuals adequately identify applicable requirements, such as DOE orders and Occupational Safety and Health Administration (OSHA) requirements, and establish institutional expectations for ISM and other such policies. ANL has adequate processes for flowing down most contractual requirements to appropriate functional areas and organizations for review. The processes for reviewing draft and final directives appropriately involve functional area (e.g., nuclear safety) expertise and division representatives. OA's review of memoranda for requirement changes from DOE to ANL and down to functional leads indicated that the contractual requirements are being adequately disseminated and reviewed.

In many cases, requirements adequately flow down from the contract and Tier 1 policies to implementing procedures in Tier 2 and 3 documents. For example, the ANL ES&H Manual adequately identifies applicable DOE ISM and ES&H program requirements (although a few OSHA requirements were missed). Also, ANL was generally effective in implementing institutional requirements for reviewing experiments and flowing down requirements to division- and department-level implementing procedures.

However, several important ISM and ES&H program requirements were not adequately flowed down from the top tiers to Tier 2 or 3 implementing procedures:

- PFS does not have an adequate implementing procedure for work planning and hazard analysis and control that adequately reflects DOE and ANL ISM requirements for effective implementation of the five core functions. As discussed in Appendix E, PFS relies heavily on individual expertise to identify and control hazards. The current implementing procedures are fragmented and are not consistently effective, and they do not reflect DOE ISM expectations (see Appendix E).

- Implementing procedures to ensure that TSRs are consistently met at AGHCF have not been developed or are inadequate to ensure effective implementation of some authorization basis requirements (see Appendix E).

- Institutional- and division-level implementing requirements for many aspects of radiation protection programs are not sufficient (outdated or not complete), and ongoing procedure development actions are incomplete, with little recent progress (see Guiding Principles #1 and #2).

- OSHA requirements (OSHA 1910.1025) for lead exposure control have not been adequately flowed down into an institutional or division/department lead control program. Requirements for exposure control and monitoring (a lead control program) are not contained within the ANL ES&H Manual or other Tier 2/3 manuals or procedures. While PFS Construction is requiring certain subcontractors to have a lead control program for subcontracted work involving lead (e.g., canal tank work), no similar program exists for work activities performed by ANL.

- OSHA requirements (OSHA 1910.146) for an annual program review of the confined space program have not been flowed down into the ES&H manual or other implementing requirement. Although EQO industrial hygiene staff indicated that some reviews are being performed, there is no specific requirement for institutional or divisional personnel to perform the required audit that ensures that adequate reviews will be performed in the future.

- Inadequate flowdown of USQ rule requirements into DOE-approved facility USQ procedures, in combination with implementation deficiencies, resulted in improper application of the USQ process (see Appendix E).

- In many cases, RWPs, job hazard analyses, work packages, and other documents that establish requirements for workers at the activity level are fragmented, overlapping, or unclear. As a result, the potential for workers to misinterpret or fail to implement a requirement are increased.

- Divisional and departmental QA plans, which implement the QA rule requirements for quality improvement, and independent, management, and self-assessments, have not been adequately flowed down into Tier 3 implementing procedures (see Appendix D).

The lack of procedures or inadequate procedures contributed to many of the performance deficiencies discussed in this report, including TSR non-compliances, deficient USQ screenings, inadequate RWPs, failure to identify and implement controls, and inconsistent implementation of radiation protection requirements. The lack of procedural requirements for post maintenance testing recently contributed to an injury to an ANL employee.

The deficiencies in flowdown of requirements contributed to weaknesses in the lower tiers of the requirements management processes. ANL procedures contain limited guidance for flowdown of requirements to implementing procedures down to the working level. Therefore, the effectiveness of flowdown of requirements to implementing procedures depends on the individual expertise and initiative of the various functional area specialists and division personnel. Also, ANL has not applied quality assurance processes to ensure that implementing procedures adequately reflect requirements and are understandable to the users.

Finding #2: **ANL requirements management systems have not ensured that all applicable DOE, OSHA, and ANL requirements flow down to institutional, division, and departmental implementing procedures and subcontractors, and that requirements are clearly and accurately reflected in activity-level work instructions.**

Subcontractors

The procurement process for obtaining subcontractors and services is formal, well documented, and guided by detailed procedures and checklists. Contract packages reviewed were complete, well organized, and provided flowdown of required ES&H information to the subcontractors. ANL's specification of low-, medium-, and high-risk activities is well defined and conservative. For example, all construction activities are categorized as a high-risk activity and thus are subject to more rigorous review. There are standard terms and conditions and special ES&H clauses with detailed instructions for subcontractor ES&H requirements for both onsite and offsite low-, medium-, and high-risk work activities. This conservative approach to procurement has resulted in an excellent safety record for construction, with accident/injury rates and lost workday cases well below industry and DOE complex-wide levels.

ANL uses a common procurement process across the site for all procurements, including service contractors and vendors, thereby ensuring that all procurements are subject to the formal procurement process and controls. Divisions and departments are required to use the formal controls of the procurement process. All subcontracts require a job-specific JSA and an environmental plan. Contract language requires the subcontractor to revise the JSA to incorporate any changes to the work scope.

Although flowdown of ES&H requirements to subcontractors is effective in most cases, the medical requirements (other than respiratory protection) have not been incorporated into subcontracts. In accordance with the CRD for DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, work activity that could present a potential health risk to subcontracted workers requires appropriate medical considerations for the subcontract. Procurement procedures, terms and conditions, and ES&H clauses do not provide for the flowdown of medical provisions that would ensure that subcontractors receive medical considerations comparable to those provided to ANL employees doing the same type of work. For example, subcontractor provisions would not ensure that subcontract employees working in a high noise area would be included in a hearing conservation program and provided with suitable noise monitoring. Although contract language does not address DOE Order

440.1A Chapter 19 requirements, the construction specifications or requirements in the JSA have addressed some aspects of medical coverage for some work (see Finding #2).

The job-specific training requirements for contractors are somewhat fragmented and are contained in several different parts of the subcontract package. Training and program requirements for subcontractors may be identified in the subcontract, the project survey review sheet, the job-specific requirement sheet, contract specifications, and the JSA. In some cases, additional training requirements may be imposed after the contract award during the JSA review process and may not be part of the contract. Although the training requirements are collectively identified on multiple documents, the fragmentation does not facilitate verification, prior to starting work, that subcontractors have all required training.

Summary of Guiding Principle #5. CH/AAO and ANL have adequately implemented some important elements of an effective requirements management system. Authorization basis documents are in place. CH/AAO's requirements management process has provided proper requirements and direction to ANL. New and changed requirements are identified by CH/AAO and are incorporated into the ANL contract in a timely manner, in most cases. ANL has adequately flowed down most contractual requirements to appropriate functional areas and organizations for review and inclusion in Tier 1 policies, Tier 2 manuals and procedures, and Tier 3 procedures. With the exception of certain medical requirements, requirements are appropriately flowed down to subcontractors performing work on site.

However, weaknesses were identified in the CH/AAO and ANL requirements management processes. CH/AAO and ANL procedures governing requirements management were not always current and were not sufficiently specific in some cases. In several cases, weaknesses in the requirements management processes caused or contributed to inadequate flowdown (e.g., missing or unclear requirements) of applicable requirements to implementing procedures. The deficient implementing procedures contributed to TSR non-compliances, deficient USQ screens, inadequate RWPs, failure to identify and implement controls, and inconsistent implementation of radiation protection requirements.

C.3 CONCLUSIONS

Overall, CH/AAO and ANL have effectively implemented many aspects of the ISM program, but there are gaps that need timely attention. Institutional policies have been effectively established and communicated. Workers and stakeholders have multiple avenues to express ES&H concerns. With few exceptions, CH/AAO and ANL have appropriate staffing and skill mixes, and roles and responsibilities that are adequately defined. CH/AAO and ANL personnel have good qualifications and have received substantial training related to their safety management responsibilities. CH/AAO and ANL have demonstrated effective leadership in establishing a work control process that is effective for a wide range of R&D activities. In most instances, CH/AAO and ANL have effective systems for ensuring that ES&H is appropriately considered in resource allocation processes, although additional attention is needed to ensure that AGHCF is afforded management attention and that resources are commensurate with the hazards.

However, CH/AAO, and ANL line management have not devoted sufficient attention in some important ISM areas. Additional management attention is needed to address performance problems in several important ISM areas, including work control processes for non-experimental work activities, nuclear safety requirements, radiation protection, and CH/AAO and ANL feedback and improvement systems. In addition, some aspects of requirements management are not effectively ensuring that requirements are clearly communicated to workers and are contributing to performance deficiencies at the inspected facilities.

C.4 RATINGS

The ratings of the guiding principles reflect the status of the reviewed elements of the ANL ISM program.

Guiding Principle #1 – Line Management Responsibility for Safety.................NEEDS IMPROVEMENT
Guiding Principle #2 – Clear Roles and Responsibilities ....EFFECTIVE PERFORMANCE
Guiding Principle #3 – Competence Commensurate with Responsibility ..EFFECTIVE PERFORMANCE
Guiding Principle #4 – Balanced Priorities..EFFECTIVE PERFORMANCE
Guiding Principle #5 – Identification of Standards and Requirements..............NEEDS IMPROVEMENT

C.5 OPPORTUNITIES FOR IMPROVEMENT

The OA review identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive. Rather, they are intended to be reviewed and evaluated by the responsible SC, CH/AAO, and ANL line managers, and prioritized and modified as appropriate, in accordance with site-specific programmatic objectives.

CH/AAO

1. **Continue and enhance efforts to drive improveme nts in contractor ISM performance through contractual performance measures and provisions.**

   - Consider establishing clear and challenging contractual ES&H performance objectives targeted at implementing or improving work control systems, radiation protection program performance, implementation of nuclear safety requirements, and assessment programs within ANL.
   - Consider establishing a measure that requires ANL to benchmark with other laboratories within DOE that are recognized ISM leaders.
   - Require ANL to establish recovery plans for key weaknesses that commit to specific improvement actions, identified funding, verification efforts, and management review and submittal of periodic status reports and briefings.
   - In coordination with SC, evaluate other ANL nuclear facilities and programmatic facilities/equipment that could have priority/funding issues similar to AGHCF, and determine whether actions are needed to ensure that landlord responsibilities for safety are met.

2. **Enhance the technical capabilities of CH/AAO staff to perform DOE line management oversight.**

   - Address CH and AAO health physics staffing needs as soon as practical with qualified health physics subject matter experts who have sufficient experience and technical capability to effectively evaluate both the ANL radiation protection program and the implementation of ISM in the radiation control arena and to interface with ANL radiation protection personnel and health physicists.
   - Identify opportunities for AAO FRs and ES&H subject matter experts to gain experience and enhance their ability to perform more rigorous reviews of work planning and control reviews of the various ANL divisions. Detail key ES&H staff, including FRs, to high-performing DOE organizations to learn new techniques and processes and to share experiences and lessons learned.
   - Utilize ES&H expertise from outside CH/AAO organizations, including staff from other DOE sites and the Office of Environment, Safety and Health , to review CH/AAO operating practices and to participate on ES&H assessments of ANL.

3. **Consider enhancing CH/AAO directives and guidance for implementing assigned DOE line management responsibilities.**

   - Revise and update expired CH orders governing the directives system (CH Order 251.1, *Chicago Operations Office Directives System Order*).
   - Revise the AAO procedure (CH-AAO SOP-5, *DOE Directive Distribution and Implementation)* to reflect current AAO practices.
   - Clarify expectations for reviewing and approving contractor exemptions.
   - Consistent with Opportunities for Improvement in Appendix D, establish clear expectations for depth and rigor of line management oversight activities. Institutionalize those expectations in AAO standard operating procedures.

ANL

1. **Enhance and accelerate efforts to achieve continuous improvement in ISM.**

   - Consider utilizing outside experts who are familiar with DOE and industry ES&H practices to mentor/coach ANL line managers regarding expectations for rigor in operations of nuclear facilities.
   - Consider increasing the use of outside expertise to review ES&H programs, with particular emphasis on work planning and control, implementation of nuclear safety requirements, radiation protection, feedback and continuous improvement programs, and areas with identified weaknesses.
   - Use other DOE laboratories with similar missions and mature ISM programs as benchmarks for ANL ISM program enhancement. Review various successful requirements management systems used by some DOE sites, and review the performance management systems that flowdown contract performance measures to senior managers.
   - Proactively identify opportunities to send ANL staff to other DOE sites that have applied ISM in a R&D environment to share experiences and lessons learned and to request personnel from those sites to visit ANL for visits or temporary details.
   - Using perspectives from above activities, continually refine approaches for implementing ISM in maintenance and R&D divisions.
   - In addition to corrective actions for the OA inspection findings, evaluate other ANL organizational elements (including R&D divisions and non-R&D groups, such as utilities) to determine whether similar problems exist.

2. **Consider increasing management attention and actions to ensure the functionality and performance of the site radiation protection program.**

   - Establish high priority on plans to hire a radiation safety officer to provide leadership and direction for radiation protection programs. Ensure that the radiation safety officer has appropriate authority commensurate with responsibility.
   - Establish a dedicated health physics team, independent of the line, that is responsible and accountable for ANL radiation protection policies and procedures for consistent implementation of radiation protection activities across ANL divisions.
   - Maintain the operational health physics standards committee to affect cross-divisional communications on radiation protection matters and to provide for review and input to newly developed policies and procedures.

- Establish an action plan with clear assignments, schedules, and commitments for finalizing radiation protection operating procedures.
- Establish clear expectations for reporting processes for resolution of disputes between line management and radiation protection professionals.
- Establish a radiation deficiency reporting process to capture a broader set of identified radiation protection problems experienced at ANL.
- Reinstitute periodic training for radiation protection personnel.

3. Consider clarifying and communicating expectations for ANL actions in a number of areas and institutionalize those expectations in implementing procedures.

- Develop an implementing procedure for directives and requirements management that prescribes the process for flowdown and verification of requirements down to the working level. Ensure that the processes consistently and effectively communicate requirements to the working level. Include provisions for continued QA of implementing procedures and work instructions to ensure effective flowdown and implementation of requirements.
- Develop a subcontract specification that will address DOE requirements for flowdown of medical provisions.
- Increase specificity on required reviews and approvals for TSR procedures (including procedure use and adherence requirements), acceptance of test results, and required immediate actions on test failures.
- Establish qualification requirements and roles and responsibilities for industrial hygiene technicians.
- Strengthen the process for verifying that subcontractors have completed required training as part of the subcontractor "Authorization to Proceed" process.
- Ensure that MOUs are maintained up-to-date and that they clearly define the hierarchy of review and approval authorities of nuclear facility managers with regard to TSR-related work being performed by support organizations. Institute appropriate QA controls for maintaining and updating MOUs.
- Consider updating the ANL Policy Manual, Chapter 11.2, to be more specific about the facility manager's roles, responsibilities, and authorities, and establish implementation and maintenance requirements for interface agreements.

APPENDIX D

Feedback and Continuous Improvement (Core Function 5)

D.1 INTRODUCTION

The Office of Independent Oversight and Performance Assurance (OA) evaluation of feedback and improvement at the Argonne National Laboratory (ANL) included an examination of the Chicago Operations Office (CH), the Argonne Area Office (AAO), and ANL programs and performance. The OA team examined the CH/AAO line management oversight of ANL integrated safety management (ISM) processes and implementation, including the facility representative (FR) program, environment, safety, and health (ES&H) program management, and the award fee/performance evaluation and measurement process. The OA team reviewed ANL institutional processes, such as assessments/inspections, lessons learned, and corrective action/issues management, and activity-specific processes, such as post-job reviews. Selected facility- and activity-level feedback mechanisms were also reviewed.

D.2 RESULTS

D.2.1 CH/AAO Line Management Oversight

CH oversight of ANL ES&H programs is performed exclusively by AAO, with support from CH organizations as needed. With few exceptions, the oversight of ANL ES&H performance by AAO is adequately described in a set of procedures and program descriptions that delineate the activities and responsibilities of FRs and ES&H specialists on the Safety and Health team and the Environmental Stewardship team. These activities include operational awareness, functional area program reviews, and event and technical document reviews. An annual AAO Unit Performance Plan includes objectives, priorities, resource requirements, and performance expectations for oversight activities. The Safety and Health team also issues an annual written charter that summarizes responsibilities, commitments, and performance goals. In February 2002, AAO issued a document summarizing the AAO activities for maintaining and improving the ISM program at AAO and ANL.

Five qualified FRs and two ES&H specialists are responsible for monitoring contractor safety and environmental performance. AAO has skill mix weaknesses in health physics and criticality safety, which have been alleviated temporarily with support from CH.

The CH/AAO line oversight program is identifying ES&H program and facility condition deficiencies and fostering continuous performance improvement at ANL. Several examples of proactive, value-added FR actions to promote safety were noted. For example, an FR took photographs of workplace hazards and shared them at a Department safety meeting to promote better safety inspections, and an FR arranged for an Occupational Safety and Health Administration (OSHA) confined space expert to conduct a training course for one Plant Facilities and Services Division (PFS) department.

Routine CH/AAO operational awareness activities, including facility walkthroughs, attendance at facility safety and experiment review meetings, and technical document reviews, are documented in logbooks. Deficiencies or concerns identified during routine operational awareness activities are communicated and resolved informally between the FR and the responsible parties or facility management. One FR is piloting the use of a handheld computer and database system for logging activities. If the pilot program proves successful and is implemented, it has the potential to provide a more detailed and trackable record of FR activities and to facilitate tracking of issues and consolidation of performance data. FRs formally summarize their awareness activities in a monthly report to appropriate AAO management. The AAO Safety and Health and Environmental Stewardship team supervisors maintain good verbal communication with the ANL Office of ES&H/Quality Assurance (QA) Oversight (EQO) through weekly meetings where events, oversight activities, and areas of concern are discussed.

In addition to routine operational awareness activities, CH/AAO has an appropriate program for performing formal functional area reviews. A schedule of reviews is developed annually, and the reviews are coordinated with ANL to identify joint assessment activities and to avoid duplication of assessment efforts. The AAO FRs and ES&H specialists performed nine generally rigorous functional area program reviews in calendar year (CY) 2001; four of them were team efforts with the ANL EQO. These reviews are communicated in writing to ANL, with a response and a corrective action plan requested when issues are identified. Five weaknesses and 38 Opportunities for Improvement were identified by the CY 2001 program reviews. Corrective actions for these issues are tracked by ANL and are monitored by AAO.

The U. S. Department of Energy (DOE)/University of Chicago (UC) contract for the operation and management of ANL includes six quantitative ES&H performance expectations. An appropriate percentage (20 percent) of the award fee is allocated to these ES&H performance measures. In addition, the contract includes an objective for ANL to maintain an ISM system that implements DOE's objectives, guiding principles, and core functions of ISM in the General Operations section of the contract. This objective contains three performance measures with 11 specific performance expectations. ANL conducts an annual self-assessment of performance against contract measures, which is evaluated for adequacy by CH/AAO, based in part on FR and ES&H specialist operational awareness results.

CH/AAO conducted a self-assessment of the FR program in July 2000, and the ES&H teams and AAO performed self-assessments in 2001. Weaknesses and opportunities for improvement were identified in these assessments.

Although most of the framework for an effective program is in place and many oversight activities are being performed, several weaknesses are limiting the effectiveness of the CH/AAO oversight of ANL performance.

- **Surveillance activities, such as observation of work activities, and record reviews to ensure the adequacy of ISM element implementation, as described in AAO FR program documents, are not being performed**. In many cases, direct observation in assigned facilities is limited to one or two walkthroughs a month, typically with little or no work activities taking place. This level of effort is insufficient to accurately characterize safety performance or to identify program and performance deficiencies.

- **In routine interactions with ANL, CH/AAO management and FRs are not consistently and clearly communicating specific performance expectations for the implementation of ISM elements**. CH/AAO has clearly communicated the expectation for ANL to implement the guiding principles and core functions of ISM. However, CH/AAO personnel are not effectively challenging ANL to achieve continuous ISM performance improvement. CH/AAO could promote continuous improvement through enhanced line management oversight activities, such as regularly monitoring field implementation of ISM core functions, establishing higher thresholds for acceptable ISM implementation performance, and verifying the adequacy and effectiveness of contractor corrective actions.

- **CH/AAO evaluations are often based on insufficient assessment of actual performance.** For example, in an April 2001 program review, CH/AAO concluded that ANL had effective processes to communicate and apply lessons learned. Those conclusions were based primarily on presentations by and discussions with ANL division staff, rather than a review of a sampling of lessons learned or an evaluation of procedural requirements. This OA inspection found that significant program and implementation weaknesses exist with the lessons-learned program. In addition, in their review of the ANL self-assessment of performance to the contract performance measures, CH/AAO confirmed that ANL met quantitative contract performance measures without sufficiently evaluating ANL's systems for meeting the measures. As a result, CH/AAO missed an opportunity to provide valuable feedback that would strengthen the measures and promote continuous improvement in ISM. For example, ANL was rated as Excellent in one measure because they conducted approximately 95 percent of scheduled facility ES&H inspections. However, the CH/AAO evaluation did not consider that ANL ES&H inspections identified many hundreds of deficiencies during the past several years for which corrective actions may not have been taken or for which resolution tracking may be inadequate. Further, the CH/AAO annual assessment report of ANL's fiscal year (FY) 2001 performance stated that the independent ISM assessments of every division was an excellent effort that confirmed that the ANL ISM program is being implemented successfully across all divisions. This conclusion is not supported by the scope of those assessments.

- **CH/AAO review and approval of Occurrence Reporting and Processing System (ORPS) reports for adequacy have not been sufficiently rigorous**. CH/AAO acknowledges a longstanding issue with deficiencies in ORPS reporting by ANL and have included a performance measure in the General Operations section of the FY 2001 contract. Examples of significant weaknesses in ANL ORPS reporting identified by this OA inspection team are detailed in Section D.2.2 of this report.

- **CH/AAO has not consistently and effectively tracked assessment findings or ensured that ANL is meeting expectations for resolving issues**. For the past 18 months, corrective actions for program review issues identified by CH/AAO and deemed complete by ANL have not been verified by CH/AAO to ensure adequacy or timeliness as required by AAO procedures and assessment schedules. Examples where unverified corrective actions have been inadequate to prevent recurrence include a failure to conduct OSHA-required annual lockout/tagout reviews, which was identified by DOE in 1999, and CH/AAO and ANL deficiencies from the ISM verification related to lessons learned and corrective action tracking, which have been closed but not corrected. Further, FRs are not consistently tracking and documenting the resolution of concerns and deficiencies noted during routine awareness activities in logbooks and monthly summary reports as required by AAO procedures.

- **CH/AAO does not have a tracking system for internal issues**. The status of corrective actions resulting from the August 2000 self-assessment of the FR program has not been tracked, and several issues appear to remain unresolved, including the need to improve observation strategies for walkthroughs, untimely occurrence reporting and root cause analysis by ANL, and the variable tracking and closure of FR findings. Corrective actions for several CH/AAO issues that were identified during the ISM system verification have not been effective in addressing program weaknesses, and the closure verification for these issues was inadequate.

Finding #3: CH/AAO has not established and implemented a fully effective and efficient oversight program, as specified in DOE Policy 450.5, *Line Environment, Safety and Health Oversight,* that ensures that ANL is effectively implementing ISM.

D.2.2 ANL

ANL has a number of institutional programs that provide feedback on the adequacy of ES&H processes and performance. Various inspection and assessment processes are being employed at the division level.

Other feedback mechanisms include the ORPS, lessons learned, employee concerns/suggestion programs, safety committees, and staff and ES&H counterpart meetings, which provide additional institutional feedback vehicles for improving ES&H performance. Numerous tracking systems are used to identify and track corrective actions for identified program and performance deficiencies.

ANL employee concerns programs (also see Guiding Principle #1) and safety committees are established and effectively implemented, with no significant weaknesses. As discussed below, assessment programs, corrective action management, and lessons-learned programs each have positive aspects as well as weaknesses that need to be addressed.

Assessments. Requirements for ANL assessments are outlined in the ANL ES&H Manual and the ANL Quality Assurance Program Plan (QAPP). These documents address facility safety inspections, independent and management assessments, management walkthroughs, and an annual assessment of performance in implementing the objectives and performance measures in the management and operating contract with DOE.

Numerous and diverse assessment activities are conducted at ANL to evaluate safety performance and implementation of ISM guiding principles and core functions. EQO issues an annual independent ESH/QA program review schedule, coordinated with CH/AAO, that in calendar year (CY) 2001 identified 5 ANL, 10 DOE and CH/AAO, and 2 joint assessments of a variety of functional areas. Twenty-four EQO program reviews are scheduled for CY 2002. A total of 29 formal internal and external institutional-level assessments were performed at ANL in CY 2001, including 3 special ORPS event-related investigations. The PFS and the Chemical Technology Division (CMT), including Waste Management Operations (WMO), have issued annual self-assessment plans that identified additional management and independent assessments for their organizations, as specified in the ANL QAPP. Three managers in WMO document the scope and findings from their monthly walkthrough assessments on a standardized assessment form. Managers in other departments and divisions indicated that periodic walkthroughs were performed, but were not documented. Many specific, functional area, ES&H-related inspections and assessments required by applicable regulations and standards and by the ANL ES&H Manual are also performed by line management. Semiannually, all facilities are inspected for unsafe conditions, which are logged into a sitewide database called I-Track for corrective action tracking. PFS Building Maintenance and Crafts crew foremen conduct monthly, documented task observations where work activities are observed and monitored against a checklist of ES&H- and quality-related attributes.

Although institutional requirements are defined and many assessment activities are performed by ANL, ANL management has not ensured the adequacy of implementation, and performance weaknesses have adversely impacted their effectiveness. Assessment process implementation requirements and expectations are not always adequately defined, many assessments lack sufficient depth and focus to effectively evaluate the adequacy of ISM implementation, and some required assessment activities are not being performed. In addition, issues identified by ANL assessment activities are not consistently and effectively evaluated and resolved (discussed below). Examples of deficiencies identified in the ANL assessment programs include the following:

- **Roles, responsibilities, and authorities for performance of independent and management assessments are not sufficiently detailed in the institutional Tier 2 procedures and division and department Tier 3 documents**. These documents provide general expectations, indicating that assessments are to be performed, but the documents do not provide details regarding specific responsibilities and process requirements.

- **Assessments do not adequately evaluate actual ISM performance**. Assessments focus on review of program documents and walkthroughs to observe facility conditions. However, assessments at all levels lack sufficient focus on observation of work, examination of records and documents that reflect the implementation of ISM, and compliance with OSHA, DOE, and ANL internal requirements.

- **Some OSHA- and ANL-required safety reviews are either not delineated in ANL documents or are not being performed as required** Annual reviews of the lockout/tagout program, as required by OSHA and the ANL ES&H Manual, have not been scheduled or conducted by CMT, PFS, or the Energy Technology Division (ET). ANL has not implemented the periodic hoisting and rigging program review identified in the PFS hoisting & rigging manual, an issue that was identified in a 1998 independent assessment.

- **The ANL assessment program has not addressed some important ISM program elements**. For example, work control, beryllium control, unreviewed safety question/technical safety requirement surveillance process implementation, and event reporting have not been addressed. In addition, the ANL assessment program lacked sufficient rigor to identify significant process and performance deficiencies in several other important ISM areas (e.g., radiation work permits, radiation protection program, and issues management/corrective action).

- **The rigor and depth of analysis of many assessments do not support ANL's conclusions regarding program and performance adequacy**. The limitations in scope are not always clearly identified to provide an accurate characterization of the results. For example, the division and summary ANL ISM implementation and annual management assessments conducted in FY 2001 included only minimal assessment and observation of work activities and review of pertinent documentation establishing effective ISM implementation, but concluded that ISM was being successfully implemented. Typically, the assessments consisted of presentations by the divisions on how ISM was being implemented, discussions with staff, and limited walkthroughs of facilities. Failure to adequately qualify the scope and basis for assessment findings can communicate an inaccurate perception of performance and impedes the progress of continuous improvement in implementing ISM.

- **With the exception of WMO, management walkthroughs and observations by line management are rarely documented** Some divisions and departments are not adequately evaluating the need for scheduling or conducting independent and non-regulatory-driven self-assessments as required by the ANL ES&H Manual.

Finding #4: Weaknesses in ANL line management assessment processes and performance are limiting continuous improvement in safety performance.

Issues and Corrective Action Management. Corrective actions for many ES&H deficiencies and issues are adequately tracked to resolution through a variety of informal and formal processes. The expectation that program and performance deficiencies are to be dispositioned and tracked to closure is clearly delineated in several institutional-level documents, including the QAPP and the ISM program description. Findings from CH/AAO and ANL institutional functional area program reviews and assessments are input to tracking systems maintained by EQO. The Alpha Gamma Hot Cell Facility (AGHCF) in ET, WMO in PFS, and CMT have formal systems that capture appropriate program and performance deficiencies and track the corrective actions to completion. In general, the incident and event investigation reports examined by the OA inspection team were thorough; they accurately identified root and contributing causes and made effective recommendations for corrective and preventive actions. In addition, they identified the limitations of the review and made recommendations for conducting further reviews.

However, the documentation, evaluation, and resolution of ES&H deficiencies and issues are not being managed in a structured, consistent, risk-based, and effective manner that fully supports continuous improvement. Examples of weaknesses in issues management processes and performance include:

- **The ANL QAPP institutional procedure for corrective action development and tracking insufficiently details process requirements and does not address essential elements for an effective issues management process**. Elements not addressed include extent of condition determination, causal analysis, risk or significance ranking, time frames for process actions, formality expectations for tracking systems, or process details for the use of the three tracking systems used by EQO. There is no definition or established criteria for determining when an issue is considered institutional and needs to be tracked in an EQO tracking system or evaluated for applicability to multiple divisions or departments. At the division and department level, general expectations for tracking corrective actions are contained in QA plans and other policy documents, but there are no procedures detailing the specific responsibilities and process requirements.

- **Many corrective actions were inadequate, and many issues were closed improperly**. Corrective action plans are not being sufficiently reviewed to consistently ensure that the issues and causal factors are adequately addressed or that the corrective actions taken are adequate. In some cases, specified actions were not sustained after closure. Issues from the ISM verification have been closed based on corrective actions that have been ineffective in fully addressing the deficiencies.

- **Submittal of some corrective action plans and completion of corrective actions is not timely.** Ten corrective actions for findings from CY 2001 institutional independent assessments were overdue, and at least 16 corrective actions had not been established as of May 2002. About 350 ES&H inspection deficiencies, many two or three years old, are listed as open in the ANL action tracking system. Many of these items have been open for several years. Periodic reports of the corrective action status of ES&H inspections and assessment findings are not issued for information and use by management. There are no effective processes for escalating situations involving untimely corrective actions to higher levels of management for follow-up action. Actions to establish and enforce accountability for timely corrective actions are minimal.

- **The timeliness of notification, event descriptions, analyses of the extent of condition and causal factors, and specified actions for many ORPS reports are inadequate to effectively communicate the issues involved and to address root causes to prevent recurrence**. Corrective actions are often incomplete, do not address root and contributing causes, or fail to identify the full extent of conditions. An example that exhibited all of these weaknesses was the April 2001 injury of an ANL technician when a pipe cap that was unsoldered and untested after a modification blew off under initial pressurization. The corrective actions did not address numerous contributing and root causes, including the lack of formal processes for controlling modification work in the two divisions involved, or the failure to adequately employ a partially completed modification/design control document. In addition, several related performance deficiencies were not addressed, including the failure to identify this event as a potential reportable event and to report the injury to medical immediately. Further, the CH/AAO was not notified for four days. In another instance, an event reported during this inspection (i.e., ANLE AGHCF-2002-0002, Discovery of Potential USQs) had met the criteria for classification as unusual, but was classified by ANL (with AAO FR concurrence) at the lower category of off-normal. Issues that involved cross-divisional or institutional responsibilities were especially problematic.

- **The multiplicity of diverse, formal, and informal tracking systems impedes data analysis for determining collective performance levels and identifying adverse trends or systemic issues**.

The EQO employs three separate tracking systems for institutional issues and ES&H facility inspection deficiencies, and there are dozens of division and department systems using different platforms and formats. Periodic trend analysis is not performed on ES&H inspection results and assessment findings to identify systemic or chronic issues or adverse and positive trending to focus resources. ET and PFS do not have a system to track division-level issues as required by institutional-level documents. Corrective actions for deficiencies noted by PFS Building Maintenance and Crafts foremen during their task observation reviews were not documented or tracked to resolution.

Finding #5: ANL processes and performance for analyzing ES&H program and performance deficiencies, developing corrective actions, and tracking actions to completion have not been fully effective in resolving many issues, preventing recurrence, and effecting continuous improvement.

Lessons Learned. Much lessons-learned information is being communicated to workers and associates in a variety of formal and informal venues at ANL. The lessons-learned program is described in the ANL ES&H Manual. Lessons learned from external ORPS reports are being screened at the institutional level, and some lessons learned from the DOE list server and the DOE Operating Experience Weekly are being screened and distributed by several Associate Laboratory Director ESH/QA coordinators. Some organizations are generating and distributing detailed and informative internal lessons learned, and there is evidence that some lessons learned have resulted in changes in ANL processes. Lessons learned are regularly shared in safety meetings and committee meetings. A lessons-learned site on the ANL intranet provides links to external and internal lessons-learned sources, a list of subject matter experts for 20 functional areas, and a listing of links to recent ORPS reports. Each of the functional areas has a website with links to a listing of related lessons learned.

Notwithstanding the examples of excellence and communication of lessons learned cited above, the unstructured process and inconsistent implementation are limiting the effectiveness of the lessons-learned program. The ANL lessons-learned coordinator is not screening and distributing lessons learned as specified in the ANL ES&H Manual. Further, there is insufficient documentation to provide assurance that available lessons learned are being consistently and adequately screened for applicability to ANL and that appropriate actions are taken to prevent similar events at ANL. The institutional procedure does not require documentation of the various steps for screening, evaluating, and applying lessons learned. This issue was identified during a CH/AAO/ANL program review in April 2001, but a corrective action to establish a database to track subject matter expert evaluations of lessons learned was not effectively implemented. The issue was identified as complete, based on the intent to use the existing I-Track database for this purpose. However, I-Track was only used to log two lessons learned at the end of CY 2001, and subject matter expert responses had still not been provided as of May 2002, over four months after transmittal of both items.

The lack of a structured process may have resulted in the failure to screen pertinent lessons learned, as evidenced by several externally generated lessons learned that were potentially applicable to ANL but had not been formally evaluated for applicability. For example, an October 2001 Rocky Flats Environmental Technology site ORPS and a January 2002 DOE Operating Experience Weekly lesson learned on a failed weld on a drum dolly that caused a dropped drum (27 dollies with defective welds) had not been evaluated for applicability to ANL, although drum dollies are routinely used at ANL. Lessons learned from a December 2001 ANL-W near-miss event where energized electrical cable was inadvertently cut during modification work was not evaluated or applied at ANL, and the same event subsequently occurred at ANL in February 2002.

Another example of weakness in the implementation of lessons learned at ANL is that few lessons learned are generated from internal events/incidents for sharing across ANL organizations, and none have been documented on the website or shared with the DOE complex. Further, the functional area lessons-learned links on the website have not been maintained current for potential users, with most of the last entries occurring in CY 2000. In addition, procedures for developing training lesson plans and for work control planning do not specify that lessons learned be applied to these activities. Also, there are no mechanisms for formal worker feedback, such as comment blocks/procedural expectations on work documents or formal post-job reviews.

Finding #6: Consistent identification, evaluation, and implementation of applicable lessons learned to prevent events and deviations from requirements cannot be assured because of the lack of a structured, documented, and consistently applied process.

D.3 CONCLUSIONS

CH/AAO has established the framework for conducting operational awareness and evaluation activities related to contractor ES&H/ISM performance. Qualified FRs have been assigned to nuclear facilities and other facilities and activities with ES&H considerations. Formal program reviews, many conducted jointly with ANL, are identifying program deficiencies and driving process improvements. Safety performance measures, which are used by ANL and CH/AAO to evaluate performance and provide financial incentives for improvements in performance, are included in the DOE/UC contract. However, weaknesses in focus and inconsistent rigor in the application of these oversight activities is hindering the effectiveness of CH/AAO oversight in promoting continuous improvement in ANL's implementation of ISM. Oversight activities need additional focus on observation of work and communicating challenging expectations for ES&H performance, especially in the areas of ORPS reporting, self-assessment, work control, and issues management.

Many mechanisms are being used to provide feedback and improvement in safety performance at ANL. Independent and management self-assessments are performed, deficiencies and issues are identified, corrective actions are developed and implemented, and lessons learned are frequently and widely disseminated. However, inconsistencies and weaknesses in processes and in the implementation of feedback and improvement mechanisms have hindered their effectiveness in driving continuous improvement in ISM system implementation. Assessments are not sufficiently focused on identifying inadequacies in ISM system implementation or consistently effective in driving continuous improvement. ES&H issues are not being effectively managed to ensure that corrective actions fully address program and performance deficiencies and are verified to be effective and sustained. Increased rigor is needed to ensure that lessons learned across the DOE complex are consistently screened for applicability to ANL activities and corrective/preventive actions tailored to ANL are promptly implemented where appropriate.

D.4 RATING

CH/AAO and ANL employ many different mechanisms for gathering feedback information, sharing lessons learned, implementing corrective actions, and conducting oversight of ES&H activities. However, process weaknesses and inadequate implementation of these mechanisms have limited their effectiveness in driving consistent, continuous improvement by identifying and resolving deficiencies, preventing recurrences, and ensuring that ISM is being adequately implemented. As a result, a rating of NEEDS IMPROVEMENT is assigned.

D.5 OPPORTUNITIES FOR IMPROVEMENT

The OA review identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive. Rather, they are intended to be reviewed and evaluated by the responsible CH/AAO and ANL contractor line management and prioritized and modified as appropriate, in accordance with site-specific programmatic objectives.

CH/AAO

1. **Consider strengthening CH/AAO processes and oversight activities for evaluating contractor performance and for documenting, communicating, and tracking the resolution of ANL performance deficiencies identified during oversight activities**.

    - Consider expanding the use of team surveillances and assessments to evaluate ISM implementation to maximize use of available FR resources.
    - Establish a more structured planning effort to identify focus areas and surveillance topics for individual FRs and for the Safety and Health and Environmental teams.
    - Ensure that FR surveillances and program reviews critically evaluate ES&H performance, including significant observations of work.
    - Clarify the definitions of concerns and issues that can be identified during operational awareness activities and establish an appropriate threshold for more formal documentation and tracking.
    - Accelerate the implementation of a more formal record keeping system for operational awareness activities and tracking of all FR issues.
    - Ensure that the evaluation of contractor performance for quantitative contractual performance measures includes a qualitative review of the overall effectiveness of ANL processes. Use the results to provide feedback for enhancing the quantitative performance measures to make them a more robust indicator of program effectiveness and thus promote improvement in ISM. Ensure that the overall evaluation of ANL performance considers qualitative factors.
    - Establish a routine, periodic written report to ANL communicating recent oversight actions, concerns, and issues.
    - Consider benchmarking against successful FR programs at other DOE sites to identify processes and techniques that could be applied to leverage the existing resources at CH/AAO.
    - Strengthen the evaluation of ANL event analysis and ORPS reporting, especially the adequacy of corrective actions in addressing root and contributing causes.
    - Resume verification of the adequacy of ANL-completed corrective actions and include a validation of the effectiveness of a sampling of ORPS corrective actions.
    - Establish a mechanism to document an evaluation of the adequacy of the contractors assessment processes in each program review or other formal surveillance or assessment. This data would be valuable for determining the overall progress in the development of a robust, rigorous, and credible contractor self-assessment program as specified in DOE Policy 450.5.

ANL

1. **Consider strengthening the processes and the conduct of assessments to foster continuous improvement in the processes and the application of the core functions of ISM.**

    - Establish or strengthen Tier 3 procedures to clarify roles and responsibilities for independent and management assessments and to provide details for the processes.

- Include/expand implementation performance reviews in program assessments and conduct periodic internal independent assessments of implementation of ISM core functions.
- Direct additional management attention toward ensuring that the scope and depth of assessments conducted at all levels is sufficient to drive continuous safety improvement and the conclusions are fully supported by the scope of the review and analysis in the report.

2. Significantly strengthen the management of ES&H issues to ensure that corrective actions that effectively address deficiency root causes are identified and tracked to completion.

- Conduct an independent review of the ORPS reporting process and its implementation and take necessary steps to ensure effective reporting, evaluation, development, and implementation of controls to prevent recurrence. Consider establishing a special review panel to monitor implementation of the ORPS process until performance consistently meets DOE expectations.
- Strengthen the institutional QAPP procedure to clarify its applicability to all deficiencies, regardless of source. Include important elements of issues management, such as expectations for risk ranking, determining extent of condition, causal analysis, time frames for completing process evolutions, determination and definition of "institutional" issues, minimum expectations for tracking of actions, and verification of completion and effectiveness.
- Accelerate the availability of and formalize the process for the utilization of a common tracking system by all ANL divisions and departments. Encourage the use of a consistent format and process to facilitate trending analysis and collective performance evaluation.
- Establish processes for periodic trend analysis of issues and ES&H inspection deficiencies to identify adverse or improving trends or generic concerns to focus resources and inspection/assessment effort.
- Ensure that Tier 3 implementing procedures are established and that they include clearly defined roles, responsibilities, and process details.
- Establish a method to document the review and acceptance of proposed corrective actions by appropriate parties.
- Routinely publish and provide a status report of corrective actions for ES&H inspections and for other action tracking systems to appropriate levels of management.
- Conduct regular independent assessments of the adequacy and implementation of the issues management processes at all levels to ensure their effectiveness in resolving deficiencies and preventing recurrence.

3. Consider strengthening the lessons-learned program to ensure that appropriate lessons learned are consistently developed, screened, and applied to training and work activities at ANL.

- Ensure that sufficient resources are applied at the institutional level to manage the lessons-learned program, including coordination of review and dissemination efforts and tracking of actions.
- Establish mechanisms to document and ensure that the screening of external lessons learned is consistently performed, subject matter expert evaluations are conducted, any required actions are tailored to ANL processes, and required actions are verified to be implemented.
- Ensure that all institutional-, division-, department-, and facility-level procedures and processes for training and work control planning specifically address the evaluation and application of lessons learned to ANL activities.

APPENDIX E

Core Function Implementation (Core Functions 1-4)

E.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) evaluation of work planning and control and implementation of the first four core functions of integrated safety management (ISM) at the Argonne National Laboratory (ANL) focused on safety performance during work activities under two Associate Laboratory Directors (ALDs) and activities under the ANL Chief Operations Officer. Within the Operations ALD, the evaluation focused on the Plant Facilities and Services division (PFS), primarily looking at the Waste Management Operations (WMO) Department and the Maintenance Department. Within the ALD for Engineering Research, the evaluation focused on Chemical Technology Division (CMT) work activities, including Building 205 activities. Within the ALD for Energy and Environmental Sciences and Technology, the evaluation focused on the Energy Technology Division (ET) work activities in Building 212, including the Alpha Gamma Hot Cell Facility (AGHCF).

Examples of activities that were observed by OA included experimental operations (including some glovebox operations), equipment preventive and corrective maintenance, programmatic and craft maintenance activities, and modification work. In addition, the work control processes used by each of the departments were evaluated. Procedures and policies were evaluated, and hazard analysis and control systems were examined. This approach enabled OA to evaluate a variety of ANL work control processes, organizations, work activities, and environment, safety, and health (ES&H) programs.

The application of ISM for work at ANL varies across the ALDs and the individual divisions within each ALD. Work at ANL can be divided into two categories—experimental and non-experimental. Experimental work consists of the experiments conducted in support of ANL's research and development mission. Non-experimental work, which makes up a significant part of the work performed at ANL, is all other work associated with operation of the laboratory, such as facility and equipment maintenance, laboratory and equipment installation and refurbishment, waste management, and service and construction subcontracts. Some ongoing work, such as experimental research, includes a formally defined process for work planning and control, while other work, such as maintenance, has relatively few formal or systematic requirements. The following paragraphs provide a brief overview of work control processes for the types of work reviewed during this inspection.

ANL established requirements for experiment safety reviews in the Experiment Safety Review chapter in the ANL ES&H Manual. Each division conducts reviews of experiments and other activities using a process established by the division, in accordance with those requirements. ET and CMT further defined the process in division-specific procedures. In some cases, a facility or apparatus safety review is performed to document apparatus-specific hazards and controls.

In preparation for an experiment, the experimenter, or principal investigator, prepares an experiment proposal that defines the scope and purpose of the experiment(s), including the location, equipment, and materials for the planned activity, and the participating personnel. The proposal's author, using manuals and input from division and ANL ES&H personnel, analyzes the hazards present in the experiment and develops preventive and mitigative controls. The controls will typically include one or more administrative or engineered controls. For some specific activities, ANL has established such permits as radiation work permits (RWPs), hot work permits, and lockout/tagouts. The safety analysis and controls are reviewed by the division ES&H coordinator, a division safety committee, an ad hoc review committee, an ANL committee, or other individuals or groups. The required level of review, authorization, and documentation is dependent on the severity of the hazards. For experiments involving non-routine hazards, approval of an experiment safety review committee is required before beginning the experiment. Following final approval, the individuals are required to perform the experiment(s) in accordance with the controls identified in the documents discussed above.

The PFS Building Maintenance and Crafts group performs much of the non-experimental maintenance work at ANL. Maintenance work is defined in work orders created for each maintenance activity, including all preventive, recurring, predictive, and corrective maintenance. For preventive, recurring, 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, a work request is generated by the maintenance foreman, who meets with the customer to refine and revise the scope as necessary. Hazards are identified based on training and experience, and are documented in a number of job safety analyses (JSAs). JSAs are prepared for routine maintenance processes that have a history of causing accidents and for new jobs with significant hazards. In addition to JSAs, task evaluations are prepared for maintenance work performed by subcontractors and are prepared for most maintenance work performed by the Building Maintenance and Crafts group. For some hazards, such as confined spaces, a permit is also completed and included in the work package. The primary mechanism for controlling hazards associated with maintenance work is through the identification and completion of training, based on information obtained in individual job hazard questionnaires. Specific controls for a given task are also defined through such mechanisms as JSAs, task evaluations, work entry clearances, Tier 2 ES&H procedures, and division-specific procedures. Work performance is based on the defined work scope, and work is authorized by the foreman, after a review by the building manager.

Waste Management Operations (WMO), also within PFS, is responsible for supporting and implementing the ANL waste management program. ANL has obtained a Resource Conservation and Recovery Act (RCRA) Part B Permit for their waste management facilities to support the waste management operations. The radioactive and hazardous wastes generated at ANL are collected and transported almost daily by WMO waste mechanics to the WMO waste management facilities, which include Buildings 303, 306, 317, 325, 331, and 379. At these facilities, WMO employees classify, process, sort, treat, and package waste for either storage on site or shipment off site for disposal. WMO waste mechanics also provide decontamination and decommissioning support and other sitewide waste services, including ventilation system high efficiency particulate air (HEPA) filter replacement, asbestos floor tile removal, and ventilation hoods/ducts installation on building refurbishing projects. WMO work crews also perform onsite packaging of waste at the various ANL facilities before transporting waste to the waste management facilities.

WMO controls work primarily through use of a work clearance permit (WCP) for routine, in-house work. In addition, WMO has developed a set of standard operating procedures. A WCP may reference these standard operating procedures. The WCP serves as a means of documenting the work planning and authorization, and is prepared by the work crew foreman for the assigned job. A planner/estimator conducts walkdowns of prospective jobs, usually in conjunction with the operations supervisor, work crew foreman, and subject matter experts. For jobs classified as non-routine work for which a standard operating procedure is not applicable, either a job plan or project-specific procedure is required. The job plan procedure is intended for more detailed planning for non-WMO personnel or work that is more complex. Recently, WMO hired project managers to provide an additional level of line management oversight, along with the work crew foreman on these projects. The work crew foreman conducts a pre-job briefing with all personnel involved before performing any part of the job plan work tasks. The WCP can also be used in conjunction with job plans; and for small, non-routine jobs, the WCP can act as the mechanism to outline job instructions in lieu of a job plan or operating procedure. Project-specific procedures may be developed for unique projects requiring more formality and rigor than either WCPs or job plans.

Within ET, the OA inspection team reviewed the implementation of nuclear safety requirements by evaluating implementation of the technical safety requirements (TSRs) and the unreviewed safety question (USQ) process at the AGHCF, which is contained within Building 212. The TSRs are the formal requirements that define the bounding conditions for safe operation of the AGHCF and the bases for those requirements. The TSRs are derived from the safety analysis report and are formatted in accordance with DOE Order 5480.22, *Technical Safety Requirements*. The TSRs were submitted to the Argonne Area Office (AAO) in October 2001, approved by AAO in December 2001, and implemented by ANL on January 16, 2002.

The USQ process, required by DOE for nuclear facilities, is used to evaluate proposed changes to facilities, equipment, or procedures to determine the proper approval authority (DOE or ANL) for the proposed change. At ANL, the USQ process is defined in the Nuclear Safety Procedures Manual. The AGHCF has a facility-specific, subtier procedure that implements both the ANL and DOE requirements.

The following section contains the OA team's evaluation of Core Functions 1 through 4. While the OA team looked at many examples of work, some jobs are used as examples in each of the core function discussions in order to highlight the integration of the core functions. Core Function 5 is discussed separately in Appendix D.

E.2 STATUS AND RESULTS

E.2.1 Core Function #1 - Define the Scope of Work

Missions are translated into work, expectations are set, tasks are identified and prioritized, and resources are allocated.

Experimental work was generally well defined for the actual conduct of experiments. Experiment proposals, and in some cases the preliminary experiment safety reviews, describe the experimental apparatus, needed materials, and the overall experimental approach in sufficient detail to permit effective hazard identification and analysis.

Some non-experimental work observed by the OA team, especially more complex work, was clearly defined. In one case, work was in progress to remove lead base paint from the Area 317 deep vaults using a "Vac-U-Blaster." Because this job involved work in six vaults and called for complex, non-routine work, the job was planned following the WMO job plan procedure. The work package included a clear description of the work, identified prerequisites, pre-job planning with hazard evaluation and controls, procedure steps, and a procedure checklist identifying the groups responsible for implementation. In another case, the operation of the Mobile Visual Examination and Repackaging System (MOVER), the work activity for visual inspection of transuranic bearing wastes, was defined in a method of work statement (MOWS) document prepared by the subcontractor. Visual inspection of waste is performed in a glovebox containment system that requires various preparatory and maintenance activities, including bag-in and bag-outs, filter changes, and related evolutions. The various work tasks are well defined and covered in a series of step-by-step, job-specific procedures.

Maintenance or maintenance-like activities conducted by research technicians or experimenters were not always clearly defined. The ANL ES&H Manual experiment safety review process provides a recommendation to address the maintenance, repair, or disassembly of experiment equipment; however this recommendation is not reflected in the CMT or ET division-level experiment safety review procedures. Consequently, most of the experiment proposals and safety reviews do not address anticipated maintenance requirements, and no other systematic processes are provided to define anticipated program maintenance activities. Some maintenance procedures do exist for more complex equipment, such as the procedures used at the AGHCF to support the upkeep or repair of systems essential to cell containment or vendor manuals and laboratory maintenance procedures for major CMT equipment.

The PFS Maintenance Department has not developed a systematic and well-documented process that sets management expectations for defining work tasks, provides for the appropriate integration of ES&H into work activities, and prioritizes tasks based on hazards, as required by DOE Policy 450.4, *Safety Management System Policy*. The maintenance work control process is fragmented and not sufficiently documented in controlled procedures and instructions to ensure that all aspects of defining the work are sufficiently considered so that hazards can be readily identified. Thresholds for routine, low-, moderate-, or high-hazard work are not established. PFS maintenance work control procedures and instructions are minimal and do not adequately define the purpose and use of a service or work request, or the roles and responsibilities and process for initiating, approving, or revising such documents, the assignment of risk, or the involvement of ES&H. Some work descriptions identified all work steps, but others did not identify some work activities that involved hazards, such as shop fabrication work.

For WMO, definition of some work activities that are considered routine by ANL personnel is not sufficient to ensure that all hazards are identified and that appropriate controls are implemented. For example, the refurbishment of the Building 202 A-Wing included a task for "busting up old drain lines, removing lead, sludge (dry or wet) and traps; and putting lead, sludge and pipes in separate drums." Other than this work description provided on a WCP, there is no other description of the work, such as a work procedure, which would detail each step of the work activity. From this task description, it cannot be determined whether "removal" of lead involves only the handling of lead or if the removal may also include the cutting or heating of lead, which would involve a different set of hazards and controls. Since the methods for "busting up" the old drain lines are not defined (e.g., hammers or saw), the description is not clear about the applicability of electrical hazards associated with power tools, or ergonomic and noise hazards associated with impact wrenches. Further, WMO procedures do not provide clear guidance or thresholds to specify when work must be defined in a procedure in lieu of a WCP, and how the level of work definition and planning is commensurate with the potential risk to the workers.

Summary. ANL processes for defining work are effective for the conduct of experiments and for some complex activities. However, for most non-experimental work (i.e., maintenance, WMO operations, and support for experiments), the work control processes do not include clearly defined thresholds for work planning and have not been effective in clearly defining the scope of all work. This core function needs improvement in the work control processes for non-experimental work, with emphasis on definition of work scopes and thresholds for increased level of rigor in review and controls. (See Finding #11, which addresses the lack of systemic processes for non-experimental work and cuts across all four core functions, in the conclusions section of this appendix).

E.2.2 Core Function #2 - Analyze the Hazards

Hazards associated with the work are identified, analyzed, and categorized.

Institutional- and division-level processes are established to effectively identify hazards associated with performing experiments. The ANL ES&H Manual establishes institutional-level requirements for the experiment safety review process, and ET and CMT each have implemented detailed procedures to tailor the review process to their respective activities. In both divisions, the experiment safety review begins with using a comprehensive checklist to identify potential hazards. The identified hazards are then analyzed to determine the appropriate controls. In the experiments that were reviewed by OA, hazard identification and analysis were generally comprehensive and appropriately addressed the hazards. Although some specific deficiencies exist (see below), the overall process provides comprehensive directions to the experimenters and is appropriate for a systematic approach to safety review.

In PFS, one specific example was noted of a concerted effort to clearly identify hazards and implement effective controls. PFS maintenance line management and workers have been proactive in the identification and analysis of hazards for work performed in the Building 368 carpentry shop. With the support of the ANL industrial hygiene organization, PFS line management initiated noise surveys and dust monitoring within the carpenter shop in Building 368. As a result, noise and dust sources were identified, analyzed, and controlled via administrative controls (postings) and some engineering controls (local ventilation additions). In addition, carpenters within the Building 368 carpentry shop and other maintenance workers in the Building Maintenance and Crafts group have been proactive in identifying and developing new JSAs for carpentry tasks. A number of JSAs were initiated and written by the carpenters.

The site as-low-as-reasonably-achievable (ALARA) committee participates in work planning and review for high-risk radiological jobs that exceed certain triggers. A team, typically consisting of four members, works with the divisions to review work planning efforts and to offer comments and advice on planned work evolutions. The team reviews the work scope, RWPs, and ALARA checklists. Committee recommendations must be satisfactorily resolved before work is authorized to proceed. An ALARA review record that incorporates ALARA committee recommendations into the work documents is maintained.

Two key problems were identified in the AGHCF safety analysis. First, the hazards associated with mercury located within the AGHCF have not been identified or analyzed in any documented hazard analysis. The AGHCF contains two fission gas collection cabinets containing approximately one gallon of potentially radioactively contaminated mercury. Second, the AGHCF seismic analysis of record uses a non-conservative assumption, calling into question the seismic integrity of the facility. The analysis contains a simplifying assumption that the hot cells are considered isolated from the rest of the building; therefore, there is no structural interaction between them. However, there are physical connections with the rest of the building and locations where building failure potentially could affect the hot cells. Therefore, this assumption is non-conservative, and the analysis does not demonstrate the seismic integrity of the AGHCF. The analysis is labeled “Preliminary,” never having been formally reviewed or approved, yet is incorporated by reference into the approved safety analysis report. In response to these problems, the facility manager issued an off-normal occurrence report, initiated application of the USQ process, and initiated a justification for continued operation.

The USQ process as implemented at the AGHCF does not meet the intent of 10 CFR 830.203 to ensure that modifications and tests remain within the approved safety envelope. 10 CFR 830.203 requires the contractor to implement the DOE-approved USQ process in situations where there is a temporary or permanent change in the facility as described in the existing documented safety analysis. Two of the three facility modifications performed over the last two years (modifications to the fire protection system and the nitrogen system) were screened out of the USQ process and implemented without performing a complete USQ determination. The AGHCF procedure for performing USQ screening and evaluation inappropriately allows this screening out because it provides inadequate and misleading screening instructions. For example, the AGHCF USQ procedure’s screening questions ask if and how the change will affect the facility, rather than asking if the activity is a change to the facility or procedures as described in the authorization bases. The USQ screening and evaluation question forms provided by the

ANL Nuclear Safety Procedures Manual, while different from the forms used at AGHCF, are similarly deficient.

Finding #7: The USQ screening, evaluation, and determination process at the AGHCF does not ensure that modifications to the facility are adequately analyzed and within the existing facility safety envelope.

Within PFS, the hazard analysis process for maintenance is fragmented and insufficiently structured to reliably identify, document, and communicate all relevant hazards to the necessary personnel. ANL has not effectively instituted a graded approach to hazard analysis as defined in DOE Policy 450.4 for maintenance activities. As the primary tool for hazard identification and analysis, JSAs and task evaluation plans document some hazards, but the description of hazards is often incomplete, and there is no process for using, controlling, or linking these documents to work activities. Pre-job briefings and job walkdowns may be conducted on some maintenance work activities to identify hazards; however, there is no established process for the conduct of job walkdowns or pre-job briefings. Work activity hazards associated with preventive and recurring maintenance activities are not defined in the work request, and the hazards are not clearly described in associated JSAs that are tailored and linked to the work activity. For example, the potential hazards associated with preventive maintenance on an air compressor in Building 306 (i.e., noise, pressure, and chemicals) are not documented on the work request and there is no associated JSA. In some cases, such as with the preventive maintenance for the air conditioning unit for Building 350, elements of one or more JSAs may be applicable. Because the JSAs are not identified in the work package, or tailored to the specific work activity, the JSAs do not effectively contribute to the identification and analysis of hazards and controls.

Another hazard identification process used within the Building Maintenance and Crafts group and for maintenance service contractors is the task evaluation. The task evaluation process is minimally documented in a paragraph of the PFS supervisor handbook. There are no instructions or guidance for when the task evaluation process applies, or the how the task evaluation form is used, completed, approved, or revised. The OA team identified similar concerns with the implementation of the task evaluation process as previously described with the JSA process. In one example observed by the OA team, the task evaluation for painting work in Building 201 was not completed until after the job was finished.

The lack of a systematic approach to hazard analysis for maintenance activities results in some hazards not being identified, analyzed, documented, or sufficiently communicated to workers. For example, the potential beryllium contamination hazard associated with the construction of a railing in Building 315 was not recognized or evaluated by building management, PFS safety, or maintenance personnel. Although the hazard had been identified and evaluated by the ANL industrial hygiene organization, the hazard characterization provided by industrial hygiene had not been accurately communicated. Maintenance and radiation protection support for this work activity had assumed that beryllium hazards in the work area had been identified, contained or eliminated by "others," such as project or building management, industrial hygiene, or WMO. As a result, adequate consideration was not given to the beryllium room or area postings, because the beryllium hazard was assumed to be below the floor in the waste pit and not present in the work area. In addition, workers and supervisors considered the work activity to be routine, and did not recognize the need for an analysis of the potential beryllium hazard, development of a JSA, involvement of industrial hygiene, or additional controls, such as beryllium awareness training. During the performance of the work, it was determined that previous assumptions concerning the beryllium hazard were in error, and that a ladder in the work area had been contaminated with beryllium. Consequently, the work clothing of two crafts maintenance workers may have been contaminated with beryllium. The PFS maintenance manager stopped work, and an occurrence report was initiated.

Hazards for some WMO work activities were also not adequately identified or analyzed. WMO management stopped several of these work activities during the OA inspection because potential problem areas were identified by OA and/or WMO. WMO typically identifies and documents hazards and controls through job plans for non-routine, higher hazard work activities, and through procedures and WCPs for routine work activities. Job plans typically provide an adequate mechanism for identifying, analyzing, and documenting hazards, although there was one exception observed by the OA team. Neither the lead nor the silica hazard for the Vac-U-Blasting of lead paint in the Area 317 deep vault job had been characterized based on monitoring results, although controls to mitigate the hazard had been implemented. In several work observations of routine work activities, a number of hazards were not recognized, sufficiently analyzed, or documented in the job plan, WCP, or the work procedure. For example, the inspection team observed a routine work activity in Building 306 to size reduce HEPA filters that were potentially contaminated with lead and radioactive material. Although the work was well defined in a procedure, the lead hazard was not identified in either the procedure or the accompanying WCP or RWP. Subsequently, the hazard was not analyzed by the ANL industrial hygiene organization to ensure that the controls prescribed for radiological hazards were also sufficient for the lead hazard. In another example, the hazards associated with the size reduction of old drain lines being removed from the A-Wing of Building 202, such as mercury and lead contamination, were not identified in the WCP, and there was no associated WMO procedure for this work activity. WMO management stopped both of these work activities pending a review of the job hazards and controls, and pending development of adequate work documents.

The process for identifying and analyzing legacy hazards in buildings that are being refurbished, decontaminated, or dismantled does not systematically consider chemical and biological hazards. Prior to refurbishing, decontaminating, or dismantling ANL buildings or office spaces, a pre-use inspection is performed by a team that typically consists of the WMO planner, building manager, job foreman, and selected subject matter experts (e.g., industrial hygiene and safety). Interviews of former workers who have knowledge of past work and hazards may also be considered. Results of the use history and legacy hazards are documented on a radiological use history form, although this is not the intended use of that form as described in the ANL ES&H Manual. Documented use history, however, is only for radiological hazards. For example, the aforementioned process was applied to identifying and documenting the pre-use history before refurbishing the A-Wing of Building 202, which housed former chemistry and biological laboratories. Completed use history forms indicate only that radiological hazards were identified. The response in one use history form was "storage of biological material and chemicals only—no radioisotopes." Legacy chemical hazards were not identified, nor were such potential hazards considered when planning the refurbishment work. For this work activity, the industrial hygiene technician recalled from his former work in the building that some mercury might have been spilled. His sampling for mercury identified mercury contamination in one of the pipes that was to be size reduced, and the pipe was isolated and removed. However, had a different industrial hygienist been assigned to the job, there is no assurance that the mercury hazard would have been identified, since the pre-use process does not sufficiently address chemical or biological hazards. In addition, the work package for this activity did not address the mercury hazards informally identified by the industrial hygienist. In another example, the OA team observed a WMO laboratory support crew size reducing scrap metal pipes in Building 206 that were suspected to have been only radiologically contaminated. Some of the scrap pipes, however, had also been contaminated with sodium. Although the building manager believed he had segregated all the sodium contaminated pipes prior to the WMO size reduction, the absence of sodium was not verified, and the potential for additional sodium contamination was not analyzed by industrial hygiene or communicated to the work crew.

As part of an effective radiation protection program, comprehensive radiological surveys and sampling are essential to identifying and analyzing radiological hazards. At ANL, some types of radiological surveys and air sampling are not being performed consistent with DOE regulatory requirements and expectations. Exposure rate measurements are taken as necessary to characterize X-ray and gamma radiation fields. However, neutron surveys have not routinely been conducted in some areas where neutron exposures are possible. Neutron surveys conducted in Building 331 at the request of the OA team revealed the presence of several drums containing neutron generating sources, with neutron exposure rates over 100 mrem/hr on contact and in the tens of mrem for general area neutron exposure. Other drums of transuranic waste were also potential sources of lower levels of neutron exposures. With the lack of proper accounting for the neutron exposures, the actual exposure rate and hazards are underestimated and/or incompletely characterized, and thus the prescribed controls may not be adequate. Some RWPs in WMO require neutron dosimetry but do not specify the need for neutron surveys or neutron control limits.

Respiratory protection is used extensively in some operations, particularly in WMO. However, areas in which respiratory protection is in use are not posted as airborne radioactivity areas, and specific air sampling is not conducted to determine the actual airborne concentration to determine whether posting is required. While it is reasonable to control an area as an airborne radioactivity area in anticipation of potential concentrations, airborne radioactivity area signs are required to be erected to advise of the airborne hazard, if concentrations exceed regulatory thresholds. In addition, air sampling must be conducted to determine the actual concentration and to document compliance with posting requirements, before allowing personnel without respiratory protection back into the area. RWPs for work involving respiratory protection did not require the collection of air samples at the required sensitivity (below the 10 CFR 835 12 derived air concentration [DAC]-hour exposure limit, which is equivalent to 0.3 DAC) as needed to demonstrate posting requirements during the work and before allowing unprotected individuals into the area after the work was complete.

Some surveys were not conducted and documented in an appropriate, technically defensible manner. For example, one RWP associated with the construction of a railing in Building 315 required fixed contamination surveys to be performed to confirm the absence of fixed contamination before drilling into the concrete. However, the health physics (HP) technician did not record any numerical readings or have specific information as to the threshold level of radioactivity for determining whether a surface is considered contaminated. The decision as to whether the surface is contaminated was based on an obvious audible increase in the count over background, but was not quantified. As such, it cannot be established from the documented survey data whether the surface may have been contaminated at low levels. While the ANL ES&H Manual reflects appropriate quantitative statistical analysis requirements associated with fixed contamination surveys, no procedure exists to outline expectations for how these surveys are to be conducted and documented in the field. HP Procedure (HPP) 116 requires the recording of quantitative measurements for release of materials from radiological control. However, it is not clear whether this procedure was applicable to fixed contamination surveys of areas.

Finding #8: Radiological surveys and sampling are not always performed as required to characterize all radiation hazards, and some types of surveys are not being conducted in an appropriate and technically defensible manner.

Summary. ANL processes for analyzing work and identifying hazards are effective for the conduct of experiments by CMT and ET. However, for most non-experimental work, the hazard analysis processes are fragmented and are not adequately defined (see Finding #11). As a result, hazards associated with work activities were not identified or were not communicated to workers. The safety analyses and USQ processes also have some deficiencies related to analysis of hazards. This core function needs improvement, with emphasis on developing a systematic process for identifying and characterizing hazards for non-experimental work, analyzing legacy hazards, ensuring adequate radiation protection surveys and postings, and ensuring adequate USQs and safety analysis.

E.2.3 Core Function #3 - Develop and Implement Hazard Controls

Safety standards and requirements are identified and agreed upon, controls to prevent/mitigate hazards are identified, the safety envelope is established, and controls are implemented.

The experiment safety review process in conjunction with the strong interest and involvement in safety demonstrated by the managers, experimenters, technicians, and safety officers has resulted in effective mitigative and preventive controls for performance of experiments. For example, experiments performed in the ET steam generator tube leak/burst high-pressure tester in Building 212 incorporated multiple layers of protection from the high-pressure hazards, including physical barriers, area access control, and procedural controls. Some controls, such as locking out energy sources for equipment not in use, were a result of comments from the experiment safety review committee during walkdowns of the experimental apparatus. The attention to detail demonstrated by the experiment safety review committee was evident. In another example, experimenters researching the characteristics of irradiated commercial nuclear fuel cladding in the Building 212 Irradiated Materials Laboratory ran multiple dry runs of a procedure with unirradiated material to ensure that the procedure was effective, the HP coverage and RWP were appropriate, and the personal protective equipment (PPE) was appropriate for the job.

For PFS activities, controls identified in the ANL ES&H Manual generally provide an adequate description of requirements, roles, responsibilities, and procedures for implementing requirements. For example, ES&H procedures on water pollution control, beryllium, and asbestos are technically adequate, understandable, and sufficiently define essential ES&H roles and responsibilities.

WMO procedures, as described in the waste management conduct of operations manual, WMO procedure manual, and waste handling procedures manual, are thorough, well structured, and generally provide adequate descriptions of controls. Most WMO routine activities are controlled through the standard operating procedures and are referenced on the WCP where applicable. For example, WMO operating procedures for waste solidification, waste sorting operations, and waste pickup included the appropriate technical references and requirements. In some cases, WMO has also supplemented the ANL ES&H Manual requirements by developing additional procedures for hazards and controls unique to their activities. For example, WMO developed a procedure for occupational heat stress control to address the frequent requirement for waste mechanics to wear vapor barrier-type coveralls plus full-face respirators to protect against radioactive contamination while performing work. As an engineering control, WMO recently installed a central air conditioning system in the Building 306 shop area to help minimize the waste sorting crew's heat stress concerns.

WCPs prepared for routine waste pickups are effectively used by the WMO foreman to ensure that hazard controls are communicated to workers. If the WCP identifies the pickup as radioactive or mixed waste, a RWP is also prepared and included with the WCP. The WCP was also used to specify pre-job briefing or additional PPE requirements. The WCP was approved by appropriate personnel, such as the foreman, health physicist, and building manager, and signed by the waste pickup crews to make sure the crews understood the task and believed that the task was safe to undertake. The foreman also conducted a morning crew briefing and plan-of-the-day meeting to ensure that the crews fully understood the tasks, to answer any questions, and to identify any special safety requirements needed to be addressed before commencing the job.

The CMT HP instrumentation group has an appropriate system and technical basis for calibration and design of instruments used at the site. The instrumentation group maintains formal database records of all radiological survey and sampling equipment used at ANL. Equipment information, users, calibration due dates, and status are tracked and managed through an electronic database. ANL has implemented a number of proactive and innovative techniques in the area of hand and foot monitoring, air sample heads, and portable HP instrumentation. For example, fixed air sample heads with visual flow readouts are manufactured to a consistent standard in-house, and a performance testing record is maintained. Several types of hand and foot monitors have been designed and manufactured to meet ANL needs using commercially available gas flow detectors and metalworking capabilities on site. These systems have been designed to meet DOE radiological requirements, and detailed records supporting the design criteria are maintained.

In some cases, controls for identified special hazards were extensive. For example, in the lead base paint removal at the Area 317 deep vaults, a number of specific controls were identified for special hazards. Those controls were summarized in the job plan and pre-job planning form and were detailed in JSA documents. Several controls existed for the lead base paint removal job:crane operators had to meet qualifications; all four outriggers were required to be fully extended and blocked on the crane during lifting operations; a confined space permit was issued for two of the vaults before entering to remove the manlift and ladder; and the job plan required workers in or near the vault opening to wear Tyveks® clothing and a full-face HEPA respirator, and to be hooked to the fall restraint system. All these controls were implemented at the job site.

For PFS maintenance work activities, the process for identifying, tailoring, and linking controls to work activities, as required by DOE Policy 450.4, is fragmented and insufficiently documented. Furthermore, in some cases, it is not clear how the information obtained in the hazard analysis process is used to define the requirements for each phase or discrete step of the planned work. For example, corrective maintenance work requests for repairing hood controls in Building 205 and replacing outside lamps on Building 306 identify a number of hazard controls, such as lockout/tagout, specific work gloves, and the use of material safety data sheets, but fail to document the hazards the controls are intended to mitigate. In general, preventive, recurring, and corrective maintenance work requests generated through SIMS, and task evaluations prepared for routine work by Maintenance, either fail to identify all the required controls, or specify generic controls that may not apply to the work activity. For example, the removal of cables, wires, and grounding clamps from pipes in the 200 Area Building most likely involved some job- or work environment-related hazards (elevated heights, pinch or ergonomic hazards), but no hazards or controls are identified. In addition, for PFS maintenance work, there is no process or lower level procedures (such as a work control procedure) for linking controls specified in the ANL ES&H Manual to work activities and work documents. As a result, some administrative, PPE, and work planning control requirements identified in sections of the ANL ES&H Manual are not adequately incorporated into the planning and conduct of maintenance work activities.

Hazard controls for some WMO work activities are not adequately identified in WMO work documents. For example, the required PPE for hazards associated with size reduction and waste packaging of scrap material in Building 206 was not specified in the work documents. In another example, the WMO procedure for sorting low-level waste in Building 306, Room A-160, does not include a control to ensure that the room is under negative pressure and that the sorting hood ventilation is adequate before performing work. There is a Magnahelic gauge outside the room entrance, and the sorting hood has a direct-reading velometer that could be used to achieve this control; however, neither of these instruments was discussed in the waste sorting procedure. In a third example, hearing protection was not identified on a Building 310 retention tank facility cleanup WCP, although project managers indicated that the scabbler noise level exceeded threshold limit values. Some moderate- to high-risk WMO work documents are not reviewed by either the building manager/administrator or industrial hygiene or safety, because thresholds for involving these functions are not clearly identified in WMO procedures. For example, the Building 202 building manager did not review the WCP for size reduction of piping during the refurbishing of laboratories in the A-Wing of Building 202. Industrial hygiene did not review the WCP for size reduction of lead contaminated filters in Building 306 to ensure that the appropriate controls for the lead hazard were identified. Similarly, neither industrial safety nor industrial hygiene reviewed the WCP for size reduction and packaging of scrap metal and piping in Building 206 (former sodium research facility), although it was reviewed by the building manager.

In some cases, hazard controls are not adequately specified in either the ANL ES&H Manual or WMO work documents. For example, although there are extensive Occupational Safety and Health Administration (OSHA) requirements for the control of lead in the workplace, WMO line managers do not have requirement or guidance documents for implementing the OSHA lead standard, either through the ANL ES&H Manual or through WMO procedures. As a result, the appropriate controls for work involving lead are inadequate for some work tasks and do not meet ANL management and ES&H expectations. Lead controls that are not discussed in work documents include training, medical surveillance, industrial hygiene monitoring and sampling, respiratory protection, clothing requirements, and contamination control. For example, none of the controls for lead exposure were in the work documents for size reduction of lead contaminated filters in Building 306, although several of the controls appear to have been implemented as a result of the job hazard questionnaire process. ANL has required a lead exposure plan for ANL subcontractors, but does not have comparable requirements for work performed by ANL employees.

In several cases, the failure to adequately identify, analyze, or communicate hazards for PFS maintenance and WMO work activities resulted in hazard controls not being identified in work documents. For example, since the potential beryllium hazard for maintenance work being performed in Building 315 had not been identified or accurately communicated, consideration was not given to isolating or decontaminating beryllium contaminated areas within the work zone. Furthermore, without the recognition of the potential beryllium hazard, the identification and assessment of other controls, such as beryllium training for workers, pre-job reviews, and industrial hygiene monitoring of the work activity, were missed. For the Building 202 laboratory refurbishment being conducted by WMO, the failure to identify the potential mercury hazard would have resulted in workers without proper respiratory protection if the mercury-contaminated pipe been size reduced. For size reduction of contaminated filters in Building 306, because the lead hazard was not identified in work documents, controls for air and surface sampling for lead by industrial hygiene and controls for the cleaning and use of respirators were not specified.

For radiological work, RWPs were not always clear, sufficiently detailed, and tailored to the work being performed to ensure that the necessary controls are reliably and rigorously identified and implemented. The scope and span of control for some RWPs are too broad to consistently determine specific requirements and ascertain radiological conditions to be expected on discrete job evolutions. For example, one RWP is for size reduction of contaminated equipment. Because it is considered routine work, the RWP was prepared in advance without knowledge of the specific equipment. Consequently, actual radiological conditions are not known or evaluated on a case-by-case basis, and the anticipated radiological conditions shown on the RWP are based on a wide range of possible conditions that could be encountered. Also, some hazards that may be important from a radiological perspective (such as puncture hazards) cannot be identified in advance. Similarly, in the irradiated materials facility, the RWP that was used provided no data to the worker for area contamination levels and referenced posted facility survey maps; however, these maps only provide dose rate information. Specific isotopes of concern were generally not identified on RWPs.

In some cases, the RWP scope was sufficiently narrow, but the anticipated radiological conditions were still not well defined. The RWP for the Building 202 laboratory refurbishment project provided no information as to expected radiological conditions inside piping to be size reduced, even though access to the interior for survey or sampling was available before working the job. The RWP for the K116 C-Cell did not provide accurate information as to specific radiological conditions in the area. The RWP information did not include the potential presence of transuranic contamination and did not establish a correct estimate for potential alpha contamination. The RWP version used in the pre-job briefing noted the range of removable contamination for alpha as less than 1,000 dpm/100 cm^2, while a revision that was made following OA team questions indicated the range to be up to 250,000 dpm/100 cm^2 alpha.

Controls specified in RWPs often lacked important details needed for successful implementation. For example, the RWP for transuranic waste visual examination in the MOVER requires an operational hand monitor, but no instruction or guidance regarding proper use of the monitor is given in the RWP or at the work site. Proper use of the monitor required a minimum hand residence time of three seconds to achieve the required sensitivity of 500 dpm alpha, which the worker is to recognize by an audible increase in count rate. An alarm indicator is present on the meter but is not used because of difficulty in achieving the necessary sensitivity. No specific information regarding the inoperability of the alarm mode was provided to the workers. An RWP in Building 212 required the use of finger ring dosimetry based on the direct handling of irradiated specimens while placing them into the furnace. The RWP was not specific as to whether rings were needed for both hands. Only one finger ring was issued and no guidance as to proper placement of the finger ring was given. In this case, the technician wore the single ring dosimeter on his right hand, while the sample was in the workers left hand the majority of the time. The RWP used to cover the experiment safety review for the thermal creep test of irradiated light water reactor cladding in the Building 212 irradiated materials laboratory did not clearly convey appropriate information to workers. In this case, the RWP referred workers to radiological survey logbooks for area-specific information and established a hold point for contamination as "greater than 100 times the values listed in the ANL ESH Manual Section 5.17 Table 5.17-1."

Differences between commonly used radiological air sampling techniques are not clearly specified in RWPs or supporting procedures. The RWP does not provide information about the type of air sample needed (high or low volume), its purpose (verify protection factors or posting), or the correct placement of the air sampler in relation to the work being performed. During HEPA filter size reduction activities in Building 306, Room A-160, a job-specific air sample was required and drawn; however, the sample location was not in close proximity to the source of the potential airborne activity, possibly underestimating concentration in the workers breathing zone. Because this control is intended as a retrospective analysis of the effectiveness of respiratory protection, timely analysis of the air samples is important to implementing effective follow-up bioassay actions should air concentrations be determined to have been unexpectedly high. However, in WMO, there is currently a six-month backlog in the analysis and reporting of job-specific air sample results.

Different RWPs with conflicting controls have been used to cover the same work. This situation occurred in Building 306, Room A-160, during HEPA filter size reduction. In this case workers believed they were working under two different RWPs, one for the filter size reduction and one for the filter crushing. However, these two RWPs specify different controls and different operational control limits. Since workers are not required to sign in on a particular RWP prior to each work evolution, it is impossible to determine which RWP they were intending to use to control the work. The ANL ES&H Manual requires a job-specific RWP; however, the RWP form does not specify whether it is general or specific. A similar situation exits in AGHCF, which uses an annual RWP to cover a broad range of activities. RWPs for this type of work, which occurs on a routine basis, are not single use documents but are valid until the end of the calendar year, similar to the ANL ES&H Manual definition of a general RWP. General RWPs are not allowed, according to the ANL ES&H Manual for more hazardous radiological work, such as work in contamination areas, airborne radioactivity areas, and high radiation areas. The practice of allowing workers to sign in for work requiring a job-specific RWP only once, even though multiple work evolutions may occur over the course of a year, is problematic for several reasons. First, the practice greatly limits accountability of the worker to ensure familiarity with all aspects of the task at hand and the specific RWP requirements. Second, it also virtually eliminates the ability to track which RWP a worker was using on a particular day, which may be important for retrospective dose analysis. Third, personnel training qualifications may have changed since the time they originally signed the RWP.

In some cases, specific controls were found to be missing from RWPs. The RWP for work in Building 331 did not include a requirement for neutron dosimetry or neutron surveys in areas where neutron radiation fields were present (see Core Function #2). Another control that is not listed on ANL RWPs is the bioassay requirements necessary to be authorized to work the job. Bioassay requirements were not specified on any RWPs reviewed. Other controls of this type, such as training and external dosimetry requirements, are clearly delineated on RWPs. On one planned job for the K116 C-Cell, the workers from CMT who were supporting workers from PFS were on different bioassay frequencies. The RWP did not state whether the more restrictive transuranic bioassay frequency should have been required. This RWP was also missing a requirement to conduct air sampling inside the cell to verify the effectiveness of respiratory protection factors.

Finding #9: **RWPs are not always clear, sufficiently detailed, and tailored to the work being performed to ensure that necessary controls are reliably and rigorously implemented.**

Bioassay results for 2001 indicate that some unknown intakes of radioactive materials have occurred without the ability to ascertain cause or corrective action. Additional rigor and detail associated with the RWP process at ANL is needed to provide greater accountability for performance and to ensure that radiological hazards and controls are effective for all work being conducted.

ANL does not have a complete set of HP implementing procedures to implement the requirements of the ANL ES&H Manual. Such implementing procedures are necessary to ensure consistent understanding of expectations and implementation of requirements. There is a partial set of radiation protection procedures that was under development two years ago; however, these procedures have not been fully developed or maintained to support all assigned tasks of health physicists and HP technicians. There is no clear institutional owner who has responsibility and authority for issuance, control, and training on radiation protection implementing procedures. Procedures are required by regulation and are needed to ensure consistent application of requirements in many areas, including such activities as air sampling, radiological posting, documenting radiological surveys, RWP preparation, determining the need for special bioassays, and similar duties that are required by the ANL ES&H Manual. Some existing procedures are inaccurate and have not been updated for two years or more. For example, the current HP procedure for response to unexpected radiological conditions (HPP-120) references collecting urine samples according to HPP-129, which no longer exists. Urine sampling alone would not be the appropriate immediate follow-up bioassay choice for a 40 or more DAC-hr continuous air monitor (CAM) alarm response to plutonium transient in areas that require CAM coverage.

The AGHCF safety analysis report derivation of a TSR surveillance requirement resulted in a non-conservative value for the minimum pressure of the fire protection system. Consequently, the TSR surveillance requirement does not verify that the pressure in the fire protection system is sufficient to meet its design specifications. The TSR surveillance requirement requires quarterly verification that the fire protection system header pressure is in the range of 40-100 pounds per square inch gauge (psig). Actual required minimum pressure for the system to meet its design performance has not been analyzed and is probably substantially higher. Therefore, the lower pressure limit in the TSR surveillance requirement was non-conservative. In response to this observation, the facility manager issued an off-normal occurrence report (see Appendix D for discussion of improper categorization of the event), initiated application of the USQ process, initiated preparation of an interim administrative control redefining the minimum acceptable header pressure, and initiated a justification for continued operation.

The AGHCF does not have adequate implementing procedures to ensure that TSR surveillance requirements are consistently performed and documented in a manner commensurate with their importance to safety. Procedures for implementation of TSR surveillance requirements are non-existent or are generally inadequate to ensure that the surveillance requirements are met. Inadequacies include the absence of a stated purpose, precautions, prerequisites, acceptance criteria, identification of required equipment, identification of the applicable TSR, identification of references, individual step sign-offs, provisions to record data and observations, review and approval sign-offs of the blank procedures, and review and approval sign-offs of the completed procedures. (See discussion of failures to effectively implement TSR requirements under Core Function #4 for additional information related to the finding below.)

Finding #10: **TSRs for the AGHCF have not been adequately implemented in a manner that ensures that the DOE-approved safety envelope is verified and maintained.**

Summary. ANL processes for establishing hazard controls are effective for the conduct of experiments by CMT and ET. In some cases of non-experimental work, special hazards were recognized, and controls were generally implemented to safely perform work. For some operations, such as waste pickup, handling, sorting, and disposal, effective procedures identify and implement controls. However, for most non-experimental work, the hazard control processes are not systematic and effective (see Finding #11). As a result, work activities were performed without adequate controls in a number of cases, and there were situations where workers could have been exposed to radiological or non-radiological hazards. The procedures and associated controls currently in place at the AGHCF are not sufficient to ensure that the TSRs are fully and effectively implemented. This core function is a significant weakness that requires timely management attention. Particular attention is needed to address systemic weaknesses in radiological and TSR controls and to develop and implement systematic PFS and WMO processes for establishing hazard controls and communicating them to workers.

E.2.4 Core Function #4 - Perform Work Within Controls

Readiness is confirmed and work is performed safely.

Most experimental work observed by the OA team was conducted in accordance with controls identified in the experiment safety reviews. Experimenters and technicians demonstrated a high level of attention to detail during performance of operating procedures, and use of physical and administrative barriers was in accordance with requirements. For example, during an operation involving a high intensity laser, the experimenter followed all steps of the laser operating procedure, and adhered to administrative requirements to change laboratory postings each time the operating status of the laser changed. In another example, the experimenter and technician for a high-pressure experiment in the ET steam generator tube leak/burst high-pressure tester rigorously followed requirements for use of face guards, established required exclusion areas during the test, posted someone at the emergency shutdown button during equipment starts, and appropriately controlled the power sources to the equipment.

PFS workers and line managers are trained and experienced within assigned areas of responsibilities and are not hesitant to stop work in the event of a potential safety concern. Most PFS workers have been working at ANL and within the PFS organization for many years. As a result, workers are generally familiar with work activities and hazards in the work place. For most work observed by the OA team, worker training was current and consistent with the hazards to which they were exposed. In several instances where potential concerns were identified by the OA team, PFS line managers stopped work until the hazards were adequately analyzed and the appropriate controls were implemented.

Waste pickup operations by the WMO operations group were conducted in accordance with the waste handling procedures. The crews used the appropriate procedures and PPE, as specified in the WCP and RWP, conducted appropriate radiological surveys as required, and maintained waste segregation to ensure that the waste was properly and safely transported and stored.

TSR surveillance requirements are not being performed within the required intervals. The TSRs require that surveillances be performed within the specified interval, with a maximum extension of 25 percent. The OA team identified several examples of required surveillance actions where the actual interval had exceeded the specified interval plus the allowable extension. These included automatic startup of the standby power supply (2 instances), automatic start of the emergency-powered ventilation fan (2 instances), calibration of hot cell and glovebox pressure sensors, testing the aqueous zinc bromide shielding solution in the hot cell windows, testing the annunciator panel lights, and dose rate measurement of the hot cell exhaust system HEPA filter. For TSRs that have only been in effect for five months (implemented in January 2002), the multiple instances of missed deadlines over such a relatively short time indicate a significant implementation problem. In response to this observation, the facility manager issued an Unusual Occurrence Report, placed the facility in the limited-operation mode, initiated a plan for prompt completion of the incomplete surveillances, and initiated a plan for improvement or addition of administrative controls to ensure future on-time performance.

During the assessment, the OA team observed one TSR surveillance performed at the AGHCF (calibration of the oxygen analyzers for hot cell areas 1, 3, and 6). Several areas of procedural non-compliance or poor practice were observed: procedural requirements were not accomplished; as-found/as-left data was not recorded; recurrent equipment deficiencies were not noted and corrected; ambiguous procedural direction was not clarified before proceeding; and anomalous indications were not investigated.

In a few cases, experimenters failed to follow requirements contained in procedures or experiment safety review documents. In one example, the hazards assessment for loss of the inert atmosphere in the J-118 electrorefining glovebox states that "Electrorefined uranium will be kept in an inert-atmosphere container or process equipment as much as possible when not actually in the electrorefiner." Kilogram quantities of electrorefined uranium were in the argon-inerted glovebox on temporary display, and out of any type of container. Following notification of this observation, the principal investigator returned the exposed material to the appropriate containers. Another example was a CMT experimenter introducing a hazard (flammable fuel) to the experiment apparatus and running the experiment apparatus before obtaining approval of the experiment safety review committee. The investigation of this event by CMT management resulted in declaring an off-normal occurrence.

There is no documented procedure that explains how maintenance work is controlled and authorized in accordance with the requirements of DOE Policy 450.4. DOE Policy 450.4 requires, and the safety management system guides clarify, that safety management systems have a process to confirm adequate preparation before performing work at the activity level. Furthermore, the DOE guides indicate that the formality and rigor of the review process and the extent of the documentation and level of authority for agreement to commence work should be based on the hazard and complexity of the work being performed. Although there are expectations of how PFS maintenance work is to be authorized, controlled, and restarted in the event of a work stoppage, these expectations are insufficiently documented in the ANL ISM system description, the PFS supervisor's manual, and other PFS procedures and manuals. Furthermore, the PFS maintenance process does not assign levels of work authorization based on the nature of the hazard, the risk to workers, or the complexity of the task. There are no systematic work planning meetings (e.g., plan of the day or plan of the week) for scheduling and authorizing work. Maintenance work activities are scheduled informally through the individual job foreman, and are often authorized solely at the discretion of the job foreman, which may be acceptable for most routine, low-hazard work activities, but not for higher risk work. Building managers are actively involved in the work authorization process for many work activities; however, the thresholds and processes for involving building managers in work authorization are not defined. Similarly, there are no thresholds for involving or requiring ES&H review or approval of work, based on risk, before beginning work.

In some cases, controls identified in PFS maintenance and WMO work documents were not implemented during the performance of work, as required by the work documents or postings. Typically, because controls for routine maintenance tasks are generic, some controls were not implemented as written. For example, the hazard control for paint fumes identified for wall painting work activity in Building 201 required workers to follow the material safety data sheet instructions for proper ventilation and respiratory protection. The material safety data sheet for the powder joint compound required a National Institute of Occupational Safety and Health (NIOSH)-approved dust respirator, which was not used by the painters. For maintenance work to construct a railing in Building 315, beryllium door postings, including the posting of recent survey results, and beryllium danger tags posted in the work zone were not observed, followed, or understood. For low-level radioactive waste sorting and compacting performed by WMO workers in Building 306, several controls were not adequately implemented. For example, two of the four workers were not wearing the required hearing protection, and the pre-use field calibration of the organic vapor analyzer that was used to sample the waste container vapor space had not been documented for the past seven months.

ANL line managers stopped work on several occasions during this OA inspection because the hazard controls were either inadequate or indeterminate, based on an insufficient hazard identification and analysis. PFS maintenance work to construct a railing in Building 315 was stopped because of the uncertainty of the magnitude and location of the beryllium hazard in the work area and thus the inability to ensure that the specified controls were adequate. Subsequent information determined that the controls were not adequate, and workers' clothing was potentially contaminated. In a second work stoppage event, WMO line management stopped size reduction of pipe in Building 202 because the hazard controls for all steps of the work activity were not adequately defined and therefore implementation of the controls appropriate for all the hazards could not be ensured. In a third work stoppage, radiological and lead controls associated with lead contaminated filter size reduction in Building 306 were either not specified or were conflicting and confusing. In none of these cases were workers initially aware of unique or special hazards to which they might be exposed. In addition, workers were unaware of necessary controls to avoid or minimize their exposure. Therefore, WMO management stopped work to avoid controls being missed or improperly implemented.

Summary. In most cases, work activities were performed in accordance with established controls, and workers demonstrated rigor in implementing the controls. However, there were a number of instances where work controls were not adequately understood or implemented as required. In cases where problems were identified, the failure to adequately identify and implement controls (see Core Function #3) contributed to inconsistent implementation or failure to strictly follow the controls (see Finding #11). TSR surveillance requirements are not being implemented on time or effectively, and there were several instances where work was stopped to address worker safety concerns. This core function needs improvement, with emphasis on TSR compliance, clarity of controls, and adherence to controls in both experimental and non-experimental work activities.

E.3 CONCLUSIONS

ANL has clearly committed to implementing ISM and has effectively implemented most aspects of the ISM core functions for the conduct of experimental work. ANL clearly recognized that experimental work was a significant source of potential safety problems and implemented a sitewide process to ensure adequate reviews.

However, significant process deficiencies in the ISM core functions for other types of work contribute to situations where worker hazards are not adequately controlled and potentially place workers at undue risk. Most of the problems can be traced to the lack of a systematic approach to work control for maintenance and maintenance-like activities. For nearly all work, other than WMO and experiment safety reviews, managers relied on individual expertise and knowledge as the primary source of hazard information and analysis. Identification and implementation of controls was dependent on individuals' knowledge of the hazards at a site, rather than documented work location surveys and walkdowns. The informal approach to maintenance and maintenance-like activities, while probably adequate for low-hazard, routine work, does not ensure adequate controls for more complicated, more hazardous, or non-routine work. The ANL ES&H Manual contains many specific requirements for specialized hazards that, when implemented correctly in conjunction with a systematic work control process, provide adequate controls to protect workers' health and safety. None of the directorates, divisions, or departments reviewed had implemented specific work control processes (other than experiment safety reviews) that would drive planners, supervisors, managers, and workers to ensure that sitewide requirements were implemented when necessary.

Finding #11: For non-experimental work, ANL has not implemented systematic mechanisms that define how the core safety management functions are performed to ensure that hazards are adequately identified and appropriately characterized and analyzed, and to ensure that tailored controls are implemented in accordance with DOE Policy 450.4, *Safety Management System Policy*.

E.4 RATING

The ratings of the core functions and environmental management program reflect the status of the reviewed elements of the ISM programs at the selected ANL facilities and organizations.

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

E.5 OPPORTUNITIES FOR IMPROVEMENT

This OA review identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive. Rather, they are intended to be reviewed and evaluated by the responsible DOE and ANL line management and prioritized and modified as appropriate, in accordance with site-specific programmatic objectives.

ANL

1. **Develop and implement an institutional process and procedures for work planning and control for non-experimental work.**

   - Include clearly defined categories for routine, low-, moderate-, and high-hazard activities.
   - Establish graduated planning, review, and approval requirements for each category of work.
   - Establish clear requirements to document and characterize all hazards at a work site and ensure that controls are tailored to the specific work requirements.
   - Establish procedures for pre- and post-job reviews, and pre-job walkdowns.
   - Establish thresholds for the involvement of subject matter experts in work planning and work authorization.
   - Provide clear definitions for skill of the craft and modification work.
   - Establish procedures to conduct and review JHAs and task evaluations.
   - Implement mechanisms that clearly define and document the hazard controls applicable to each job so that workers are fully aware of the requirements to perform work.
   - Ensure that workers and supervisors are encouraged to participate in the work planning process so that their knowledge and experience are supplemented by appropriate reviews and approvals.

2. **Assign responsibility and complete development of a comprehensive set of ANL HP implementing procedures for health physicists and HP technicians to ensure consistent implementation of duties in accordance with the expectations of the ANL ES&H Manual.**

   - Issue a policy or directive on the ownership, development, approval, issuance and maintenance of HP procedures.
   - Develop or reestablish HP procedures for such activities as air sampling, posting, radiological surveys, record keeping, RWP preparation, determining the need for special bioassays, and other such activities in which consistent implementation of requirements is necessary for technical defensibility of program activities and accountability.
   - Develop and provide for ongoing training on required procedures.

3. **Increase emphasis on radiation protection mentoring activities and information sharing with other DOE sites around the complex.**

   - Encourage division HP personnel to visit other 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. **Increase emphasis on creating sufficiently specific RWPs, with more attention to detail in hazard identification and ensuring that the controls and radiological information provided are specifically tailored to individual tasks and job locations.**

   - Subdivide broad-scope RWPs into two or more discrete RWPs, with more narrow and realistic numerical ranges on expected radiological conditions and suspension limits, ideally based on actual survey data or anticipated conditions. Attach actual survey results to RWP where possible.
   - 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.

- Institute a requirement for workers to review and acknowledge understanding of the RWP they are working under and its specific requirements by signing in on RWPs for each discrete job evolution being performed.

5. Review the AGHCF TSRs to ensure that all established limits have a firm engineering basis, and that appropriate procedures are implemented to ensure that the intent of the TSR is met.

- Verify that each specified limit accounts for system performance, as well as design factors and instrument errors.
- Verify for existing TSR implementing procedures that all requirements of the TSR are performed.
- Develop new procedures for any surveillance requirements not already covered by procedures.
- Implement a TSR tracking system that ensures that surveillance requirements are completed when required.

6. Revise the existing USQ process to ensure that all changes are evaluated and documented per 10 CFR 830.

- Simplify the USQ screening process such that screenings can be performed easily by trained personnel.
- Revise the screening questions such that all nuclear facility modifications receive documented safety evaluations before installation of the modification.
- Implement a systematic review process that includes regular management review of all USQ screens to ensure that safety evaluations and USQ determinations are performed when required.

This page intentionally left blank.