

# Summary Report

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Inspection of  
Environment, Safety, and Health  
and Emergency Management  
at the

# Argonne National Laboratory - East



May 2002

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

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## Abbreviations Used in This Report

|       |   |
|-------|---|
| AAO   | Argonne Area Office                                       |
| AGHCF | Alpha Gamma Hot Cell Facility                             |
| ANL   | Argonne National Laboratory                               |
| CEMP  | Comprehensive Emergency Management Plan                   |
| CFR   | Code of Federal Regulations                               |
| CH    | Chicago Operations Office                                 |
| CMT   | Chemical Technology Division                              |
| DOE   | U.S. Department of Energy                                 |
| EQO   | Office of ES&H/Quality Assurance Oversight                |
| ERC   | Emergency Response Center                                 |
| ERO   | Emergency Response Organization                           |
| ES&H  | Environment, Safety, and Health                           |
| ET    | Energy Technology Division                                |
| FR    | Facility Representative                                   |
| IC    | Incident Commander  |
| ISM   | Integrated Safety Management                              |
| OA    | Office of Independent Oversight and Performance Assurance |
| PFS   | Plant Facilities and Services Division                    |
| QA    | Quality Assurance   |
| RWP   | Radiation Work Permit                                     |
| SC    | DOE Office of Science                                     |
| TSR   | Technical Safety Requirements                             |
| UC    | University of Chicago                                     |
| USQ   | Unreviewed Safety Question                                |

# OVERSIGHT

## 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 Department of Energy's (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.

### Background

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, safety, and emergency management programs at the site. Line management responsibility for the operation of ANL falls under the Chicago Operations Office (CH), which has delegated most responsibilities, including contract management and line management oversight of contractor performance, to its subordinate Argonne Area Office (AAO). ANL is managed and operated by the University of Chicago (UC) under contract to DOE.

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 and emergency management 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-assessments. 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.



Aerial View of the ANL Site

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.

## ES&H Review Scope and Overview

The ES&H portion of this inspection evaluated the effectiveness of selected aspects of the 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: (1) implementation of the guiding principles of ISM by CH/AAO and ANL, (2) CH/AAO and ANL feedback and continuous improvement systems, and (3) implementation of the core functions of safety management for various work activities.

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 and Facility Services Division (PFS), the Chemical Technology Division (CMT), and the Energy Technology Division (ET).

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 basic research 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, and waste management. 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. OA examined selected work activities in both of these categories.

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, operations at the Alpha Gamma Hot Cell Facility (AGHCF), including implementation of nuclear safety requirements, and radiation protection. 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.



Hot Cell at the AGHCF

## Emergency Management Program Review Scope and Overview

OA evaluated the site-level emergency management program, which is managed and administered by the ANL Office of ES&H/Quality Assurance Oversight (EQO), and elements of building emergency preparedness programs. As part of this inspection, the OA team conducted tabletop performance tests with a sample of the site’s key decision-makers, which include incident commanders (ICs), emergency response center (ERC) managers, and area office managers, to evaluate their ability to employ available tools and training in responding to postulated emergency conditions.

In June 2001, the site conducted an emergency exercise and identified numerous programmatic weaknesses in the emergency management program. ANL management recognized that additional resources and management attention were needed to improve performance in this program. Self-assessments were then conducted in January 2002 that identified weaknesses in all emergency management elements evaluated. In February 2002, the ANL Chief Operations

Officer reassigned the responsibility for the emergency management program from PFS to EQO, a direct report to the Laboratory Director's Office. This organization change provided greater management access and visibility as well as increased resources to support program improvements. Additionally, a new individual was assigned as the Emergency Management Officer with overall responsibility for the program. With these changes came a new focus toward strengthening and integrating the sitewide capabilities for responding to operational emergencies. Until this time the role of the emergency operations center (now the emergency response center) was primarily limited to supporting the on-scene efforts of the incident commander.

As discussed in this report, the emergency management program is in a state of transition resulting from the recent organizational, personnel, and programmatic changes. ANL has developed hazards assessments that generally serve as a good foundation for the emergency management program for the events that have been analyzed, and in most cases the ICs and the ERC team appropriately considered protective actions and took actions to mitigate the postulated event. However, the hazards assessment does not always analyze the maximum potential quantities of hazardous materials allowed by authorization basis documents and does not analyze the full spectrum of accidents. Plans and procedures do not provide for consistent and preauthorized actions necessary to protect onsite personnel and to notify DOE and offsite agencies in the event of an operational emergency, such as a hazardous material release. Roles and responsibilities are not clearly established for important, time-urgent functions, such as emergency categorization and classification. Additionally, there are no systematic training, drill, or exercise programs to establish and verify the integrated response capabilities of emergency response personnel and organizations. The absence of clear, consistent procedures, combined with training

weaknesses, decreases the ability of the emergency response organization (ERO) to mount an effective response to the more severe events analyzed in the hazards assessment. Tabletop performance tests of the ERO demonstrated a lack of proficiency in making some critical decisions, such as event categorization and classification. Although the worst-case event analyzed for ANL does not result in hazardous material releases off site, onsite consequences could involve significant risks to onsite personnel and the emergency management program needs to be able to respond to these events effectively. Finally, an ongoing self-assessment process has not been established to ensure continuous improvement in the emergency management program. In order for the ANL emergency management program to meet DOE requirements, sustained management attention is warranted.

## Organization of Report

Section 2 of this report provides an overall discussion of the results of the review of the ANL ES&H and emergency management program elements that were evaluated. Section 3 provides OA's conclusions regarding the overall effectiveness of CH/AAO and ANL's management of the ES&H and emergency management 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 findings that require corrective actions and follow-up.

More detailed information on the inspection results is contained in two separate volumes of this report, which were provided to CH/AAO and ANL and which are available to other DOE sites on request. Volume I provides more detailed information on the review of the ANL ISM program, and Volume II provides more detailed information on the review of ANL emergency management programs.

## 2.1 Positive Program Attributes

### ES&H 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 have 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



Equipment at an ANL Laboratory

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 Associate Laboratory Directors 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 of 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 coverage and radiation work permit (RWP) were appropriate, and the personal protective equipment was appropriate for the job.

### **Emergency Management Positive Program Attributes**

The emergency management program at the building level is well conceived and supports effective response to events with localized impact. Specific positive attributes of the ANL emergency management program include the following.

### **ICs demonstrated effective command and control; took appropriate actions to mitigate the event; and with few exceptions took appropriate actions to protect responders and site personnel.**

The front line for protection of site personnel are the first responders who control the event scene, determine initial protective actions, and obtain resources to mitigate the accident. At ANL, the fire department ICs fulfill this duty, and during simulated performance tests, they demonstrated very effective performance. In particular, the ICs demonstrated disciplined communications, safe approach to and access control of the event scene, and effective actions to obtain additional response resources (i.e., mutual aid and activation of the ERC). Furthermore, the ICs made appropriate shelter-in-place and evacuation decisions for buildings potentially impacted by the postulated events. Weaknesses were identified in event categorization and classification and in notification. Given that ANL does not have any analyzed hazardous material events that would require development of prompt offsite protective action recommendations, these weaknesses do not significantly detract from the ICs' effective performance in their highest priority actions to protect site workers, visitors, and emergency responders.

**The building emergency plans serve as a useful resource for the IC, the area emergency supervisor, and building occupants.** ANL has developed emergency plans for each occupied building. Each building emergency plan provides layouts and maps of the building, construction details, emergency response actions for the building's area emergency supervisor and occupants, and types and locations of hazardous materials.

### **ANL has provided emergency response personnel with the facilities and equipment needed to effectively implement emergency plans.**

Several systems are effectively employed and maintained at ANL to notify the ERC cadre, employees, and the public of an emergency. These include telephones, radios, pagers, public address systems, and an outdoor warning system. The fire department is fully equipped to respond to fires, medical emergencies, and hazardous material events. The first-response vehicle is equipped with computerized pre-fire plans developed for all buildings. The fire department also maintains a decontamination trailer that is well equipped and maintained, and that is designed for use in freezing weather.

CH/AAO is actively involved in the recent efforts to strengthen the ANL emergency management program. Activities have included the conduct and evaluation of an emergency exercise (usually functions performed by the contractor), tabletop performance tests, and program element reviews. These efforts have been effective in identifying performance weaknesses and ensuring that corrective actions are initiated.

## 2.2 Program Weaknesses

### ES&H 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



Postings for a Contamination Controlled Area

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 health physics 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 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 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



Postings at an ANL Laboratory

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 through observation of 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.

## Emergency Management Weaknesses

Although the ANL emergency management program provides an effective response capability for localized events, the emergency management program does not have the capability to provide an integrated site-wide response to high consequence operational emergencies, such as those involving significant airborne hazardous material releases. Specific weaknesses include the following.

**The ANL Comprehensive Emergency Management Plan (CEMP) and current procedures do not clearly establish roles and responsibilities or provide adequate direction for emergency responders and decision-makers to accomplish required actions.** Response actions, such as ERC activation, emergency classification, event notification, and dissemination of emergency public information, are not clearly defined by the CEMP, and implementing procedures have yet to be developed. Division of authorities that would support effective coordination between the IC and the ERC manager is not established for such functions as emergency classification, offsite notifications, and onsite protective actions. The processes for emergency response provided in the CEMP are fragmented and, in some cases, contradictory. Additionally, memoranda of understanding referenced in the CEMP plan are not comprehensive in that they do not form the basis for communicating roles and responsibilities, carrying out emergency operations, or providing for treatment and care of patients. Tabletop performance tests confirmed that procedural weaknesses adversely impact event classification and notification, and coordination of response actions between the IC and ERC manager.

**The emergency management training and drill program does not adequately prepare ERO personnel to perform assigned functions.** The site's ERO training and drill program is not being conducted in accordance with the ANL CEMP and the ANL Emergency Management Training Plan. ERO training for both ANL and AAO does not include a formally defined and structured program element that familiarizes the trainee with position-specific tasks and equipment in the job setting, and drill/exercise participation is not required for initially establishing or maintaining position qualifications or for maintaining proficiency.

**ANL has not established an ongoing feedback and improvement program for emergency management that includes annual emergency management assessments.** Two comprehensive

assessments, conducted in 2002 , were effective at identifying weaknesses and providing ANL a baseline for determining the breadth and scope of required program improvements. Corrective actions have been initiated to address the identified weaknesses; however, the corrective actions do not always provide assurance that all weaknesses will be adequately addressed. Additionally, annual assessments of the emergency management program have not been conducted previously, and there are no requirements in ANL procedures or schedules for ensuring that they will be conducted in the future. In addition to being required by DOE Order 151.1A, *Comprehensive Emergency Management System*, an ongoing evaluation of program effectiveness is essential, considering the number and scope of identified weaknesses and the broad program changes that ANL has planned.

### ANL ISM Program

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 by 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 flowdown 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.

## ANL Emergency Management Program

The emergency management program at ANL is currently in the process of transitioning from one that focuses exclusively on mitigation actions at the event scene and protective actions to one that effectively implements and integrates sitewide capabilities in response to operational emergencies, as required by DOE. The need for this expanded focus was identified by an emergency exercise conducted by CH/AAO in June 2001 and two self-assessments conducted by ANL in January 2002. CH/AAO has provided ERO training in the form of tabletop exercises to improve performance and has conducted reviews of program elements to identify additional areas for improvement. Corrective actions to address weaknesses identified during these activities are now in progress. This OA evaluation confirmed the results of the recent CH/AAO evaluations and ANL self-assessments of the emergency management program, and identified additional program elements needing improvement.

Consistent with ANL's previous focus on event scene response actions, this OA evaluation found that, in general, the emergency management program at the building level is well conceived and supports effective but localized response activities. The ANL ICs demonstrated the ability to effectively mitigate postulated events and to protect emergency responders and site personnel. The training, tools (e.g., fire department emergency response procedures manual and pre-fire plans), and equipment effectively supported a localized response to lower-consequence events.

However, the site's integrated response functions and capabilities to address operational emergencies, such as large airborne releases of hazardous material

(i.e., Site Area Emergency or Alert) are not adequately planned and documented in procedures for use by decision-makers. Particularly, duties and responsibilities for each ERO position are not comprehensively or consistently established by the emergency plan or procedures. Emergency plan implementing procedures have not been developed to describe how to accomplish important response tasks, such as timely and accurate emergency categorization, classification, offsite notification of emergency events, field monitoring, and protective actions. Additionally, a comprehensive training and drill program for the ERO has not been implemented to develop and maintain specific response capabilities, and ANL has not established an exercise program to validate the effectiveness of all elements of the emergency management program. Consequently, during tabletop performance tests, the ERO demonstrated a lack of proficiency in some critical decision-making.

In addition to the concerns described above, the hazards assessment and the feedback and improvement program exhibited weaknesses. The hazards assessment does not always analyze the maximum potential quantities of hazardous materials allowed by authorization basis documents and does not analyze the full spectrum of accidents (i.e., onsite transportation, malevolent acts, and aircraft accidents); therefore, ANL may not have the appropriate tools and training for promptly responding to the full spectrum of potential events. Finally, an effective feedback and improvement program has not been established that provides for annual emergency management program assessments and an effective process for identifying and validating corrective actions to sustain management attention and continuous improvement beyond the current program transition.

The ratings reflect the current status of the reviewed elements of the ANL ISM and emergency management 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

## Emergency Planning

Hazards Surveys and Hazards Assessments ..... NEEDS IMPROVEMENT  
 Program Plans and Procedures ..... SIGNIFICANT WEAKNESS

## Emergency Preparedness

Emergency Facilities and Equipment ..... EFFECTIVE PERFORMANCE  
 Training, Drills and Exercises ..... NEEDS IMPROVEMENT

**Emergency Response** ..... NEEDS IMPROVEMENT

## Readiness Assurance

DOE Performance Monitoring ..... EFFECTIVE PERFORMANCE  
 Contractor Assessments and Issues Management ..... NEEDS IMPROVEMENT

# APPENDIX A

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## SUPPLEMENTAL INFORMATION

### A.1 Dates of Review

|                                | <b>Beginning</b>  | <b>Ending</b>     |
|--------------------------------|-------------------|-------------------|
| Scoping Visit                  | February 26, 2002 | February 28, 2002 |
| Planning Meeting               | April 22, 2002    | April 26, 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 | Patricia Worthington |
| Charles Lewis      | Dean Hickman         |
| Robert Nelson      |                      |

#### A.2.3 Review Team

Charles Lewis, Team Leader

#### Emergency Management System

Jeffrey Robertson, Lead  
Alan Cerrone  
James O'Brien  
J.R. Dillenback

#### 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

## APPENDIX B

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### SITE-SPECIFIC FINDINGS

**Table B-1. Site-Specific ES&H Findings Requiring Corrective Action Plans**

|  |
|--|
| <p>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.</p> |
| <p>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.</p>   |
| <p>CH/AAO has not established and implemented a fully effective and efficient oversight program, as specified in DOE Policy 450.5, <i>Line Environment, Safety and Health Oversight</i>, that ensures that ANL is effectively implementing integrated safety management (ISM).</p>   |
| <p>Weaknesses in ANL line management assessment processes and performance are limiting continuous improvement in safety performance.</p>   |
| <p>ANL processes and performance for analyzing environment, safety, and health (ES&amp;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.</p>   |
| <p>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.</p>   |
| <p>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.</p>   |
| <p>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.</p>  |
| <p>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.</p>  |
| <p>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.</p>  |
| <p>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, <i>Safety Management System Policy</i>.</p>  |

**Table B-2. Site-Specific Emergency Management Findings Requiring Corrective Action Plans**

|   |
|---|
| <p>ANL has not fully analyzed the potential impact of the release of hazardous materials at ANL to support development of emergency action levels and preplanned protective actions and to ensure that the ANL emergency management program is commensurate with the hazards, as required by DOE 151.1A, Chapter IV.</p>      |
| <p>The ANL emergency plan and implementing procedures do not establish the processes and requirements for emergency response functions as required by DOE Order 151.1A (Chapters I, IV, and VIII and Attachment 1), thus significantly inhibiting the capability for timely decision-making and response in an emergency.</p> |
| <p>AAO and ANL have not ensured that emergency response organization members are capable and proficient in fulfilling their assigned response functions and duties through a systematic training and drill program as required by DOE Order 151.1A, Chapter IV.</p>   |
| <p>The ANL exercise program used to evaluate the emergency response program is not adequate to validate all elements of the emergency management program over a multiyear period as required by DOE Order 151.1A, Chapter IV.</p>   |
| <p>ANL has not established an effective feedback and continuous improvement program that provides for annual emergency management program assessments and effective process for identifying and validating corrective actions as required by DOE Order 151.1A, Chapters I, X and Attachment 1.</p>                            |

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