

**Office of Enterprise Assessments
Targeted Review of Radiological Controls
Activity-Level Implementation at the
Argonne National Laboratory
Nuclear Facilities**



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Acronyms

AGHCF	Alpha Gamma Hot Cell Facility
ALARA	As Low As Reasonably Achievable
ANL	Argonne National Laboratory
ASO	Argonne Site Office
CA	Contamination Area
CAM	Continuous Air Monitor
CAS	Contractor Assurance System
CFR	Code of Federal Regulations
CHPT	Chief Health Physics Technician
CRAD	Criteria, Review, and Approach Document
CTA	Clean Transfer Area
DOE	U.S. Department of Energy
DRA	Decontamination and Repair Area
EA	DOE Office of Enterprise Assessments
EPD	Electronic Pocket Dosimeter
ESDH	Environment, Safety and Health Division
ES&H	Environment, Safety and Health
FR	Facility Representative
FRA	Functions, Responsibilities, and Authorities
FY	Fiscal Year
GERT	General Employee Radiological Training
HP	Health Physicist
HPP	Health Physics Procedure
HPT	Health Physics Technician
HSS	DOE Office of Health, Safety and Security
IAS	Integrated Assessment Schedule
IH	Industrial Hygiene
ISM	Integrated Safety Management
JHQ	Job Hazard Questionnaire
LMS	Laboratory Management System
OFI	Opportunity for Improvement
PEMP	Performance Evaluation Measurement Plan
PMA	Performance, Management and Assurance
PIC	Person in Charge
PPE	Personal Protective Equipment
RA	Radiation Area
RAR	Radiological Awareness Reporting
RBA	Radiological Buffer Area
RH	Remote-Handled
RMA	Radioactive Materials Area
RPP	Radiation Protection Program
RSO	Radiological Safety Officer
RWP	Radiological Work Permit
SC	Office of Science
SMART	Science Management Actions and Record Tracking
TBD	Technical Basis Documents
TLD	Thermo luminescent dosimeter
TRU	Transuranic
WMO	Waste Management Organization

Executive Summary

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted a review of Radiation Protection Program activity-level implementation at the Argonne National Laboratory (ANL). ANL is managed by the University of Chicago, Argonne LLC with oversight by DOE's Office of Science and its Argonne Site Office (ASO). Independent Oversight conducted the review within the broader context of ongoing targeted assessments of radiological control programs, with an emphasis on the implementation of radiological work planning and control across DOE nuclear facilities. The targeted review of ANL was performed during the period from April 7-25, 2014.

ANL continues to improve on design and implementation of its Radiation Protection Program. ANL currently has a sound and appropriately structured centralized radiation protection infrastructure. ANL has appropriate radiological protection documentation including management policy statements, program requirements documents, implementing procedures, and technical bases documents. Engineered controls are used effectively during many operations to reduce potential personnel exposures.

Independent Oversight identified some concerns with implementation of the Radiological Work Permit and As Low As Reasonably Achievable review processes that present potential vulnerabilities to adequacy of radiological controls. Systematic weaknesses were identified in selected aspects of radiological control implementation including controlled area posting and training requirements, respiratory protection program design and implementation, and job specific air sampling.

ASO oversight of the radiological protection program includes operational awareness, participation/observation of Laboratory assessments, and ASO led assessments. ASO operational awareness and informal communications are effective in providing meaningful insights on ANL radiological control performance and needed improvements, and the Performance Evaluation and Measurement Plan (PEMP) is used to formally communicate significant issues to ANL. However, one of two ASO formal assessments of radiological protection elements did not sufficiently evaluate performance and, as a result, missed opportunities to identify some performance deficiencies that were identified in this EA assessment.

Overall, ANL performance in the areas of activity level implementation of radiological controls is improving. However, the deficiencies identified indicate that further improvements are needed in a few areas.

Office of Enterprise Assessments
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Argonne National Laboratory Nuclear Facilities

1.0 PURPOSE

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) was established in May 2014 and assumed responsibility for managing the Department's Independent Oversight Program from the Department's former Office of Health, Safety and Security (HSS). Prior to creation of EA, an HSS Independent Oversight team conducted a review of Radiation Protection Program (RPP) activity-level implementation (e.g. tasked based implementation of work control) performed by the University of Chicago, Argonne LLC (UChicago, LLC) and its subcontractors at the Argonne National Laboratory (ANL) Alpha Gamma Hot Cell Facility (AGHCF) and Buildings 306 and 331. The UChicago, LLC, under contract to U.S. Department of Energy's (DOE's Office of Science (SC) has managed and operated ANL since the Manhattan project. The Argonne Site Office (ASO) is an organization within the U.S. Department of Energy's Office of Science with responsibility to oversee and manage the Management and Operating (M&O) contract for the ANL in Argonne, Illinois.

Independent Oversight conducted the review within the broader context of ongoing targeted assessments of radiological control programs, with an emphasis on the implementation of radiological work planning and control across DOE sites that have hazard category 1, 2, and 3 facilities. The purpose of this set of facility-specific Independent Oversight targeted reviews is to evaluate the flow down of occupational radiation protection requirements (as expressed in facility RPPs required by 10CFR 835) into work planning, control, and execution processes, such as radiological work authorizations that include radiological work permits (RWPs) and other technical work documents. To meet the goals of the targeted review, Independent Oversight performs assessments that are primarily driven by activity-level observations. After a set of facility-specific reviews is completed, Independent Oversight will develop a report with a compiled analysis of the performance of Departmental Elements' RPP activity-level implementation in protecting workers from potential health effects of ionizing radiation.

This targeted review was performed at ANL during the period from April 7-25, 2014. This report discusses the scope, background, methodology, results, and conclusions of the review, as well as findings, opportunities for improvement (OFIs) and items identified for further follow-up by Independent Oversight.

2.0 SCOPE

The scope of this review is defined in the HSS document entitled, "Plan for the Independent Oversight Targeted Review of Radiological Controls Activity-Level Implementation at ANL Hazard Category 2 and 3 Facilities," approved on March 10, 2014. The principal focus is on activity-level implementation of radiological control requirements at the AGHCF, Building 306, and, to a lesser extent, waste storage operations at Building 331. The specific scope of the review included RPP organization and administration; work planning, exposure, and contamination control; and radiological surveys and monitoring. Independent Oversight also evaluated DOE oversight of contractor radiation protection performance.

Most of the ongoing work associated with ANL nuclear facilities centers around removal, management, storage, and shipment of radioactive waste materials still present inside the AGHCF, as well as other low-level radioactive waste generated across ANL from scientific operations. Independent Oversight

observed work in the AGHCF including remote-handled (RH) and contact-handled transuranic (TRU) waste handling, repackaging, and onsite transport, as well as ancillary support operations. Independent Oversight also observed waste management activities at Buildings 306 and 331 including waste handling and movement, contact waste sorting and segregation, onsite shipment receipt and offloading, and related support operations.

3.0 BACKGROUND

The Independent Oversight program is designed to enhance DOE safety and security programs by providing DOE and contractor managers, Congress, and other stakeholders with an independent evaluation of the adequacy of DOE policy and requirements, and the effectiveness of DOE and contractor line management performance in safety and security and other critical functions as directed by the Secretary. The Independent Oversight program is described in and governed by DOE Order 227.1, *Independent Oversight Program*, and a comprehensive set of internal protocols and Criteria, Review, and Approach Documents (CRADs).

Radiological controls activity-level implementation was identified as an Independent Oversight targeted review area for 2013 in an HSS memorandum from the Chief Health, Safety and Security Officer to DOE senior line management, *Independent Oversight of Nuclear Safety – Targeted Review Areas Starting in FY 2013*, dated November 6, 2012. This review is further described in the *Plan for the Independent Oversight Targeted Review of Radiological Controls Activity-Level Implementation at Argonne National Laboratory Hazard Category 2 and 3 Facilities*, dated March 27, 2014, which defines the specific focus at ANL for this targeted review area.

Title 10 Code of Federal Regulations (CFR) Part 835, *Occupational Radiation Protection*, explains the requirements for developing, implementing, and maintaining an RPP. Title 10 CFR 835.101(a), *Occupational Radiation Protection*, states that “A DOE activity shall be conducted in compliance with a documented RPP as approved by the DOE.” Each DOE site that works with radiological material has developed an RPP and supporting implementing procedures for radiological control.

The ANL RPP is documented in the *Argonne National Laboratory Radiation Protection Program, Implementation of 10 CFR 835 Occupational Radiation Protection*, dated August 13, 2012, and approved by DOE on November 14, 2012. Applicability of the ANL RPP is defined as all ANL operations at the ANL site managed under the prime contract # DE-AC02-06CH11357; therefore, the ANL RPP covers the operations reviewed during this assessment.

4.0 METHODOLOGY

This review was guided by selected lines of inquiry associated with activity-level work control contained in Sections A, B, and C of HSS CRAD 45-35, Rev. 1, *Occupational Radiation Protection Program Inspection Criteria, Approach, and Lines of Inquiry*. This targeted review area assesses contractor implementation of RPP radiological work planning and control commitments by observing radiological work activities and practices that are reviewed against site radiological control implementing procedures, the RPP, and 10 CFR 835, as indicated in HSS CRAD 45-35, Rev. 1.

5.0 RESULTS

Independent Oversight reviewed the effectiveness of the flow down of occupational radiation protection requirements to work planning, control, and execution processes at ANL's AGHCF and Buildings 306 and 331. Results of this review are based on a sampling of data and work that was ongoing at the time of the review and are not intended to represent a full programmatic review of the site RPP.

5.1 Radiation Protection Organization and Administration

Inspection Criteria: Radiation protection program (RPP) design including organizational structure and administration are sufficient to provide for effective implementation and control of all radiological protection activities. (10 CFR 835.101)

Previous Independent Oversight integrated safety management (ISM) and radiological protection reviews at ANL identified numerous systematic weaknesses in the design, organization, and administration of the ANL RPP. Independent Oversight reviews of ISM at ANL in 2002 and 2005 identified programmatic weaknesses in fundamental elements of the RPP organization, infrastructure, and implementation. These weaknesses contributed to regulatory enforcement actions against ANL in the areas of nuclear safety and radiation protection in 2006. While ANL had some difficulty developing timely and effective corrective actions to radiation protection concerns during that period, the most recent Independent Oversight radiological review (2009) noted improvements in fundamental program areas such as organizational structure, internal and external dosimetry, training and qualification, and self-assessment. However, systematic weaknesses were still noted in the adequacy of program technical bases in some areas, and flow down mechanisms, such as implementing procedures, were still not sufficient to consistently drive proper performance.

While Independent Oversight identified additional weaknesses during this 2014 review (described later in this report), the Independent Oversight team found that the design and implementation of the RPP was much improved from prior visits. For example, the existence of a new radiological awareness reporting (RAR) process is a feature normally found in relatively mature radiological programs. This process has the goal of identifying, tracking, and trending radiological performance concerns that fall below the threshold for DOE Occurrence Reporting and Processing System reporting but that may represent leading indicators, and are therefore worthy of management attention. Independent Oversight also found that ANL was identifying and documenting RARs and using them as a tool for internal communications fostering improvement. Further, required RPP functional area audits were of sufficient breadth and scope, and were conducted using independent outside support resources where possible, and various performance issues were appropriately entered and tracked through the ANL Issues Management Tracking Systems.

Independent Oversight also observed a lesson learned post-job review of the recent radioactive source replacement operation (known as CARIBU) conducted at the AGHCF, involving a Cf-252 source replacement that is performed every few years. The most recent evolution involved a number of unexpected radiological concerns. The intent of the lessons learned review was to capture and discuss actions that were effective and those that may need improvement for the next evolution. The meeting was formal, well attended, and included interactive discussion among involved workers. Assignments were made to document the discussion and the planned changes to improve future evolutions.

ANL currently has a sound and appropriately structured centralized radiation protection infrastructure. The ANL Radiological Safety Officer (RSO) manages the ANL RPP and reports to the Director of the Environment, Safety, Health and Quality Division. A Health Physics manager for radiological operations and a deputy RSO support the RSO. The HP Manager for radiological operations manages field

operations associated with ANL nuclear facilities and radiochemistry, with a staff of two health physicists (HPs)—one for Building 306 and one for AGHCF and Building 205. The HPs are supported by a staff of deployed health physics technicians (HPTs) at each facility, including a chief HPT (CHPT) and a variable number of HPTs who maintain DOE core Radiological Control Technician (RCT) qualifications. The Deputy RSO is responsible for managing the balance of ANL radiological operations associated with research and is supported by a similar staff of HPs, CHPTs, and HPTs. Outside vendors are also used for certain aspects of the RPP such as portable instrument calibration; administration of external dosimetry devices, such as thermo luminescent dosimeters (TLDs); and internal dose evaluations.

The ANL RPP is documented in the ANL RPP documented entitled, *Implementation of 10 CFR 835 Occupational Radiation Protection*, dated August 13, 2012, and approved by ASO November 14, 2012. ANL has developed appropriate programmatic radiological protection documentation that includes management policy statements, implementing procedures, and technical basis documents (TBDs). ANL also appropriately maintains a formal compliance matrix associated with the RPP that links much of its programmatic radiological protection documentation, including TBDs and internal procedures, to the compliance commitments made in the RPP.

5.2 Radiological Work Planning, Exposure, and Contamination Control

***Inspection Criteria:** Radiological work planning processes are formally defined, designed, and implemented in a manner that adequately defines work scopes, integrates with other safety and health disciplines, minimizes the potential for spread of contamination, and ensures radiological exposures to personnel are maintained as low as reasonably achievable (ALARA). (10 CFR 835.101)*

Radiological hazards at ANL facilities observed during this review involve potential for exposure to both external and internal radiation hazards from waste handling activities including RH and contact-handled TRU waste and other radioactive wastes generated across the site. Engineered controls, the principal mechanisms used to control radiological hazards, employ enclosures, such as the AGHCF itself, gloveboxes, hoods, shielded casks, and ventilation systems. Engineered controls were used effectively during many operations to reduce potential personnel exposures. For example, RH TRU waste containers exhibit external exposure rates well in excess of 1 R/hr at 1 foot; and over packing these containers prior to shipment for disposal is done remotely with engineered controls. AGHCF has an elaborate remote operated transfer system which can lift and transport primary 7 gallon TRU waste containers located inside the hot cell to an engineered transfer chute for bagging and remote placement into a 30 gallon overpack drum shielded by a gated cask and located outside the hot cell in the clean transfer area (CTA). The CTA in its normal closed configuration offers similar protection as the hot cell, with manipulator functionality, but can also be opened to permit personnel entry. The 30 gallon overpack in the CTA is contained in an engineered shielded gated cask that effectively reduces the external exposure rates from tens of R/hr to below 100 mR/hr, allowing for safe personnel entry and hands on inspection and repositioning of the gated cask within the CTA. The CTA is then placed back in its closed shielded position for remote retrieval of the 30 gallon drum from the gated cask and placement into a similarly shielded transport shipping cask for movement to an onsite storage location.

While engineered controls can effectively reduce external and internal exposure potential, administrative controls and personal protective equipment (PPE) are also necessary to adequately manage much of the work accomplished during ANL waste operations. Administrative controls include radiological training, radiological postings and boundary controls, RWPs, operations procedures, and pre-job/RWP briefings conducted for all new or revised RWPs.

RWPs and ALARA reviews are the principal radiological work planning mechanisms at ANL. Radiological work planning is performed as part of the ANL institutional work planning and control

process, which results in radiological controls being specified in an RWP for the work. Radiological work planning is further planned and reviewed during ALARA reviews which are required for certain higher hazard radiological work, such as work in high dose rate work or work in high contamination and airborne radioactivity areas. The RWP is intended to satisfy regulatory requirements that call for written authorization for entry and for performing work within radiological areas. The RWP specifies radiation protection measures designed to mitigate and control the radiological hazards associated with the work. ANL workers are required to read, be briefed, and acknowledge, by signing, the RWP. In conjunction with RWP development, ALARA reviews are also performed for all radiological work that exceeds pre-defined radiological triggers. The ALARA review is intended to apply a standardized systematic approach to review the specific work and optimization of radiological controls, and includes additional rigor and peer review than RWP development alone.

While most aspects are adequate, Independent Oversight identified a few gaps and inconsistencies that could impact the effectiveness of implementation of the RWP and ALARA review processes that are intended to ensure adequacy of controls: (See **OFI-1.**) Examples include:

- ALARA Form ANL 246A checklists are not always prepared in accordance with form instructions, resulting in ALARA reviews of limited quality and value, with overly generic descriptions of items required to be addressed and controls to be employed. For example, ALARA Review 2014-212-164 and 2014-212-165 CARIBU Source Transfer and Decon was high risk radiological work with a documented Laboratory Level ALARA review. Form ANL 246A instructions for Item 1.9 state, “Note any special tools considered and state whether they will or will not be used and why.” However the resulting description on the ALARA review form under Item 1.9 states only “remote/robotic equipment used to reduce dose and contamination levels,” with no further specifics. Similarly, the instructions for Item 2.2.8 for air sampling state, “Describe air sampling requirements and techniques and include in the procedure.” The resulting description for this item states only “CAM and retrospective,” without any specifics on justification or proper placement. This level of air sampling was not sufficient for adequate airborne characterization during respirator work. Similarly generic statements are made throughout this and other ALARA reviews. While ANL is performing many ALARA reviews by conservatively applying the ALARA review trigger thresholds, the quality and detail lack sufficient rigor and provide limited value in optimizing controls and developing RWPs that are tailored to the specific work being performed. (Also see **Finding-3**, in section 5.3.)
- ALARA reviews do not normally have predefined expiration dates (unlike RWPs which have an expiration date up to one year). The ALARA review for RWP 2014-212-200 for TRU waste out loading was dated 8/6/2012 and used for a similar 2012 RWP, but was not revised to provide proper reference to the specific operations procedure being used for campaign 40 (AGHCF OPS-014).
- Radiological hold points contained in operations procedures are not always listed in associated RWPs as required by Health Physics Procedure (HPP) 9.1. For example, AGHCF OPS-314 contains numerous radiological hold points, none of which are included in RWP-2014-212-200.
- ANL does not require daily or task specific RWP sign in or sign out to establish positive correlation to a given day’s work activities and the workers acknowledgement of the RWP that governs the scope(s) of work being performed. While the pre-job brief could satisfy this purpose, such briefs are only required for new or revised RWPs except where specified in HPP 9.1. No formal mechanism ensures that workers are actually working under the correct RWP and that external dose tracking from electronic pocket dosimeters (EPDs) are actually assigned to the correct RWP.

- RWP 2014-331-002 and associated ALARA review 2014-009 Rev 0 contains no requirement for extremity dosimetry for handling drums with dose rates greater than 50 mR/hr; other RWPs used by Waste Management Organization (WMO) contain this provision. Based on interviews with site personnel, Independent Oversight determined that the writer assumed the majority of the activity would be conducted remotely; however, Waste Management Mechanics use hand tools to remove the bolts which secure the shielded cask lid, potentially placing them in close proximity (contact) for a greater time than assumed in either the RWP or ALARA review.

As indicated, pre-job briefings are required for all new and revised RWPs. Such briefings were observed by Independent Oversight and found to be appropriate with a few exceptions. In one case at Building 306, the person in charge (PIC) confirmed readiness to perform work, including a review of the load rating on a ladder for work in a contamination area (CA) to ensure the worker could safely use the ladder; however the individual exceeded the rated capacity. In addition, an RWP briefing (RWP 2014-331-002) at Building 306 to receive an RH TRU waste drum from AGHCF did not cover radiological data from surveys at AGHCF that addressed the expected dose rates associated with the unshielded inner TRU waste drum to be removed from the shielded transport cask for placement into the B331 shell. While this information may have been used to plan the work, workers were not informed during the briefing of actual measured dose rates and proper standoff distances. One individual's EPD went into the alarm state during the remote move. Lastly, AGHCF HPTs providing work coverage for a material pickup by WMO staff were not included in the pre-job and RWP briefing for work package WCD-13-WM0082, and were not aware of an RWP requirement (RWP 2014-SITE-007) for extremity dosimetry for individuals potentially coming into contact (primarily riggers) with drums having contact dose rates greater than 50 mR/hr. WMO management took interim steps to address these concerns during the review. (See **OFI-2.**)

Radiological postings and boundary controls are prevalent in facilities observed by Independent Oversight. In general, postings were appropriate and compliant for radiological areas and radioactive material areas (RMAs). However, Independent Oversight identified a few examples where postings were not in accordance with expectations. For example, at Building 306 an HPT covering receipt of a radioactive material package inappropriately used CA posting to control access to the transport vehicle while awaiting smear results. Neither the vehicle nor the packages were expected to be contaminated, and the HPT was not wearing PPE while taking smears in the vehicle before posting the area as a CA. Independent Oversight identified several radiological area posting anomalies at the Building 306 loading dock and roll up door, including the use of radiation area (RA) postings when no radioactive material was present, and the lack of a rope or boundary control across an open roll up door that had an RA posting on the wall next to the door. At AGHCF, there were transient exposure rates in excess of 1 R/hr in the CTA when unshielded 30 gallon TRU waste containers were being remotely handled. Neither the operations procedures nor RWP required the CTA door control mechanism to be locked out or otherwise controlled through continuous surveillance at these times, as required for HRAs exceeding 1 R/hr.

Independent Oversight identified a more systemic concern with the required use of controlled area postings at ANL and associated required radiological training. 10 CFR 835 defines a controlled area as *any area to which access is managed by or for DOE to protect individuals from exposure to radiation and/or radioactive material*. 10 CFR 835 defines radiological area as *any area within a controlled area defined in this section as a "radiation area," "high radiation area," "very high radiation area," "contamination area," "high contamination area," or "airborne radioactivity area."* Therefore, radiological areas, by definition, are required to be located within the confines of controlled areas.

10 CFR 835.901(a) also requires radiation safety training be provided to all employees before being permitted unescorted access to controlled areas, and before receiving occupational dose during access to controlled areas. ANL General Employee Radiological Training (GERT) is intended to satisfy this requirement.

The following non-mandatory guidance, excerpted from the DOE Guide 441.1-1C, Radiation Protection Programs Guide, Section 3.1, provides further interpretation for demonstrating compliance with controlled area posting provisions of 10 CFR 835.

Controlled areas are established and posted to warn individuals that they are entering areas in which radiological areas and/or RMAs exist. All radiological areas and RMAs lie within the boundaries of controlled areas (although the boundaries may be contiguous). Each entrance or access point to a controlled area shall be posted if that area contains radioactive materials or radiation fields that require posting under 10 CFR 835.603 [10 CFR 835.602(a)]. The sign should contain wording equivalent to "CONTROLLED AREA"; however, the actual wording, color scheme, and sign may be selected by the contractor to avoid conflict with local security requirements [10 CFR 835.602(b)]. In the event that the boundaries of the controlled area are contiguous with those of radiological areas or RMAs, the area should be posted with both the controlled area and radiological area/RMA postings. A controlled area may incorporate one or more radiological areas and/or radioactive material areas. Controlled area borders should not be contiguous with the site boundary.

While ANL Laboratory Wide Procedures and HPPs provide direction consistent with 10 CFR 835 requirements for controlled areas, ANL has not ensured that controlled areas are properly and consistently established and posted at each access point to areas where radiological areas and/or RMAs exist. For example, in many areas in and around Buildings 212, 306, 331, and 205, individuals are able to encounter radiological area postings without encountering a controlled area posting. ANL's current use of the individual's job hazard questionnaire (JHQ) to determine the need for GERT, which asks each individual if they encounter or enter controlled areas, is flawed. A spot sampling of training records of approximately 20 individuals indicated that a few individuals (about 10% of the sample population) did not have the required GERT. This condition could be worse in other ANL organizational elements that may have a higher percentage of transient and visiting workers. (See **Finding-1** and **OFI-3**.)

Independent Oversight observed that most of the hands on radiological work in AGHCF and Building 306 required the use of respiratory protection. However, Independent Oversight identified a number of weaknesses in the design and implementation of the Respiratory Protection Program at ANL. For example: (See **Finding-2** and **OFI-4**.)

- LMS-Proc-219 and IHOP-006 do not contain all required elements of 29CFR1910.134 for written respiratory protection programs (e.g., procedures for cleaning, storing, maintaining, inspecting, discarding respirators).
- Within both facilities, respirators were stored un-bagged on tables and shelves and hung by their straps.
- No established periodicity for cartridge and respirator change out resulted in a run to failure possibility.
- There is no requirement for smears of the interior of the respirator after use in a radiological environment (an external smear is taken).
- Workers were observed donning respirators without performing qualitative fit checks (positive/negative tests).

- Subcontractors are entirely responsible for their own respiratory protection programs, as well as equipment, fit testing, and medical programs.

Site management responded to identified concerns and took initial interim compensatory measures including development of operator aides to address proper storage and qualitative fit testing, and communication of expectations for interior radiological surveys.

Workers at both AGHCF and Building 306 in general exhibited good donning and doffing practices for radiological PPE. However a few potential contamination control weaknesses were observed during work: (See **OFI-5**.)

- At Building 306, workers exiting the whole body contamination monitor walked along the same herculite pathway used to enter the whole body contamination monitor, prior to the HPTS surveying the pathways.
- At AGHCF, the Decontamination and Repair Area (DRA) RWP requires alpha and beta hand frisking to be performed at least every 5 minutes in a low background location away from the glovebox. However there is no requirement to perform alpha surveys upon each removal of hands from the glovebox, as is customary and appropriate except in certain conditions (e.g., high background levels). Since alpha background is near zero at the glovebox, survey with an alpha probe would be easily accomplished.
- Workers at the DRA glovebox were required to sit on the radiological buffer area (RBA) floor in order to access glove ports close to the ground. Aside from a hand and foot frisk, no survey of their pant legs was performed before exiting the RBA. HPP-9.2 requires that a hand and foot frisk, at a minimum, be performed when exiting an RBA established for contamination control.
- AGHCF Ops-305 and 314 inappropriately allow for CA levels of contamination to be present on the outside of 30 gallon RH TRU overpack drums (200 dpm per unit area alpha, 2000 dpm per unit area beta-gamma) before placement in Idaho National Laboratory (INL) cask. While hot cell technicians did in fact decontaminate the outside of these drums below these levels, the procedures incorrectly allow for unintentional spread of contamination because these drums are later moved to a storage location that is not a posted CA.

5.3 Radiological Surveys and Monitoring

Inspection Criteria: Adequate routine and non-routine radiological surveys and monitoring are performed for external radiation, fixed and removable contamination, and airborne radioactivity, as needed to characterize radiological conditions and ensure safety of personnel. (10 CFR 835.401; 10 CFR 835.403)

Most radiological survey and monitoring activities were conducted appropriately at ANL facilities. Routine radiation and contamination surveys and monitoring are conducted at appropriate frequencies in and around radiological areas as defined by written radiological surveillance plans developed for each facility. Specific survey techniques and documentation requirements are defined by RSO HPPs. Continuous air monitoring is also conducted at both AGHCF and Building 306 through a network of Canberra intelligent alpha/beta continuous air monitors (iCAMs) as well as stationary air samplers located around engineered radiological containment systems such as gloveboxes, hoods, and the AGHCF.

Independent Oversight observed performance of HPT routine radiological surveillances and job coverage,

and found it to be effective. Survey documentation associated with these efforts was also generally thorough and complete. However, at AGHCF, Independent Oversight identified that job coverage survey reports did not always use maps or otherwise provide adequate description in order to determine the specific location where each smear was taken, as required by HPP-3.0 (i.e., specific floor surface locations). In addition, for the campaign 40 load out, specific hold point surveys required by the operations procedure were documented with a description rather than the specific procedure step number requiring the survey. These descriptions were sometimes not sufficient to determine the actual step that was executed and associated with the survey result because various conditionals in the procedure may or may not be executed for a particular packaging evolution. (See **OFI-6.**)

Radiological survey and monitoring instrumentation was appropriate for the radiation hazards. All instruments were within required calibration intervals. External beta and gamma exposure rates are measured with portable air ionization chambers while neutron exposure potential is measured with portable moderated boron trifluoride (BF₃) “rem-ball” rate meters. Smears and fixed air samples collected weekly are counted in alpha, beta-gamma proportional, counting systems (i.e., DABRAS or TENNELEC).

For external exposure, TLDs are used to provide the permanent record of worker exposures. ANL also conservatively requires the use of supplemental alarming EPDs to provide for real time tracking of external dose for work in radiation areas and high radiation areas. Incremental doses for each worker are recorded and cumulatively tracked, giving management a real time picture of workers’ external dose profiles prior to obtaining TLD results. For high exposure potential work such as the TRU out loading, this information is used to select and rotate appropriate workers based on individual ALARA goals and administrative control levels.

ANL effectively uses electronic data systems to manage a variety of radiological information. For example, RSO uses an electronic database system which provides easily retrievable electronic access to RWPs, radiological survey records, air sampling results, and related information. In the RWP database, all supplemental radiological information associated with a particular RWP (e.g., ALARA review, bioassay determination) are attached electronically and easily retrievable from a single location.

Personnel monitoring for contamination upon exit from a CA at AGHCF relies on a whole body frisk with a portable survey instrument because the facility lacks an available automated whole body contamination monitor. The effectiveness of hand held whole body frisks is highly variable and contingent on diligent, methodical, and time consuming survey of the individual at a rate of at least 3-5 minutes per individual. The observed frisking practices at AGHCF were performed much more quickly and allow for greater potential to miss contamination that otherwise might be detected using a state-of-the-art automated system. While it is recognized that AGHCF source terms create high background dose rates which impede use of portal monitor or whole body monitoring on exit, options for modified exit paths or shielded monitoring have not been fully considered to address this vulnerability. (See **OFI-5.**)

Independent Oversight observed that most work included required use of respiratory protection because of the potential for elevated airborne radioactivity. While air sampling is being performed, Independent Oversight identified some implementation weaknesses.

Airflow studies at the Building 306 Perma-Con were not sufficient to define placement needs. The only information related to air sampler placement was an industrial hygiene evaluation conducted in 2010. In this evaluation, a “smoke test” was used but the IH evaluation made no recommendations for air sampler placement. The section of the data sheet related to placement of continuous air monitors (CAMs) states, “For All Conditions; CAM needs to be located on South Side of Work Area, 24” from Wall Near Center of Lower Area.” Independent Oversight observed the CAM and retrospective air sampler located on the

West and North walls respectively with some individuals working in locations (i.e., elevated portion of work area) where the sampler placement is not representative of the worker's breathing zone. Furthermore, while the placement recommendation and performer signature block was noted as "Health Physicist" the actual recommendation was made by the CHPT. Subsequent interviews with Health Physics professional staff and cognizant system engineer indicated that more recent studies are significantly more comprehensive and additional review is warranted. (See **OFI-7**.)

Independent Oversight identified a systematic weakness associated with job specific air sampling during operations when respiratory protection is being worn. Specifically, ANL job specific air sampling requirements are not sufficiently defined and implemented; as a result, potential airborne concentrations present in work areas where respiratory protection is used may not be adequately characterized. The specific weaknesses contributing to this finding are further discussed in the remainder of this section. (See **Finding-3** and **OFI-8**.)

During Campaign 40 load out work, individuals were in full PPE and respiratory protection, but no representative job specific air sampling was performed inside the CTA where the source of potential airborne radioactivity would occur. While the CTA air environment is sampled via retrospective air samples taken from the exhaust system on a regular basis, this type of sampling was not adequate to meet the intentions of job specific air sampling defined by institutional procedures. The RWP erroneously authorized the use of a fixed retrospective air sampler located at the entrance to the CTA and an operational ICAM located outside the CTA to meet the purpose of job specific air sampling. Since these samplers were not representative of worker breathing zones inside the CTA, they were not sufficient to adequately characterize the airborne environment of the work area or the adequacy of respiratory protection being worn, as required by institutional air sampling requirements discussed below. Also, no evidence existed that an air sampling protocol had been developed, as required by HPP-9.1 when preparing RWPs that require respiratory protection. (See **Finding-3** and **OFI-8**.)

In response to these observations, management directed the installation of a giraffe air sampler in the center of the CTA for subsequent work.

The following are some specific ANL procedural requirements related to air sampling that were not effectively defined or implemented: (See **Finding-3** and **OFI-8**.)

- HPP-9.1, *Radiological Work Permits* states, "If respiratory PPE is required, develop an air sampling protocol per HPP 6.1, *Job Specific Air Sampling*."
- HPP-6.4, *Job Specific Air Sampling* states, "Position the collection head of the air sampler so that air samples collected are representative of air breathed by the workers."
- HPP-6.4, *Job Specific Air Sampling*, states, "Obtain air samplers (area) such as a giraffe with an ESH-7 head or Hi-Q 'blue box.' When feasible, use lapel air samplers for breathing zone sampling."
- HPP-6.4, *Job Specific Air Sampling*, Appendix A states, "When respiratory protection is required per the RWP, the use of lapel samplers is the preferred method of sampling with worker's breathing zone. If air sampling is being conducted to determine the concentration in a work area, use the giraffe with ESH-7 head or Hi-Q 'blue box' and place the sampling head in the area with the highest potential concentration."

Independent Oversight also determined that conflicting information presented in ANL HPPs with respect to job specific air sampling requirements could contribute to these weaknesses. For example, HPP-6.4,

Job Specific Air Sampling contains a blanket statement that fixed location retrospective air samplers may be used for job specific sampling, per HPP-6.3, *Fixed-Location Retrospective Air Sampling*. No constraints are placed on this allowance. HPP-6.3, *Fixed-Location Retrospective Air Sampling* does not provide for such an allowance and specifically states, “This procedure applies to fixed-location retrospective air sampling for areas outside of containment where airborne radioactivity is not expected. It does not address job specific air sampling for areas where airborne radioactivity may be expected.” (See **Finding-3** and **OFI-8**.)

Independent Oversight also reviewed work planning documentation associated with the CARIBU source replacement efforts referenced earlier in this report and performed just prior to this assessment. The planning documentation identified the same air sampling concerns in the RWP and ALARA reviews covering that work. Air sampling was performed with the same fixed air samplers and CAM located outside the CTA and did not collect representative job specific air samples at the source of potential exposure. While RWP-2012-212-165 for CARIBU decontamination specified job specific air sampling, it directed that the sampler be placed in F-113 at the step off pad from the CTA, rather than in the immediate work area. The CARIBU evolution involved very high levels of unexpected contamination during source removal and installation, voiding the RWP, and necessitating revisions to allow for CTA area decontamination. This activity also involved the need for a special bioassay for one worker. The incident driven bioassay sample resulted in the determination that no intake had occurred. While this was fortunate, the lack of representative air sampling during work with respiratory protection presents a potential for unmonitored exposures and inability to validate adequacy of the assigned respiratory protection factor. (See **Finding-3** and **OFI-8**.)

5.4 DOE Oversight

Argonne Site Office (ASO) Radiological Control Oversight Program

ASO oversight of radiological control is implemented through the ASO oversight plan. ASO oversight is composed of four principal elements: the Performance Evaluation Measurement Plan (PEMP), Review and Approval of Systems and Programs, Operational Awareness, and Assessments. ASO approved the ANL RPP on November 14, 2012.

Assessment

ANL performance in the radiological controls area is addressed within the broader safety and environmental protection goals in ANL PEMP Goal 5.0, *Sustain Excellence and Enhance Effectiveness of Integrated, Safety, and Environmental Protection*. ASO collects information for the PEMP on a quarterly basis, which is the primary documented source of feedback to the contractor in the area of radiological control. During FY 2013, PEMP feedback associated with radiological controls addressed the following topics: Building 205 radiological inventory concerns, improving work planning and control by electronically linking RWPs, and concerns about radiological contamination events.

An ASO health physicist (HP) performs most radiological control oversight of ANL. This HP is qualified to DOE-STD 1174-2003, *Radiation Protection Functional Area Qualification Standard*, and conducting effective operational awareness activities. During a post-job review for the CARIBU project observed by EA, the ASO HP asked pertinent questions and demonstrated a good understanding of the project goals, the radiological hazards, and the hazard controls involved. Independent Oversight also observed the removal of material from the AGHCF Building 212, with the ASO HP and the Building 212 facility representative. The HP demonstrated thorough knowledge of contamination levels, radiation levels, air flow studies, and radiological monitoring equipment. The Facility Representative (FR) demonstrated a sound understanding of the facilities’ safety systems. Independent Oversight also toured WMO facilities

in Buildings 306 and 331, with the ASO HP and FR. The ASO FR and the HP were both knowledgeable of radiological hazards and the controls used to mitigate those hazards.

Operational awareness activities are documented in the ASO SMART database. EA's review of ASOACT entries confirmed that the ASO HP was conducting and documenting a wide variety of operational awareness activities including observation of work activities, attendance at meetings (e.g., plan-of-the-day meetings, RWP briefings, and pre-job reviews), walkthroughs, follow-up to events and issues to ensure operational awareness of radiological activities. In addition, the ASO HP conducted some follow-up of ANL's use of lessons learned.

ASO creates an Integrated Assessment Schedule (IAS) as part of its annual performance plan that identifies assessments that will be performed by the ANL contractor. In most cases, ASO personnel assess ANL performance by observing/shadowing the ANL assessments. In some cases, ASO personnel participate on the assessment activities. For example, the ASO HP Physicist served as a team member on an ANL Performance, Management and Assurance (PMA) review, and provided input on the written product. However, the ASO Oversight Plan does not define requirements for conducting or documenting these ASO activities. (See OFI-9.)

Two ASO assessments of radiological protection elements were performed in calendar year 2013. In October 2013, ASO completed a comprehensive review of ANL efforts to characterize hold-up contamination in Building 205 which helped DOE management make informed decisions about start-up of operations in Building 201. During September 2013, ASO performed a Functional Area Review of the Argonne Respiratory Program that evaluated the program documentation but did not evaluate the respiratory program implementation, missing an opportunity to identify the deficiencies identified in this EA report. In preparation for this review, ASO also conducted a historical "holistic" review of internal and external assessments related to radiation protection using past reviews as a baseline. (See OFI-9)

At the time of the EA assessment, ASO was working to improve their oversight program in accordance with the ASO Annual Performance Plan. Current actions include completing efforts to address recommendations from a 2013 ASO self-assessment. Some planned initiatives included an update of the ASO Oversight Plan to better address the Contractor Assurance System and clarifications to ASO's issues management system. The plan also included a commitment to complete an effectiveness review of the CAS.

6.0 CONCLUSIONS

ANL continues to improve on design and implementation of its RPP since prior Independent Oversight visits. ANL currently has a sound and appropriately structured centralized radiation protection infrastructure. ANL has appropriate radiological protection documentation including management policy statements, program requirements documents, implementing procedures, and TBDs. Engineered controls are used effectively during many operations to reduce potential personnel exposures.

Independent Oversight identified some concerns with implementation of the RWP and ALARA review processes that present potential vulnerabilities to the program in ensuring adequacy of controls. Systematic weaknesses were identified in selected aspects of radiological control implementation including controlled area posting and training requirements, respiratory protection program design and implementation, and job specific air sampling.

ASO oversight of the radiological protection program includes operational awareness, participation/observation of Laboratory assessments, and ASO led assessments. ASO operational

awareness and informal communications are effective in providing meaningful insights on ANL radiological control performance and needed improvements, and the PEMP process is used to formally communicate significant issues to ANL. EA's review of two ASO assessments of radiological protection elements indicate that one (i.e., the Building 205 characterization assessment) was comprehensive and the other (i.e., respiratory protection assessment) assessed program documentation but did not sufficiently evaluate performance (e.g., through observation of work); as a result, the latter assessment missed opportunities to identify some performance deficiencies that were identified in this EA assessment. .

Overall, ANL performance in the areas of activity level implementation of radiological controls is improving. However, the continuing deficiencies indicate that further improvements are needed in a few areas.

7.0 FINDINGS

Findings indicate significant deficiencies or safety issues that warrant a high level of attention from management. If left uncorrected, findings could adversely affect the DOE mission, the environment, the safety or health of workers, and the public or national security. Findings may identify aspects of a program that do not meet the intent of Federal regulation, DOE policy or DOE orders. Findings may identify specific failures to conform to safety regulations, DOE policies, or DOE orders, or they may identify systemic failures to conform to internal procedures, standards, or guidance that are invoked by contracts or the facility safety basis as the means to satisfy the requirements in the regulations or orders.

Finding-1: UChicago, LLC has not ensured that controlled areas at ANL are properly established and posted at each access point where radiological areas and/or RMAs exist, and that unescorted workers that enter posted controlled areas are properly trained, consistent with 10 CFR 835.

Finding-2: UChicago, LLC has not ensured that the ANL Respiratory protection program meets all Occupational Safety and Health Administration requirements of 29CFR1910.134, such that respirators used by workers and subcontractors are properly cleaned, stored, inspected prior to use, and discarded at appropriate predetermined schedules to reduce the likelihood of failure while in use.

Finding-3: UChicago, LLC has not ensured that job specific air sampling requirements are sufficiently defined and implemented as necessary to effectively characterize the airborne environment when respiratory protection is prescribed, consistent with 10 CFR 835 requirements.

8.0 OPPORTUNITIES FOR IMPROVEMENT

OFIs are not intended to be prescriptive or mandatory, and do not require formal resolution through the corrective action process. Rather, they are suggestions offered by Independent Oversight that may assist site management in implementing best practices, or provide potential solutions to minor issues identified during the conduct of the review. In some cases, OFIs address areas where program or process improvements to enhance safety best practices can be achieved through minimal effort. In other cases OFIs may reveal weaknesses or isolated behaviors that could become systemic over time and degrade the safety of the facility, resulting in a finding or deficiency. Independent Oversight anticipates that these OFIs will be evaluated by the responsible line management organizations and either accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

Independent Oversight identified eight OFIs for ANL consideration and one OFI for ASO consideration, as listed below:

ANL

OFI-1: Continue efforts toward improving implementation of RWP and ALARA Review processes. Specific actions to consider include:

- Review existing ALARA reviews and crosswalk to RWPs.
- Use a graded approach to develop more rigorous ALARA reviews.
- Consider establishing an HPP to govern selection and to conduct ALARA reviews, including proper use of thresholds, clear expectations for content and level of detail for each required review element of ANL 246A, and proper flow-down of controls into the RWP.
- Consider implementing an expiration date on ALARA reviews that coincides with the RWP expiration.
- Use training and/or procedure revisions to clarify expectations for incorporating hold points from operations procedures into associated RWPs.
- Consider a requirement for task specific RWP sign in and sign out using a manual system or through upgrade to a commercially available electronic RWP package (most commercially available electronic RWP packages offer sign in functionality).
- Consider adding a radiological work planner position responsible to support the project HPs. This position would provide line oversight and assistance in radiological work planning and be responsible for review and approval of all RWPs and ALARA reviews, with a focus on proper implementation of radiological work planning requirements with consistent definition of radiological controls.

OFI-2: Modify RWP and Pre-job briefing processes to ensure they appropriately confirm readiness to perform radiological work. Specific actions to consider include:

- Provide additional guidance and/or training to PICs on expectations for confirmation of readiness to perform work.
- Provide instruction or guidance on the conduct of reverse briefing, where appropriate, to increase worker engagement.
- Develop additional tools (e.g., checklist, review criteria) for use by PICs and HPT's when conducting briefings.

OFI-3: Establish standardized and consistent posting protocols for controlled areas and implementation of required GERT. Specific actions to consider include:

- Determine root causes for controlled area posting weaknesses and revise procedures as necessary to ensure that all areas with radiological postings or RMAs are contained within the posted boundary of an established controlled area, or are contiguously posted with both the required controlled area and radiological area posting.

- Conduct extent of condition reviews of existing posting to meet 10 CFR 835 requirements and revise postings as needed.
- Conduct review and determine adequacy of current use of the JHQ to determine GERT training requirements.
- Consider including GERT as a requirement for all employees as part of new hire orientation training (new employees) and inclusion of the GERT module to existing HazCom training.

OFI-4: Strengthen existing respiratory protection programs and practices to ensure respirators used by workers and subcontractors are properly cleaned, stored, inspected prior to use, and discarded in accordance with a predetermined schedule to reduce the likelihood of failure. Specific actions to consider include:

- Revise LMS-Proc-219 and IHOP-006 to contain all required elements of 29CFR1910.134 for written respiratory protection programs (e.g., procedures for cleaning, storing, maintaining, inspecting, discarding respirators).
- Provide facilities and direction to ensure respirators are stored properly.
- Establish a periodicity for cartridge and respirator change out.
- Establish a requirement for smears of the interior of the respirator after use in a radiological environment.
- Provide additional training to ensure that workers perform qualitative fit checks (positive/negative tests) when donning respirators.
- Ensure through program review that subcontractors who are entirely responsible for their own respiratory protection programs, equipment, fit testing, and medical surveillance, etc., are adequately meeting expectations.

OFI-5: Continue efforts toward improving contamination control practices. Specific actions to consider include:

- Provide additional training and/or use of additional worker job aids to assist workers in their contamination control techniques and practices. Revise procedures and RWPs where appropriate to include additional contamination control guidance.
- Establish additional RBA requirements to ensure individuals exiting RBA's monitor not only their hands and feet but also any portion of the body that may have been in contact with potentially contaminated surfaces during work.
- Enhance existing requirement for glovebox workers to monitor hands in a low background area at least every 5 minutes but also upon each removal from gloves when alpha emitting nuclides where background radiation levels should not present interference.
- Evaluate options for installation of an automated whole body personnel frisking system for individuals prior to exiting AGHCF, including options for modified exit paths and/or shielded monitoring.

OFI-6: Provide additional training to HPTs and consider revisions to HPP- 3.0 to clarify expectations for radiological survey documentation, including methods for effectively reporting hold point surveys to ensure specific survey locations are clearly identified.

OFI-7: Review existing airflow studies to determine their adequacy in establishing a basis for proper air sampler placement, and reconsider the broad allowance for use of retrospective air samplers to accurately represent conditions in workers breathing zones. Specific actions to consider include:

- Revise procedures to address more prescriptive uses of both lapel and stationary air sampling methodologies.
- Revise airflow studies as needed to address current workplace conditions.
- Relocate current air sampler placement to address any identified placement deficiencies.

OFI-8: Improve processes for definition and implementation of job specific air sampling requirements, including provisions for ensuring representative air sampling in the work area when a potential exists for creating airborne contamination and when respiratory protection is used for radiological hazards. Specific actions to consider include:

- Conduct an extent of condition review to determine those RWPs and ALARA reviews that do not provide sufficient level of air sampling requirements, and revise RWPs and sampling practices to meet expectations.
- Revise the HPP-6.XX series of procedures to eliminate conflicting instructions regarding job specific air sampling, fixed retrospective air sampling, and lapel air sampling.
- Clarify HPP-9.1 to define management expectations of the content, detail, and documentation of an air sampling protocol when respiratory protection is prescribed.
- Conduct additional training of HPs and HPTs regarding HPP-6.XX procedure expectations for air sampling including proper location of samplers and proper specification of air sampling requirements in RWPs and ALARA reviews (including air sampling protocol development).
- Integrate air sampling corrective actions into RWP and ALARA review improvement items noted in OFI-1, as applicable.

ASO

OFI-9: Consider the following enhancements to ASO oversight processes:

- Revising the ASO Oversight Plan to better define expectations for shadow assessments and identifying insights that may be useful in support of monitoring CAS performance. The ASO HPs SMART database could be used to capture relevant information.
- Include performance as an element of all ASO assessments.
- Include periodic discussion on nuclear safety management programs to ensure that information from operational awareness, CAS and assessments is adequate to inform management on performance of all program elements.

9.0 FOLLOW-UP ITEMS

Independent Oversight will maintain operational awareness of site and responses to the findings. Following completion of the site wide targeted reviews, Independent Oversight will prepare a summary report identifying DOE complex wide issues and trends.

10.0 REFERENCES

- 10 CFR Part 835, *Occupational Radiation Protection*.
- DOE G 441.1-C, Radiation Protection Programs Guide, For Use With 10 CFR Part 835, *Occupational Radiation Protection*.
- *HSS CRAD 45-35*, Rev. 1 Occupational Radiation Protection Program Inspection Criterion, Approach and Lines of Inquiry.
- Plan for Targeted Review of Radiological Controls Activity-Level Implementation at Argonne National Laboratory, April, 2014.

Appendix A

Supplemental Information

Dates of Review

Onsite Review: April 7-11 and April 20-25, 2014

Office of Enterprise Assessments Management

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Appendix B

Key Documents Reviewed

Institutional

- Argonne National Laboratory Radiation Protection Program, *Implementation of 10 CFR 835 Occupational Radiation Protection*, August 13, 2013
- ANL Radiation Protection Program 10 CFR 835 Crosswalk Matrix, October 2013 ANL RPP Independent Assessment, *Implementation of Triennial Assessment Findings*, Final Assessment Report, Rev. 0, May 30, 2013
- Argonne National Laboratory Radiological Safety Program Description, *Ensuring Radiological Safety for Argonne National Laboratory Workers*, October 31, 2013
- PMA-FY13-IA-01, *Independent Assessment of the Argonne Radiological Survey Program*, October 2012
- ANL RPP Triennial Assessment, *Functional Elements Organization/Administration and ALARA program*, Final Assessment Report, Rev. 0, October 2010
- ANL Radiation Protection Program Improvement Plan Effectiveness Review, 04/20/2012
- ANL Radiological Work Permits (eRWPs)
- HPP 7.5, *Bioassay Program Guidance*, Rev. 0, 12/1/2011
- HPP 3.0, *Performing Radiological Surveys*, Rev. 9, 10/01/2012
- HPP 6.3, *Fixed-Location Retrospective Air Sampling*, Rev. 7, 10/01/2013
- HPP 6.4, *Job Specific Air Sampling*, Rev. 3, 06/01/2012
- HPP 6.5, *Lapel Air Sampling*, Rev. 1, 04/01/2012
- HPP 9.1, *Radiological Work Permits*, Rev. 11, 04/22/2013
- HPP 9.2, *Contamination Control Requirements*, Rev. 1, 05/01/2013
- HPP 9.3, *Radiological Posting and Labeling*, Revision 3, 11/01/2012
- HPP 9.5, *Assessing Workplace Engineering Controls*, Rev. 2, 12/21/2013
- LMS-PROC-93, *Reviewing Radiological Work to Keep Personnel Exposure as Low as Reasonably Achievable*, Rev. 2, 01/28/2013
- LMS-PROC-140, *Radiological Work Permit*, Revision 2, 07/22/2013
- LMS-PROC-146, *External Dosimetry*, Rev. 0, 04/26/2013
- LMS-PROC-147, *Access Control*, Rev. 0, 03/11/2013
- LMS-PROC-172, *Posting of Radiological Control Areas and Labeling of Radioactive Materials*, Rev. 2, 01/18/2013
- LMS-PROC-200, *Local Work Planning and Control Implementing Procedures*, Rev. 3, 2/25/2013
- LMS-PROC-219, *Respiratory Protection*, Rev.0 9/24/2012
- NOD-OPS-203, *Defining Locations for Alpha and Beta Continuous Air Monitors for Nuclear Facilities*, Rev. 0, 09.01/2010
- IHOP-006, *Industrial Hygiene Operating Procedure, Respirator Program*, Rev. 5, August 2013
- Various ANL Radiological Awareness Reports 2012-2014 AGHCF and WMO facilities
- Various ANL Radiation Protection Department Technical Basis Documents
- Various ANL 10 CFR 835 Functional Area Self Assessments, 2012-2014
- Argonne Site Office (ASO) Annual Performance Plan October 1, 2012 –March 31, 2014
- Argonne Site Office Oversight Plan, 9/27/2012
- ASO Quality Assurance Program Description(QAPD), 3/22/2013
- ASO ES&H Function, Responsibilities and Authorities (FRA) Document
- Argonne Site Office SOP-26: Facility Representative Program

- Integrated Support Center Chicago Office Mission and Functions, 2/23/13.
- CAS Peer Review Report, March 2012

Facility Documents

WMO

- RWP 2014-SITE-007, *Transport/Transfer of Radioactive Material and Radioactive Waste by WMO*, March 2014
- RWP 2014-306-004, *Sorting and segregating waste and visual inspection in ARA/HCA and RA*, April 2014
- ALARA Review Record NWM-ALARA-2014-007, *Sorting and Segregation of RadWaste*, Rev. 0
- RWP 2014-331-002, *RH TRU Moves in the RWSF*, April 2014
- WMO-PROC-69, *Lifting Requirements in the Building 331 Shell*, Rev. 7, July 2013
- ANL Survey Report, 20140207 A_G 331 JSS 02, *Transfer RH TRU drums from cask to behind shield wall*, February 2014
- ALARA Review Record NWM-ALARA-2014-009, *RH TRU Moves in the RWSF*, Rev. 0
- WCD-13-WM-082, *Onsite transfer of RH Containers*, March 2013
- Job Plan# JP-14-WM-146, *Onsite Transfer of RH Containers*
- WMO-PROC-7, *Hazard Analysis and Control, On-Site Transfer of Radioactive and Mixed Waste to Waste Management Facilities*, Rev. 4, June 2009
- WCD-12-WM-066, *Work Planning and Control Worksheet, Nondestructive Assay*, May 2012
- WMO-PROC-25, *Sorting, Visually inspect, and package Radioactive Waste for Disposal*, Rev. 2, August 2013, and associated SOP Hazard Analysis
- WCD-11-WM-912, *Work Planning and Control Worksheet, Fire Protection Maintenance, Troubleshooting, Inspections in Buildings 306, 331, 331A, 331 shell and 303*
- Building 306 PermaCon (D165) *Defining Location for Air Monitor...*, January 2010

AGHCF

- RWP 2014-212-001, *AGHCF General Access*, April 2014
- RWP 2014-212-200, *AGHCF CY 2014 RH-TRU Drum Outload Campaigns*, Rev 7 and Rev 8, April 2014
- RWP 2014-212-236, Rev. 2 *CARIBU Source Transfers During Closed door CTA Operations*, February 2014
- RWP 2014-212-165 Rev. 1 *Post-CARIBU Decontamination*, March 2014
- ALARA Review Record NWM-2012-AGHCF-015, *RH-TRU out load*
- ALARA Review Record NWM-20140-AGHCF-0002, *CARIBU 1.76 Ci Source Transfer and Subsequent Decon*
- ALARA Review Record NWM-2012-AGHCF-016, *CARIBU 500 mCi Source Transfer*
- ANL Survey Report 20140409 WAS 212 JSS 02, *survey inside CTA for out load #40*, April 2014
- ANL Survey Report 20140411 G_H 212 JSS 01, *out load RH TRU waste*, April 2014
- AGHCF-OPS-305, *RH-TRU 30 Gallon Waste Drum Out-Loading*, 9/6/2013
- AGHCF-OPS-314, *RH-TRU 30 Gallon Lever Lock Waste Drum Out-Loading*, 9/6/2013
- NOD-AGHCF-OPS-201, *Operation of the Shield Doors*, 9/19/2011
- NWM-AGHCF-OO-119, Rev.0 *Operations Order, Use of the Bull Run Casks for out-loading Activities in the AGHCF*, July 2013