Independent Oversight Review of Radiation Protection Program Implementation at the Idaho Site

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Acronyms

ALARA	As Low As Reasonably Achievable
AMWTP	Advanced Mixed Waste Treatment Project
ATR	Advanced Test Reactor
BEA	Battelle Energy Alliance, LLC
CAM	Continuous Air Monitor
CFR	Code of Federal Regulations
CRAD	Criteria, Review, and Approach Document
CWI	CH2M-WG Idaho, LLC
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
DOE-ID	DOE Idaho Operations Office
EM	Office of Environmental Management
HFEF	Hot Fuel Examination Facility
HPT	Health Physics Technician
HSS	Office of Health, Safety and Security
ICP	Idaho Cleanup Project
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IRB	Incident Review Board
ITG	Idaho Treatment Group, LLC
MCP	Management Control Procedure
MFC	Materials and Fuels Complex
NE	Office of Nuclear Energy
NWCF	New Waste Calcining Facility
OFI	Opportunity for Improvement
OSHA	Occupational Safety and Health Administration
PAPR	Powered Air Purifying Respirator
PPE	Personal Protective Equipment
RadCon	Radiological Control
RCT	Radiation Control Technician
REC	Research and Education Campus
RH	Remote Handled
RH-TRU	Remote Handled Transuranic
RPP	Radiation Protection Program
RWMC	Radioactive Waste Management Complex
RWP	Radiological Work Permit
TRU	Transuranic
TWD	Technical Work Document
ZPPR	Zero Power Physics Reactor

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1.0 PURPOSE

This report documents an independent review of radiation protection program (RPP) implementation at the Idaho Site conducted by the U.S. Department of Energy (DOE) Office of Enforcement and Oversight (Independent Oversight) within the Office of Health, Safety and Security (HSS). The review was performed by the HSS Office of Safety and Emergency Management Evaluations and was carried out within the broader context of an ongoing program of targeted assessments of RPP implementation across the DOE complex at sites that have hazard category 1, 2, and 3 nuclear facilities. The purpose of this Independent Oversight targeted review effort is to evaluate the flowdown of occupational radiation protection requirements, as expressed in facility RPPs, to work planning, control, and execution processes. Independent Oversight accomplished this review by performing assessments that included activity-level observations.

This targeted review was performed at the Idaho Site from September 4 to 7, 2012. This report discusses the scope, background, results, conclusions, and opportunities for improvement resulting from this review, as well as items identified for further follow-up by HSS.

2.0 SCOPE

The Idaho Site is comprised of the Idaho National Laboratory (INL), the Idaho Cleanup Project (ICP), and the Advanced mixed Waste Treatment Project (AMWTP). The DOE Idaho Operations Office (DOE-ID) provides direction and oversight for the design and operation of the Idaho Site nuclear facilities for the DOE Headquarters Offices of Nuclear Energy (NE) and Environmental Management (EM); with NE being responsible for INL facilities and EM being responsible for ICP and AMWTP facilities. Within DOE-ID, the two line management organizations exercise responsibility for oversight of these nuclear facilities and their activities. The Deputy Manager for Operations Support is ultimately responsible for contractor oversight of the NE facilities, and under the Deputy Manager for ICP, oversight of the EM facilities is the responsibility of the Assistant Manager for Nuclear Safety and Performance.

The primary contractors responsible for the management and operation of the INL and ICP facilities are Battelle Energy Alliance, LLC (BEA) and CH2M-WG Idaho, LLC (CWI), respectively. Most of the Idaho Site nuclear facilities, which are categorized as hazard category 1, 2, or 3, pursuant to DOE-STD 1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*, are located at the Advanced Test Reactor (ATR) Complex, the Materials and Fuels Complex (MFC), the Idaho Nuclear Technology and Engineering Center (INTEC), and the Radioactive Waste Management Complex (RWMC). BEA operates the ATR Complex and MFC, while CWI operates the ICP facilities (e.g., INTEC and RWMC) except for those that are part of the AMWTP.

AMWTP is operated by a separate contractor, Idaho Treatment Group, LLC (ITG). Due to recent and ongoing oversight and improvement activities, the assessment of AMWTP has been deferred. Independent Oversight will review AMWTP RPP implementation after improvement activities that are currently under way have been completed and after DOE-ID has fully incorporated any resulting adjustments in its associated oversight processes.

For this review, Independent Oversight assessed the documented CWI and BEA processes for planning

radiological work and establishing radiological hazard controls, and then observed work activities to verify the effectiveness of the overall RPP implementation at selected Idaho Site facilities. In particular, Independent Oversight observed work activities at INTEC, RWMC, MFC, and ATR. Independent Oversight also conducted interviews of selected key personnel responsible for this subject area. The execution of this scope was guided by HSS Criteria, Review, and Approach Document (CRAD) 45-35, Rev. 1, *Occupational Radiation Protection Program Inspection Criteria, Approach, and Lines of Inquiry*.

3.0 BACKGROUND

Title 10 Code of Federal Regulations (CFR) Part 835, *Occupational Radiation Protection*, contains the requirements for developing, implementing, and maintaining an RPP. Title 10 CFR 835.101(a), *Radiation protection programs*, states that "A DOE activity shall be conducted in compliance with a documented radiation protection program (RPP) as approved by the DOE." This HSS targeted review area is intended to assess the contractors' compliance with 10 CFR Part 835 by observing the conduct of work activities involving radiological hazards.

In January 2011, BEA, the primary contractor responsible for the management and operation of INL, instituted a voluntary suspension of work requiring radiation controls (called "rad work"), beginning with the MFC. This action followed a history of poor performance with regard to radiological hazard controls, dating back many years. Between 2009 and early 2011, DOE-ID and BEA both identified that changes to, and management of, the INL occupational radiation protection program were ineffective. BEA therefore suspended radiological work to reassess the condition of the program, identify the major shortcomings, and develop a plan for corrective action. During this cessation of radiological work at INL, BEA identified weaknesses in key management positions and conducted independent reviews of its RPP, the radiological work planning process, and the overall work control process. Those reviews revealed additional weaknesses in access control for high radiation areas, instrumentation, and radiological worker training and qualification program effectiveness, as well as other functional areas. In addition to conducting those reviews, BEA replaced key management personnel at INL. BEA also began to develop a formal "Radiological Controls Road to Excellence Plan" for its occupational radiological protection program, with the intention of addressing all of the identified programmatic deficiencies. Among other activities, this plan initiated efforts to address human resource issues, update and upgrade training and procedures, upgrade the INL bioassay program, and more clearly define the roles and responsibilities of key radiation control personnel (e.g., radiation control supervisor, radiological engineer). Independent Oversight performed an independent assessment from July 25 through 28, 2011, to assess the state of the INL RPP, and to evaluate the effectiveness of the then recent enhancements. Independent Oversight did not evaluate the RPPs as implemented at the ICP or AMWTP facilities as part of that effort. The results of that assessment noted the ongoing improvement efforts, but highlighted a need for improvement in many additional areas of radiation protection and work control, specifically procedures and process execution. These results were documented in an HSS Independent Review Report issued in August 2011.

On November 8, 2011, the Zero Power Physics Reactor (ZPPR) facility, located within the MFC, experienced an accidental loss of control of radioactive transuranic (TRU) material that resulted in personnel and equipment contamination. An Accident Investigation Board found that there were still significant deficiencies in radiation control, work planning, and RPP implementation at INL. The Accident Investigation Board's report was issued in January 2012.

As the result of the ZPPR accident and the many previous events, BEA ceased all radiological work with transuranics at INL and, under the oversight of DOE-ID, began to re-evaluate its approach to improving radiological work practices. Following the conclusions and judgments of need expressed in the ZPPR Accident Investigation Board report, a corrective action plan was developed by BEA and approved by

DOE-ID. The planned improvements were documented by BEA in its project execution plan PLN-4145, *Radiological Controls Road to Excellence*, which intends to outline the use of an Integrated Safety Management System approach to "realign" the INL radiological control program. Work to satisfy this plan had made significant progress, but was still under way at the time Independent Oversight performed this current review.

There have not been a large number of events reported involving radiological hazards at the ICP facilities in the recent past.

4.0 RESULTS

The following sections discuss the observations made by Independent Oversight during this review. As discussed above, Independent Oversight reviewed the implementation of both the ICP and INL RPPs. Independent Oversight first reviewed all applicable documentation for these programs, but this review was designed to focus on activity-level observations as the primary means of assessment. The results of this review are discussed below.

Idaho National Laboratory

The BEA RPP is documented in PLN-260, *INL Radiation Protection Plan*, which covers BEA managed facilities or projects, their physical locations, and the personnel working at the facilities/projects. The INL PLN-260 thoroughly reflects an understanding of the applicable requirements of Part 835; however, the documents that support the implementation of the RPP (e.g., procedures and technical analyses) are not comprehensively referenced in the PLN-260 document. Therefore, the methods that INL uses to comply with and implement the requirements of Part 835 are not provided by, and cannot be discerned from, the PLN-260 RPP document alone. The specific facilities currently managed by BEA under this RPP are the ATR Complex, the Specific Manufacturing Capability (SMC), the Site Wide Complex (SWC), the MFC, and the Research and Education Campus (REC). (See OFI-1.)

The INL RPP is managed by a BEA Radiological Control Director, who reports directly to the BEA Environment, Safety and Health (ES&H) Director. The Radiological Control Director is supported by a senior radiation control manager, a radiological engineering manager, an instrumentation and dosimetry manager, and several support personnel. The BEA managed operating nuclear facilities each also have a dedicated radiological control manager who reports directly to the BEA Radiological Control Director. The ATR Radiological Control Manager also manages radiological operations for BEA's other radiological facilities located at the Central Facilities Area and at the Idaho Falls REC. Facility radiological support staff – radiation control technicians (RCTs) and health physics technicians (HPTs) – assigned to each location report directly to their respective radiological control managers located at ATR or MFC.

Advanced Test Reactor

Adequate radiation controls were determined to be established for ATR radiological activities observed by Independent Oversight. Work was well defined in work control documents for most activities, and the potential radiological hazards and associated requisite controls were adequately defined in radiological work permits (RWPs). Workers demonstrated appropriate radiation controls during donning and doffing of personal protective equipment (PPE), as well as appropriate self-survey and contamination control techniques while exiting radiological boundaries. Most hazards were adequately identified and analyzed prior to performing work, and the potential radiological hazards were adequately identified and characterized in RWPs, As Low As Reasonably Achievable (ALARA) management work sheets, and by

RCTs, for all jobs reviewed by Independent Oversight.

During several observed work evolutions radiation controls were employed without incident. These included the pre-job surveys of equipment prior to maintenance (including elevated work during crane inspection and maintenance), contamination surveys for free release of previously-used new fuel shipping containers, and RCT coverage of maintenance evolutions that included returning equipment air system components to service. As was seen in the July 2011 Independent Oversight review, computer-based access controls and RWP issuance is a strength that serves the facility well confirming workers' training status and ensuring that they are made aware of and acknowledge RWP requirements before conducting radiological work. The extensive use of engineering controls, in conjunction with a knowledgeable and professional radiation control staff, significantly benefits the site's ability to ensure that sound radiation controls are maintained.

During one work activity at the ATR fuel pool canal, several individuals were observed changing ion exchange system filters. During this evolution, workers were located on both the canal parapet and the reactor building floor; the contamination area was primarily limited to a roped-off area in the immediate area of the raised canal floor. Approximately six individuals were conducting hands-on activities at the canal's edge, while two individuals remained on the reactor floor below to provide support, including radiological surveillance and procedure reading functions. The workers observed to be conducting the ion filter exchange had donned the required anti-contamination PPE in accordance with the RWP assigned for this task. These workers included operators removing and replacing filters and RCTs providing radiological monitoring (including use of a Teletector and ion chamber and collection of swipes for determining removable contamination). The observed activities followed the respective procedure.

While the procedure addresses the slip and fall hazards that exist on the canal parapet and floor areas, Independent Oversight noted several concerns with how this work was conducted. Most individuals were observed to have to work at the shear edge of the platform and often leaned over the canal to retrieve the filters with long reach tools. One worker in particular, who was assigned radiological monitoring with a Teletector, was continuously required to reach across the width of the canal with arms extended and leaning the upper third of body mass over the canal edge to monitor materials as they were being raised out of the water. The procedure and PPE requirements addressed the drowning hazard for the approximately 20 to 40-foot depth of the canal by using a combination of flotation and rescue devices and the buddy system, which would provide warning of unsafe conditions and rescue if needed; however, no fall restraint was used although Occupational Safety and Health Administration (OSHA) standards require that fall protection be provided when working over dangerous equipment and machinery, regardless of the fall distance. (See OFI-2 and OFI-3.)

Although the ALARA Review and RWP are both intended to be comprehensive, the potential for immersion and exposure hazards was not assessed. Given the nature of the work – including reaching over the plane of the canal, the slippery conditions, and the required PPE utilized –, the potential for a head first fall into the canal does exist. However, the ALARA review did not assess the possibility of internal exposure from immersion, ingestion, inhalation and aspiration of contaminated water (including hot particles). Additionally, although workers at the canal edge used PPE protection against the drowning hazard (primarily flotation belts), the ALARA Review did not assess the direct exposure to the extremities or the whole body following the initial immersion, while sinking to some depth (potentially closer to the irradiated materials in some areas of the canal than at the surface of the water), or while remaining in the water and floating at the surface after PPE deployment and awaiting rescue or during the time to self-rescue. (See OFI-1.)

Furthermore, the ALARA Review and RWP require air sampling to monitor potential contamination and airborne hazards but provide no specific guidance. Independent Oversight noted that the placement of the

air sampler (on the building floor outside of the established contamination area boundary) did not appear to be representative of the workers' breathing zone. In total, the following observations were noted with regard to air sampling:

- The distance from the sampling head to the workers was at times several meters.
- Only one air sampler was used for a myriad of workers – some kneeling, some standing, and some leaning over the canal.
- The air flow in the area was not known by those directly involved in performing the work (judging by questions asked at the work site), and the air intake for the area appeared to be on the opposite side of the work area, potentially drawing contaminants away from the sampler; further, some workers were positioned between the sampler and the area's intake air vent.
- Lapel-type breathing zone air sampling was not considered for this work and is not routinely used at the ATR. (See OFI-2.)

Materials and Fuels Complex

The MFC is a prime testing center for advanced technologies associated with nuclear power systems. At the MFC, the Office of Nuclear Facilities Management supports National Energy Policy goals by maintaining and operating facilities required for advanced nuclear energy technology research and development and other initiatives, including the Global Nuclear Energy Partnership. The Independent Oversight review at MFC consisted of observations of radiological work at the Hot Fuel Examination Facility (HFEF), which involved several decontamination cell entries associated with repair and maintenance of hot cell structures.

Engineering and administrative controls are prevalent in MFC and were found to be used effectively to mitigate many radiological hazards. Radiological engineered controls consist of various containment and enclosure devices, such as gloveboxes, hot cells and hoods, and associated ventilation systems. Engineered controls are complemented by a variety of administrative controls, including RWPs, postings, administrative and operations procedures, and work instructions prepared to control particular activities. Postings and boundary controls throughout the facility were clear and legible. The use of extremity and multi-pack dosimetry, as well as remote telemetry to monitor real-time exposure conditions within the hot cell, was particularly robust and provided for comprehensive external exposure assessment and ALARA controls.

PPE donning and doffing practices were also performed appropriately, and radiological job coverage was effective. HPTs performing whole body frisks did so thoroughly and at the appropriate frisking speed for both alpha and beta contamination. The HPTs supporting operations at HFEF were knowledgeable and competent in performing radiation control functions.

Although positive aspects of radiation control practices were noted, Independent Oversight also determined that weaknesses in radiological work planning remain prevalent. Review of the work planning documentation and observation of this work identified various radiological work planning weaknesses that had the potential to impact the effectiveness of intended controls. These weaknesses include incomplete work planning in some areas, incomplete work scope definition and integration of work control documents, and lack of rigor in assessment and completion of all required elements of the ALARA review and RWP, as discussed in further detail below. (See OFI-4.)

HFEF Decontamination Cell entry work meets the criteria for high radiological hazard work requiring a full ALARA committee review. ALARA Review HFEF-2012-006 was performed and a resulting RWP, MFC2012171, was issued for the work. Prior to making the initial cell entry, a pre-job briefing was held.

Pre-job briefings serve as a final readiness check prior to performing work and are intended to communicate the scope, hazards, and controls to be employed during the work. They also serve as a forum to raise questions or concerns if necessary. While workers displayed a healthy questioning attitude, several pre-job briefings were needed before initiating the cell entry work due to incomplete radiological work planning. For example, during the first pre-job brief, it was determined that the Operating Instruction for cell entry and exit could not be performed as written because some steps were not applicable or had already been completed remotely, and a procedure field change was deemed necessary. A second pre-job brief, conducted after the field change was approved, raised questions about the actual scope of work to be performed that day. The task to be performed during this entry was for radiological characterization by an HPT only. This task was not specifically delineated in the RWP or technical work documents (TWDs). Instead, the RWP for the job (MFC-2012171) was written broadly to cover the entire repair work as one evolution, and was not appropriately subdivided into different tasks (e.g., characterization survey, specific work order completion) intended to be accomplished on different entries. During a third pre-job brief the next morning, just before the entry, there was uncertainty about where the job-specific air sampler needed to be placed, resulting in a request for a radiological engineer to review the situation and make a recommendation. While the pre-job brief is an appropriate forum for raising questions and concerns, the questions asked here indicate weaknesses in the work planning process, which should have addressed these topics at an earlier phase. (See OFI-4.)

Independent Oversight also noted incomplete definition and integration between work control documents. For example, radiological support functions, such as transporting and counting swipes, were not included in RWP MFC-2012171. The use of a separate standing RWP (MFC-20122010) to address this function was not identified in the ALARA review or other TWD, nor was the intended use of this RWP communicated during the pre-job briefs. RWP MFC-20122010 was not discussed at the pre-job briefs, and because its title states that it is for "low risk radiological activities," and because it defines radiological conditions and limits far below what are allowed for swipe sample results under RWP MFC2012171, it needed revision before being used for this activity. The need for separate RWPs and the intended interface between the two RWPs was not clear, and the documents did not identify proper actions and controls for evaluation of swipes and air samples with high levels of radioactivity. Similarly, not all of the specific work orders prepared for the maintenance activities contained the job-specific hazard and control information relevant to the work in the decontamination cell. For example, Work Order (WO) 163346-01 did not identify radiological hazards or the governing RWP and contained only generic language such as, "If entry into a radiation area is required, an RWP is required." (See OFI-4.)

Independent Oversight also observed several weaknesses in the quality and content of the required ALARA Review performed in support of the work. For example, as noted above, proper placement and location for the job-specific air samples was not adequately addressed during the ALARA Review nor specified in the RWP. Collection of a representative sample is necessary to ascertain airborne concentrations in order to validate the protection afforded by respiratory protection. The ALARA Review (and resulting RWP) required only a job-specific air sample to be taken, and provided no information about proper placement to obtain a representative sample, given the airflow patterns and strong negative pressure gradient into and within the cell. In a similar concern, the ALARA review did not provide the required discussion of specific bioassay requirements applicable to the work, including whether workers were already on, or needed to be on, a routine bioassay program. The ALARA Review made generic, unverified statements that there were no specified pre-job bioassay requirements for the described work tasks, and that workers were being monitored for internal exposure in accordance with Technical Evaluation (TEV) TEV-233 and Management Control Procedure (MCP) MCP-2246. These generic statements were found to be incorrect, and a separate programmatic concern about the routine bioassay program is discussed separately below. (See OFI-4.)

Other isolated planning weaknesses were noted, including incomplete flowdown of all relevant controls

from the ALARA Review to the RWP. While requirements presented in bold text in Sections 14-22 of the ALARA Review were properly included in the RWP, other relevant controls and requirements from the ALARA Review were not. For example, actions to be taken in the event of a loss of telemetry signal were not presented in the RWP; they were covered in the pre-job brief only when a question was asked. There was also unclear terminology used in the ALARA Review and RWP regarding the meaning of the term "decon cell access control point." Based on differences in respiratory protection controls and continuous air monitor (CAM) placement requirements, it was not clear whether this term meant the small area between the two doors separating the operating floor from the entry point to the Decontamination Cell (second door), or whether it meant the operating floor prior to entering the first door. Under a heading "Decon Cell Access Control Point," the RWP requires a full face air purifying respirator to access the posted airborne radioactivity area (ARA), which is a different level of respiratory protection than specified for entering the actual cell. In neither case would this refer to the operating floor area. The ALARA review provides separate placement of alpha and beta CAMs when pulling the shield plug (required at the radiological boundaries) and also at the entry point of the Decontamination Cell (presumably the small area between the two doors). The only CAMs in use were located at the radiological area boundaries established for contamination control on the operating floor. (See OFI-4.)

Lastly, it appeared that a choice of respiratory protection – powered air purifying respirator (PAPR) or supplied air – was offered, without documented consideration of the industrial hygiene or industrial safety hazards that might influence this decision (e.g., heat stress, working on ladders, snag potential). While the RWP allows PAPRs to be used, anecdotal evidence suggests that they were never considered for use because the breathing air system has always been used during cell entries. The potential for heat stress in the cell at the time of this entry was fairly low, given the relatively low air temperatures in the cell (i.e., 75-80 °F). The potential for airline snags or other negative conditions, such as ladder use, could make the PAPR a more appropriate and safer choice. It does not appear that the industrial hygiene organization was required to participate or formally concur in the selection and approval of respiratory protection for radiological work. (See OFI-4.)

In addition to the work planning weaknesses discussed above, a separate programmatic concern with respect to bioassay was also identified. Based on the information gathered during this review, it was determined that BEA's routine bioassay program at MFC lacks the formality and technical bases that are required by institutional requirements and are needed to ensure adequate control and assessment of potential internal exposures. One of the corrective actions following the 2007 HSS Integrated Safety Management review at MFC was to implement a routine bioassay program for MFC workers who have a reasonable potential for internal exposures in excess of 100 mrem. The method for determining the need for worker participation in the routine bioassay program, currently prescribed in MCP-2246, appropriately relies on the use of an airborne hazard index calculation for areas and/or operations. All workers involved in the HFEF Decontamination Cell work met the criteria requiring routine bioassay, based on the calculated and documented airborne hazard index. In addition, the level of participation by some categories of workers who may routinely access these areas, such as Facility Representatives, is not currently defined. The Internal Dosimetry Technical Lead is considering the use of occupancy estimates to better define which workers need to participate.

It was MFC's position that there is a routine bioassay program in place that uses an annual whole body count for assessment of internal exposure potential. However, while it was determined that some workers have been subjected to annual whole body counts, MFC still lacks a routine bioassay program that meets the requirements of MCP-2246, which includes a formally documented technical basis that justifies the type, participation, and frequency of bioassay. It is questionable whether or not routine whole body counts, which rely on the presence of gamma emitters as markers for alpha and beta emitters, are adequate to meet the objectives of the institutional program defined in TEV-233. Specifically, MCP-2246 requires the development of a technical basis document or ALARA review to support the bioassay

protocols to be employed. Further, Independent Oversight's review of bioassay records indicates that a significant percentage of workers who should be included in the routine program at MFC either have not been monitored at all, or have not had a minimum of one whole body count annually. MFC relies on informal correspondence rather than a systematic, formally defined method or procedure to enroll workers and ensure their continued participation the program. (See OFI-5.)

Idaho Cleanup Project

The ICP RPP is documented in PLN-260, *CWI Radiation Protection Program*, which covers CWI managed facilities or projects, their physical locations, and the personnel working at the facilities/projects. The ICP PLN-260 thoroughly reflects an understanding of the applicable requirements of Part 835; however, the documents that support the implementation of the RPP (e.g., procedures and technical analyses) are not comprehensively referenced in the PLN-260 document. Therefore, the methods that ICP uses to comply with and implement the requirements of Part 835 are not provided by, and cannot be discerned from, the PLN-260 RPP document alone. Some of the specific facilities currently managed by CWI under this RPP are: INTEC, RWMC, and MFC Decontamination & Decommissioning (D&D). (See OFI-1.)

The ICP RPP for each CWI project under the ICP (e.g., INTEC and RWMC), is implemented by an individual Radiological Control (RadCon) Manager. Each RadCon Manager leads an organization that provides RadCon support and radiological work planning services for a focused group of facilities with a shared mission. Each RadCon Manager maintains a staff of radiological work supervisors, radiological engineers, and RCTs to perform their given functions at the project level, with the CWI Radiological Control Director providing programmatic policy and oversight leadership for all of ICP. This de-centralized approach to managing radiation control activities appears to give CWI an enhanced capability to respond to the demands of the various facilities and radiological work evolutions. In addition, CWI makes regular use of what is referred to as a "Center of Excellence," comprised of the RadCon Managers and the Radiological Control Director, which convenes to develop solutions to exceptionally challenging radiological issues.

Radioactive Waste Management Complex

Adequate radiation controls were established for RWMC D&D activities. D&D work was well defined in work control documents for most activities observed by Independent Oversight. Workers demonstrated appropriate radiation controls during donning and doffing of PPE, as well as self-survey and contamination control techniques while exiting radiological boundaries. Most hazards were adequately identified and analyzed prior to performing work, and the potential radiological hazards were adequately identified and characterized in RWPs, ALARA management work sheets, and by RCTs for all jobs reviewed by the Independent Oversight.

During several observed work evolutions, radiation controls were employed without incident. These included the pre-job RWP briefings, surveys of equipment prior to operator use, contamination surveys of waste (batteries) before their removal from the contamination area, and radiological survey of Class D breathing air supply prior to use. As was the case at the ATR facility, computer-based access controls and RWP issuance is a strength that serves the facility well in confirming workers' training status and ensuring that individuals are made aware of and acknowledge RWP requirements before conducting radiological work. Significant effort has been put forth in the design and use of engineering controls where applicable. These controls, in conjunction with a knowledgeable and professional radiation control staff, significantly benefits the ability of the site to ensure that sound radiation controls are maintained. The extensive use of lapel-type breathing zone air sampling for each worker entering a potential airborne

radiation area, in conjunction with stationary air sampling and CAMs, significantly decreases the likelihood of missed internal exposures and helps ensure that the protection factors for respiratory protection equipment are not exceeded.

In one observed D&D work activity at the Accelerated Retrieval Project (ARP) - I, an individual breached an outer layer of anti-contamination PPE (Tyvek®) while attempting to service a manlift that had become disabled due to a filter failure and subsequent motor overheating. During this evolution, the worker's sleeve appeared to come into contact with a hot surface (either motor or exhaust component), causing the outer Tyvek to locally melt. Sensing the heat and observing the failure of the outer layer of anti-contamination clothing, the worker immediately notified the RCT providing job coverage in the area and was immediately escorted from the area and reviewed for potential damage to the inner layer of PPE. Once the PPE was deemed intact (including survey), the worker was allowed to dress in new PPE and return to work. Subsequent fact-finding was held using the site's Incident Review Board (IRB) process; although not required by procedure. The IRB concluded that the filters had become plugged in the past, primarily caused by the sprayed fixative (Blue Max) being taken in through the manlift air intake and causing premature filter failure. The work was not discussed during the pre-job brief that day, as the equipment failure was not foreseen. It is possible that workers in the past waited for the engine to cool down before changing the filter, thereby avoiding this hazard. Additionally, the specific design of the equipment and filter placement may have contributed to the worker coming into contact with a hot surface. The IRB requested interim measures be taken to prevent recurrence, aimed at preventing filter clogging while in use and limiting the work on equipment internal components while equipment is still hot. These interim measures included having the filter housing inspected on this piece of equipment to determine the filter's proximity to hot surfaces and considering the options for changing filters more frequently while the equipment is cold, perhaps at the start of each day.

While these interim measures are appropriate, Independent Oversight noted several concerns with respect to how this work was planned and conducted. First, although maintaining equipment is within the scope of work authorized in work control documentation, it appears that workers or supervisors did not consult the equipment service manual for precautions related to working on the equipment while hot. A reliance on workers' skill of the craft to resolve these types of issues, in lieu of developing a specific plan of action in response to equipment failure, does not ensure that an appropriate level of hazard analysis is performed. Also, during the IRB process, it was noted that this type of equipment failure had occurred previously while spraying fixative. The worker stated that this type of filter replacement had been required before and that he "had not thought about the heat, as in the past equipment may have cooled while waiting for the filter to arrive." Additionally, although the RWP and ALARA Review for D&D work appropriately identified PPE to protect against cutting, burning, and welding activities and puncture resistance against sharps, these extra levels of protection were not employed for this work evolution because the work planning had not sufficiently analyzed the potential thermal hazard from equipment maintenance and identified these additional thermal sources to the RadCon organization. Given the potential radionuclides of concern encountered during waste retrieval activities and their presence during D&D activities, it is of high importance to plan sufficiently to ensure that the risks of PPE breach and the potential for burns and/or injection of radiological contaminants are minimized. (See OFI-6.)

Idaho Nuclear Technology and Engineering Center

Independent Oversight observed radiological work activities at the New Waste Calcining Facility (NWCF) of INTEC. One such work activity involved the receipt of an empty remote handled transuranic waste (RH-TRU) 72-B waste shipping cask, and then loading of this cask with a hot (radioactively) removable lid canister (RLC). Though there are radiation hazards associated with this work, most of the complexities associated with the process involve challenging hoisting and rigging operations.

Adequate radiation controls were established for this observed work activity. Workers demonstrated appropriate survey and contamination control techniques while work was being conducted. Hazards were adequately identified and analyzed prior to performing work, and the potential radiological hazards were adequately identified and characterized in RWPs, ALARA management work sheets, and by RCTs associated with this work activity. Independent Oversight observed that this operation was governed by no fewer than three separate procedures, one of which belongs to the Waste Isolation Pilot Plant (DOE/WIPP), which is the owner of the 72-B cask. Nonetheless, the supervision, operators, and RCTs involved in this work activity proved to be quite thorough, deliberate, and proficient in executing the governing procedures, and most involved appeared to be quite familiar with the entire process.

Independent Oversight did, however, note that the RH-TRU canister loading area of the NWCF, which was used for this work activity, is a dynamic environment, with building superstructures (e.g., overhead crane) and the position and characterization of the source term itself changing from operation to operation. To protect workers from direct shine dose, the facility uses "jersey bouncers," concrete block-type barriers, configured as shielding. The ALARA Review for the associated RWP (RWP-31011104 02) documents a calculation of the attenuation credit taken for these barriers; however, there is no discussion of skyshine (i.e., radiation of a primary gamma source scattered to a target atmospherically or from points above that target). The strength of the typical RH-TRU source term seen in these operations indicates that skyshine is likely to be negligible. Nevertheless, the ALARA review did not discuss or address skyshine as a potential radiological hazard associated with waste handling in the NWCF, given the design of the facility. (See OFI-8.)

5.0 CONCLUSIONS

For most work activities observed by Independent Oversight at the Idaho Site, radiation controls were effectively implemented. Management exhibited an expectation for radiological work to be performed safely, and the workforce understands this expectation. Management also provided the resources and time for planning and safely performing radiological work, and the workforce demonstrated a high level of awareness of radiation controls and care in performing work. Further, systematic radiological work control processes have been established and implemented, and radiological work was defined in sufficient detail to support hazard analysis, which was effective in identifying most radiological hazards. Appropriate radiation controls were included in RWPs and work packages for most observed work, and the workforce followed these controls. Therefore, Independent Oversight can conclude that, for most of the work that was observed, both contractors appropriately implemented their radiation protection programs for INL and ICP.

However, continued management attention is needed in the conduct of ALARA engineering reviews and analysis and the flowdown of radiological hazard controls into RWPs for both contractors. Additionally, recent challenges regarding the effective execution of planning processes associated with radiological work have been identified through various reviews and assessments, and though considerable work is under way, at MFC in particular, Independent Oversight has identified some opportunities for improvement that may aid this effort. The opportunities for improvement discussed in Section 6 should be considered in ongoing site efforts to improve the implementation of Idaho Site RPPs and the performance of radiological work at the Idaho Site.

6.0 OPPORTUNITIES FOR IMPROVEMENT

During the review, Independent Oversight identified several opportunities for improvement (OFIs). The DOE-ID oversight process identifies issues as concerns, findings, or observations. An observation

represents a "situation that is presently in conformance with requirements but has the potential for future problems, deficiencies, failures, or adverse conditions, etc., based upon the assessor's judgment." A finding is a "failure to perform a specified action contrary to specific requirements" and can be based on requirements that "range from laws to contractor facility level procedures that if left unchecked could result in an adverse condition or outcome." Observations closely approximate OFIs, which, according to Independent Oversight protocols, are "suggestions offered by the Independent Oversight appraisal team that may assist line management in identifying options and potential solutions to various issues identified during the conduct of the appraisal." The OFIs from this Independent Oversight review are provided to DOE-ID for evaluation and follow-up in accordance with site procedures and processes.

Idaho Site

OFI-1: Consider improving both the INL and ICP RPP compliance matrices to provide a more complete linkage to specific implementing mechanisms and technical basis documents that support the commitment basis for each specific requirement.

- Conduct a gap analysis to identify areas where the INL and ICP compliance matrices lack clarity and linkage to specific implementing procedures and technical basis documents intended to satisfy RPP commitments.
- Revise each compliance matrix to include appropriate references to implementing procedures and technical basis documents.

Idaho National Laboratory

Advanced Test Reactor

OFI-2: Strengthen ALARA review and RWP for control of work in the canal parapet area.

- Analyze the potential internal exposure from ingestion, inhalation, or aspiration of contaminated pool/canal water (including hot particles) in the event of immersion of a worker.
- Analyze the potential external exposure to extremities and whole body, in the event of immersion of a worker.
- Provide additional guidance for placement of air samplers to ensure that sampling is representative of the workers' breathing zone.
- Consider the use of lapel-type breathing zone air samplers.

OFI-3: Enhance fall protection.

- Revisit the use of fall restraint systems to minimize the potential for immersion. Systems that have been deployed in recent years throughout the DOE complex have successfully dealt with unencumbered movement, including reaching, use of tools, etc.
- Consider the potential applicability of OSHA requirements for providing fall protection during work over dangerous equipment and machinery, regardless of the fall distance.
- Consider applying a combination of fall protection techniques to minimize the potential for immersion, including guardrails, toe boards, tie-off points, and fall restraint systems.

Materials and Fuels Complex

OFI-4: Improve the implementation of the RWP and ALARA review processes.

- Develop and implement RWP and ALARA review procedure guidance or writers guides that define the proper completion and minimum content expectations for various sections of both RWPs and ALARA reviews.
- Conduct additional training of RadCon staff regarding expectations for properly defining work scope and radiation controls and for ensuring their clarity in RWPs.
- Establish a mechanism or revise RWP software to ensure that RWPs can be broken down or subdivided into the multiple tasks needed to complete the work so that controls are sufficiently tailored to the specific work being performed each day or shift.
- Ensure that all RWPs intended for use during a single work evolution are appropriately identified in work planning documents and briefed prior to work.
- Ensure that all relevant controls defined in the ALARA review are incorporated into the RWP or repeated in the ALARA review sections that require flowdown to the RWP.
- Establish a mechanism to ensure that the industrial hygiene organization reviews and concurs with RWPs that require respiratory protection in order to evaluate potential industrial safety and hygiene risks, as well as radiological concerns.

OFI-5: Formalize the routine bioassay program so that it is adequately supported by appropriate technical basis documentation, as required by institutional procedures, and that it provides formal mechanisms to ensure that all workers who are required to be monitored are appropriately enrolled and current on their bioassays before they are allowed to work.

- Determine root causes and establish corrective actions for known instances of not following applicable institutional and procedural requirements associated with implementation of the routine bioassay program at MFC. This process should result in the establishment of suitable technical basis documentation to support the type, participation, and frequency of bioassay.
- Proceduralize the selection, enrollment, and verification processes for routine bioassay implementation.
- Establish an RWP field that can be used to establish and/or verify bioassay requirements (routine and/or job-specific) applicable to the given work and location.
- Prepare additional training for radiological engineers to convey the expectation that bioassay discussions in ALARA reviews are to be complete and address the specific details listed on the ALARA review form. Generic assumptions and statements concerning bioassay should be avoided, or at least verified with objective evidence, in the ALARA review.

Idaho Cleanup Project

Radioactive Waste Management Complex

OFI-6: Strengthen hazard analysis and control for work considered off normal or reactive in nature.

- Revise procedures and training to ensure that work to be performed in response to equipment failures take into consideration an analysis of potential hazards that may be introduced.
- Assess hazards associated with repair or maintenance of equipment, utilizing equipment service manuals or input from maintenance personnel who routinely service such equipment, to augment the skill of the craft of D&D workers in this area.

OFI-7: Enhance RWP content.

- Consider revising the current PPE Category that provides for protection against "hot work" (cutting, burning, and welding) to include working with thermally hot sources, where the addition of barriers may be required to protect radiological PPE from degradation.
- Consider adding a limiting condition for working conditions, which may place PPE at increased risk of damage and/or degradation.

Idaho Nuclear Technology and Engineering Center

OFI-8: Assess and discuss skyshine hazards in the context of radioactive waste handling when planning radiological work activities. Use the ALARA Review process to determine whether skyshine will be a potential hazard for the given work activity.

7.0 FOLLOW-UP ITEMS

Independent Oversight will return to the Idaho Site to assess the implementation of the AMWTP radiation protection program by the primary contractor, ITG.

Appendix A
Supplemental Information

Dates of Review

Onsite Review: September 4-7, 2012

Office of Health, Safety and Security Management

Glenn S. Podonsky, Chief Health, Safety and Security Officer
William A. Eckroade, Principal Deputy Chief for Mission Support Operations
John S. Boulden III, Director, Office of Enforcement and Oversight
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Quality Review Board

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