Independent Oversight Review
of the Lawrence Livermore National Laboratory
Radiological Controls Activity-Level Implementation

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Office of Environment, Safety and Health Assessments
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Acronyms

ALARA	As Low As Reasonably Achievable
CA	Contamination Area
CAM	Continuous Air Monitor
CFR	Code of Federal Regulations
CRAD	Criteria, Review and Approach Document
CZ	Contamination Zone
DAP	Discipline Action Plan
DLP	Diagnostic Load Package
DOE	U.S. Department of Energy
DOP	Deliberate Operations Plan
EA	Office of Enterprise Assessments
ES&H	Environment, Safety and Health
FAM	Functional Area Manager
FR	Facility Representative
FSP	Facility Safety Plan
FY	Fiscal Year
H&ST	Health and Safety Technician
HAZWOPER	Hazardous Waste Operations and Emergency Response
HP	Health Physics
HSS	DOE Office of Health, Safety and Security
ISM	Integrated Safety Management
IWS	Integration Work Sheet
LAW	Large Area Wipe
LFO	Livermore Field Office
LLNL	Lawrence Livermore National Laboratory
LLNS	Lawrence Livermore National Security, LLC
LO/TO	Lock-Out/Tag-Out
MAP	Master Assessment Plan
MAS	Master Assessment Schedule
MDA	Minimal Detectable Activity
nCi	nanoCurie
NIF	National Ignition Facility
NMTP	Nuclear Materials Technology Program
NNSA	National Nuclear Security Administration
NRCT	NIF Radiation Control Technician
OFI	Opportunity for Improvement
OSP	Operational Safety Plan
PLS	Physical and Life Sciences
PPE	Personal Protective Equipment
RBA	Radiological Buffer Area
RCT	Radiation Control Technician
RHWM	Radioactive and Hazardous Waste Management
RP	Radiation Protection
RPP	Radiation Protection Program
RWP	Radiation Work Permit
SME	Subject Matter Expert
TBD	Technical Basis Document

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1.0 PURPOSE

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted a targeted assessment of radiation protection program (RPP) activity-level implementation performed by Lawrence Livermore National Security, LLC (LLNS) at Lawrence Livermore National Laboratory (LLNL) Radioactive and Hazardous Waste Management (RHWM) Storage Facilities, National Ignition Facility (NIF), and other selected radiological facilities.

EA conducted this assessment 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, including National Nuclear Security Administration (NNSA) sites that have hazard category 1, 2, and 3 nuclear facilities. The purpose of these facility-specific EA targeted assessments is to evaluate the flowdown of occupational radiation protection (RP) requirements (as expressed in facility RPPs) into work planning, control, and execution processes, such as radiological work authorizations that include radiation work permits (RWPs), integrated work sheets (IWSs), and other technical work documents. To meet the goals of the targeted assessment, EA performs assessments that are primarily driven by activity-level observations. When sufficient data has been collected, EA will develop a report with a compiled analysis of the performance of RPP activity-level implementation throughout the DOE complex.

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. This targeted assessment was performed from March 3-21, 2014, and May 12-16, 2014. An observer from the Defense Nuclear Facilities Safety Board (DNFSB) was also present during much of the onsite portion of the review. This individual accompanied EA team members during certain inspection activities and observations. Also, one or more LLNL representatives accompanied each EA team member during field work observations. This report discusses the scope, background, methodology, results, and conclusions of the assessment, as well as findings and opportunities for improvement (OFIs) and items identified for further follow-up by EA.

2.0 SCOPE

The scope of this assessment is defined in the document entitled, "Plan for the Independent Oversight targeted Review of Activity Level Implementation of the Radiological Controls at the Lawrence Livermore National Laboratory," dated October 2, 2013. The principal focus of the assessment is activity-level implementation of radiological requirements at the LLNL RHWM Storage Facilities, NIF, and selected radiological facilities within the Physical and Life Sciences (PLS) Directorate. The specific scope of the assessment included RPP organization and administration; radiological work planning, exposure, and contamination controls; and radiological surveillance and monitoring. This EA assessment also evaluated the effectiveness of the NNSA Livermore Field Office (LFO) oversight of laboratory implementation of RPP.

3.0 BACKGROUND

LFO oversees LLNL and is responsible for administering the performance-based contract, executing assigned NNSA and DOE programs, and conducting oversight of work performed at LLNL in support of NNSA requirements and priorities. LLNL's primary mission is to strengthen U.S. security through development and application of world-class science and technology to enhance the nation's defense; reduce the global threat from terrorism and weapons of mass destruction; and respond with vision, quality, integrity, and technical excellence to scientific issues and national importance. LLNS is a partnership that includes the University of California, the Babcock and Wilcox Company, Bechtel National, Inc., the Washington Division of URS Corporation, and Battelle.

The EA assessment program is designed to enhance DOE safety and security programs by providing DOE and contractor managers, Congress, and other stakeholders with an independent assessment 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 of Energy. The program is described in and governed by DOE Order 227.1, *Independent Oversight Program*, a comprehensive set of internal protocols, and CRADs. Radiological controls activity-level implementation was identified as an EA targeted assessment area for 2013 in a memorandum from EA's predecessor organization to DOE senior line management, *Independent Oversight of Nuclear Safety – Targeted Review Areas Starting in FY 2013*, dated November 6, 2012.

Title 10 CFR Part 835, *Occupational Radiation Protection*, establishes 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 radiation protection program (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 LLNL RPP is documented in a LLNL document entitled *LLNL Radiation Protection Program (RPP) Rev. 9.3, Implementation of 10 CFR 835, Occupational Radiation Protection*, January 31, 2012, approved by LFO April 10, 2012. The scope of applicability for the RPP, as defined by LLNL, applies to each LLNL operation and facility that could result in the occupational exposure of an individual to radiation or radioactive materials. Therefore, the LLNL RPP covers the operations reviewed during this assessment.

4.0 METHODOLOGY

The EA assessment process was driven by the inspection criteria identified in HSS CRAD 45-35 Rev. 1 *Occupational Radiation Protection Program Inspection Criteria, Approach, and Lines of Inquiry*, dated December 4, 2012. Specifically, EA evaluated selected lines of inquiry associated with activity-level work control contained in Sections A, B, and C of CRAD 45-35.

Additional lines of inquiry from HSS CRAD 45-35 were used when EA evaluated programmatic aspects of the RPP that were relevant to the primary focus of this assessment. The following secondary areas were reviewed only to the extent that they supported assessment of the primary criteria:

- Radiological postings, access, and materials accountability and controls
- External and internal dosimetry
- Radiological training and qualifications
- Radiological records.

This assessment also used elements of HSS CRAD 45-21, Rev 1, *Feedback and Continuous Improvement Inspection Criteria and Approach – DOE Field Element*, to collect and analyze data on field office oversight activities.

5.0 RESULTS

During this assessment, EA reviewed the effectiveness of the flowdown of occupational RP requirements to work planning, control, and execution processes at LLNL RHWM Storage Facilities, operated by Nuclear Materials Technology Program (NMTP); NIF, operated by Photon Sciences Directorate; and radiological research and development activities conducted by the PLS Directorate at Buildings 235 and 151. EA also reviewed the details and response by NMTP to a Pu-238 contamination event that occurred at Building 332 in the Superblock during the assessment. Results of this assessment are based on a sampling of data and work that was ongoing at the time of the assessment, and are not intended to represent a full programmatic assessment of the site RPP.

5.1 Radiation Protection Organization and Administration

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

The LLNL site maintains an effective RP infrastructure staffed by qualified, experienced personnel. The LLNL RPP is managed by the LLNL Radiological Control Manager, who reports directly to the LLNL Environment, Safety and Health (ES&H) Director. The ES&H Director is a direct report to the Deputy Laboratory Director. The Radiological Control Manager has a staff of health physicists necessary to support RP infrastructure needs such as maintenance of document hierarchy, internal and external dosimetry, radiological measurements and instrument calibration, and related functions. In addition to the site Radiological Control Manager, two ES&H team leaders report directly to the ES&H Director. These individuals manage ES&H team 1 and ES&H team 2, which are deployed to the line organizations to assist line management in properly implementing RP and ES&H requirements. ES&H team 1 is assigned to LLNL nuclear facilities operated by NMTP, while ES&H team 2 covers all other LLNL facilities that perform radiological work. Each ES&H team leader has a deputy team leader and a radiological support staff including health physicists, technical supervisors, health and safety technicians (H&STs), and radiation control technicians (RCTs) at individual facilities across the site. H&STs maintain DOE RCT qualifications but are also trained and qualified to support other safety functions such as industrial hygiene monitoring. The NIF facility, due to its unique nature and operations, has two resident line management health physicists on its staff, including the NIF Radiological Operations Director and the NIF Radiation Safety Officer. These individuals work closely with ES&H team 2 personnel in management of RP operations associated with NIF operations. A memorandum of understanding is in place between NIF and the ES&H Division that outlines roles and responsibilities and interface agreements.

EA noted that a significant number of ES&H radiological control personnel have professional certifications such as certified health physicist and/or have advanced degrees in health physics (HP) or related disciplines, as well as years of applied RP experience. Based on EA observations, the health physicist and H&ST/RCT personnel were knowledgeable of the operational issues and capable of performing their responsibilities.

Document 20.1, Sections 3.6 and Appendix B, establish the conduct of a formal internal assessment program to assess the RPP and evaluate strengths, weaknesses, and areas of vulnerability and

noncompliance. All functional elements of the RPP are evaluated every three years. EA reviewed several recent radiological functional area assessments and found them to be of sufficient scope and quality to effect feedback and improvement in the topical area. Deficiencies and OFIs were clearly identified, and issues were being formally tracked and managed to closure using the site issues tracking system.

The LLNL RPP is documented in *LLNL Radiation Protection Program (RPP) Rev. 9.3, Implementation of 10 CFR 835, Occupational Radiation Protection*, dated January 31, 2012, and approved by DOE April 10, 2012. To further define expectations, LLNL has developed appropriate programmatic RP documentation that includes management policy statements and requirements documents, implementing procedures, and technical basis documents (TBDs). While LLNL maintains a crosswalk showing where each 10 CFR 835 requirement is addressed by LLNL's programmatic RP documentation and procedures, this information is not formally linked to the DOE-approved RPP. Section III.B of the RPP specifically states that "*the RPP takes precedence over other LLNL documents*" and that "*the LLNL RPP does not invoke any LLNL implementation documents (e.g., Volume II of the ES&H Manual, Occupational Radiation Protection, Documents 20.1, 20.2, 20.3, and 22.6).*" Thus, the RPP insufficiently defines the manner in which the RPP intends to meet the compliance commitments. (See **OFI-LLNL-1**.)

The following non-mandatory guidance, excerpted from the DOE Guide 441.1-1C, *Radiation Protection Programs Guide*, Section 3.1, provides a suggested means for demonstrating compliance with 10 CFR 835 in this area:

> *The approved RPP details how a DOE activity shall be in compliance with 10 CFR 835 and should identify the functional elements appropriate for that activity. Additional documentation should be developed and maintained to supplement the approved RPP to demonstrate that an RPP can be effectively managed and administered to achieve compliance with 10 CFR 835. This documentation typically includes a site radiological control manual developed to the guidance contained in the RCS [Radiological Control Standard, DOE-STD-1098-99], as well as detailed implementing procedures, appropriate management policy statements, and technical basis documentation. While this documentation need not be part of the RPP, it should be clearly linked to the compliance commitments contained 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)

The LLNL institutional work control process is defined in Environment, Safety and Health (ES&H) Manual Document 2.2, *LLNL Institution-Wide Work Control Process*. The requirements provided in Document 2.2 provide for a systematic approach to hazard analysis and control of all hazards, including radiological, and describes the basic integrated safety management (ISM) system processes to be followed at the activity/task level to ensure that hazards associated with all work are identified and analyzed and that appropriate controls are implemented and followed. Specific radiological work planning requirements are further delineated in ES&H Manual 20.1 Section 5.0.

The institutional processes allow implementing organizations to apply a graded approach for classifying and categorizing work according to the level of complexity and hazards associated with the work. Most work with radioactive materials and in radiological areas at LLNL require an IWS or equivalent written

work authorization that has been developed with the involvement of workers and subject matter experts (SMEs) in the analysis of hazards and determination of controls. Radiological work observed by the EA team spanned several LLNL directorates, each of which uses slightly different tailored mechanisms for identifying and controlling radiological hazards at the activity level. While institutional requirements stipulate the IWS as the preferred mechanism, equivalent mechanisms are allowed, and for the facilities reviewed, these mechanisms consisted of a combination of the following: IWSs at PLS and RHWM, work permits and operational safety plans (OSPs) at RHWM and Superblock, and RWPs at NIF. Regardless of the mechanisms used, ES&H manual requirements for work planning stated in Document 2.2 and 20.1 must be followed. Overall, the review of selected directorates' radiological work indicates that radiological work authorization documents (whether IWSs, safety plans, RWPs, and/or work permits) have been developed with appropriate ES&H team health physicist involvement and concurrence.

The following sections outline EA's assessment of radiological work planning, exposure, and contamination control effectiveness at LLNL facilities reviewed during this assessment.

National Ignition Facility

The NIF Radiological and Beryllium Control Manual (referred to as OSP Appendix L) is a comprehensive document that describes in detail the hazards and controls associated with operations at NIF. This includes methods for managing radiation hazards and radioactive material and hazardous materials (particularly beryllium, uranium, and resulting fission and activation products) used in NIF targets during NIF operations. Ionizing radiation hazards at NIF include potential for both prompt and delayed radiation sources. Prompt radiation sources that may be created during a shot include low energy x-rays from laser interactions with target material, as well as prompt neutron and gamma radiation from any targets that contain deuterium and/or tritium (e.g., Fuel Shots). Delayed sources of radiation include radioactivity that is generated in NIF target materials, equipment, structures, and cooling water that may result from nuclear reactions, primarily neutron capture and fission. NIF targets that contain radioactive or hazardous materials can be dispersed during a shot, which can result in radioactive contamination of the target chamber and support systems. Delayed sources include activated target assembly materials, related diagnostics and positioners, fission products from fission of depleted uranium in the hohlraum, uranium isotopes from the hohlraum, and tritiated particulates.

External radiation hazards at NIF are well controlled through use of administrative and engineered access control systems and procedures that prevent individual occupancy in any area of the facility that could result in radiation exposures in excess of 5 millirem (mrem) following a shot. Control is accomplished through a combination of facility shielding including shield doors on each level, and redundant systems including postings, individual electronic entry control systems (access key station tokens), and comprehensive administrative sweep procedures. Prior to and following a shot, target bay entrances are posted as radiation areas in restricted or controlled access entry modes. Target bay area re-entry following a fuel shot is made by radiological control personnel using an operations procedure and RWP. For each target bay level, dose rates are measured while opening the shield door at contact with the personnel door and must be below 1 milliroentgens per hour (mR/hr) at the personnel door in order to proceed (hold point). If necessary, additional decay time is added and the door survey repeated until dose rates are below 1 mR/hr. Comprehensive radiation surveys are then performed throughout the NIF target bay levels at locations specified in the procedure. Routine personnel target bay access is restored when average general area dose rates are verified to be less than 3 mR/hr and any localized radiation areas within the target bay are posted. Operational experience to date is such that dose rates have been well below these thresholds, but could increase with shots of progressively higher neutron yields.

Currently, the principal radiation hazard to workers at NIF is the potential for airborne and particulate tritium contamination during equipment configuration work performed following a shot, and in

preparation for the next shot. This work involves accessing the internals of closed systems (i.e. the confinement envelope), and handling, removing, and installing new equipment and components. While fission product and uranium contamination was deemed a possibility during initial development of OSP Appendix L, operational experience and radiological surveys performed following shots with the neutron yields achieved to date indicate no expectation for detectable beta-gamma contamination from fission product or uranium. Other radiological hazards include potential for low levels of external radiation exposure from activated materials and components. All workers are required to wear LLNL thermoluminescent dosimeters for NIF access. In addition, all workers signing in on an RWP for hands on work with systems or components, or in posted radiation areas, must wear electronic pocket dosimeters which track activity specific exposure rates and accumulated radiation exposures during work.

Radiological controls for management of contamination and airborne radioactivity include establishing posted contamination zones (CZs) around accessible confinement envelope enclosures, radiological air sampling and monitoring, and using personal protective equipment (PPE) during hands on work in these areas. RWPs are the principal administrative mechanism used to control work with potentially contaminated systems and components, including both radiological contamination and beryllium. While workers and staff were very knowledgeable in NIF hazards and operations, EA noted that RWPs governing observed work contained insufficient task breakdown to accurately and clearly convey the hazards and controls associated with the specific work. Specifically, the scope and span of control of some RWPs was too broad to permit effective analysis and communication of task specific hazards, resulting in extensive use of conditional statements with controls for hazards that were irrelevant to the specific work being performed. The following examples are based on observation of work involving installation/removal of snouts and attachments governed by RWP 13-004 rev. 04, DIM and SXI Operations: (See **OFI-LLNL-2**.)

- The RWP authorizes five different tasks including installation/removal of snouts and attachments; diagnostic load package (DLP) cart exchanges; maintenance inside the vessel or in general CZ area; closed loop cooling water maintenance; and transport of snouts, DLP carts, and related equipment. Each of these tasks differs in the level of hazards and controls, as well as method of accomplishment. For example, closed loop cooling water maintenance could include splashing hazards, which is different than the hazards associated with accessing a snout. Similarly, certain vessel maintenance or access requires the workers feet to leave the ground outside the vessel, which invokes different hazards and controls.

  Document 2.2 outlines LLNL institutional work planning expectations associated with the use of IWSs or equivalent mechanisms. The following excerpts are taken from Sections 2.1.1, 2.2.2, and 2.4.3.1.

  The planner/RI shall identify the specific tasks necessary to accomplish the scope of work. The tasks should be discrete and discernible. A clear task description effectively communicates to the workers what they are allowed to do and the boundaries of the authorized task(s), material(s), equipment, and work location(s) for work. . . .

  The hazard analysis process must ensure that hazards and their potential impacts on workers, the public, and the environment are adequately identified, quantified where appropriate [e.g., for high noise levels, dose rates, respiratory hazards, or the extent of a Radiation-Generating Device (RGD) impact zone], and documented for the scope of work being assessed.

  The IWS work package must describe and document the scope of the work broken down to the task level, the location, and responsible management, and identify and document the task-associated hazards and controls.

While the specific task titles are appropriately defined and documented in the work scope section of the RWP, hazards and controls for all the tasks in aggregate are lumped together in the remainder of the RWP, rather than for each task as called for in Document 2.2. This practice has resulted in numerous conditional statements in the body of the RWP with controls extraneous to the specific work being performed. The resulting RWP is difficult to follow and not well tailored to the specific work being performed.

- The expected radiological and beryllium conditions for the work were not documented or accurately reflected by the RWP as required by Document 20.2 and OSP Appendix L. The only radiological or beryllium information provided were hold points far above expected conditions for the work. For the evolution performed and neutron yield of the prior shot, there was no expectation for beryllium or beta-gamma contamination, or airborne beta-gamma radioactivity. No posted beryllium control zones were in effect. However the RWP included hold points of 100,000 disintegrations per minute (dpm)/100 square centimeters (cm2) beta-gamma, 1 derived air concentration beta-gamma airborne, 0.2 micrograms (ug) per cubic meter of air beryllium(Be) airborne, and 0.2 ug/100cm2 Be surface contamination, none of which were being monitored for or evaluated during work. Actual radiological conditions at even fractions of the hold point values for beta-gamma contamination and air activity would require different radiological controls than were specified in this RWP (e.g. personnel frisking and respiratory protection). Operational experience to date has not revealed the potential for contaminants other than tritium.

- The RWP NIF RCT (NRCT) coverage requirements are stated as "intermittent" in Section 3100, "NRCT Coverage." However, at least five conditions are stated elsewhere in the RWP where "continuous coverage" or NRCT presence is required, one of which is listed in section 3100. HP-FO-103 provides expectations for describing job coverage requirements by the tasks authorized in the technical work document.

- Undefined acronyms are extensively used in the body of the RWP, not all of which may be known to all individuals expected to work under or support RWP implementation.

EA identified similar concerns in other NIF RWPs governing hands on work. Discussions with NIF management revealed that numerous formal and informal assessments at NIF have been performed since beginning operations, some of which indicated that NIF had "too many RWPs." As a result, NIF recently consolidated its RWPs from approximately 85 down to 15.

EA evaluates adequacy of RWPs based on whether work scopes, task breakdown, and associated hazards and controls for observed work evolutions are clearly defined and sufficiently tailored to the specific work being performed, consistent with ISM principles. These same principles are reflected in LLNL institutional requirements including Document 2.2, 20.1, and the NIF Radiological and Beryllium Control Manual. Using sentinel RWP modules for creation of RWPs at NIF allows for RWPs to be broken down into various sub-tasks; however, this capability is inconsistently applied for NIF work.

Physical and Life Sciences Directorate

EA observed ongoing research work with radiological hazards at several divisions of the PLS Directorate, principally the Condensed Matter and Materials Division at Building 235 and the Chemical Sciences Division at Building 151. A diverse range of radiological hazards is associated with research work within PLS, including external and internal radiation exposures which could impact research work, and possible spread of contamination resulting from using dispersible radioactive materials. Engineering and administrative controls include the use of containment systems such as gloveboxes and hoods for dispersible materials, and graded limits on authorized quantities of radioactive materials that can be used

both inside and outside enclosures. Engineered interlock and access control systems are also present on various radiation generating devices used within PLS.

The primary activity-level mechanism for identifying radiological hazards and controls at PLS is the IWS. Document 2.2 requires development of task based IWSs that subdivide broad work scopes into discrete work activities, specifying task specific hazards and controls. The IWSs reviewed were generally sufficient to bound the hazards and controls for a range of experiments and activities that may be performed within a particular laboratory or facility. However, while the transition to the task based IWS format over the years has resulted in some improvement, IWS tasks are in some cases still too broad to effectively convey actual task specific radiological hazards and necessary controls. For example, a number of glovebox gloves in Building 235, Room 1130 were tied off but were not secured and covered with a protective cover when not in use during the shift, as called for in Document 20.2, Section 6.2.4. IWS 10439.15, which covers work in this area, does not provide specification of this glove protection requirement. Similarly, this IWS contained an open ended authorization allowing for maintenance work as an authorized task, without analysis of the specific hazards and required controls. Under the maintenance task, the IWS states, "*contamination if present would be determined by the RI prior to maintenance. If the equipment is contaminated, the RI will consult with the ES&H Team Health Physicist and H&ST for advice on proceeding with the work.*" Open ended authorizations on IWSs have been problematic in LLNL IWSs in the past, and LLNL added a requirement in HP-FO-103 that specifically prohibits the use of such open ended authorizations. It states, "*Open-ended statements that appear to allow changes in radiological controls or authorize new work without revision of the TWD and re-authorization from the TWD Authorizing Individual are prohibited.*" (See **OFI-LLNL-3**.)

Broad scope IWSs and related weaknesses in contamination control were observed during some research activities. The EA team observed various examples where contamination control requirements were either not properly identified or conveyed in the IWS or were not followed by workers performing radiological work. Examples of inadequate contamination control observed during radiological work include: (See **Finding F-LLNL-1** and **OFI-LLNL-4**.)

- A number of contamination control concerns were identified during plutonium dissolution work in Building 151, Laboratory 2318. This work involved preparation of liquid scintillation vials containing different concentrations of plutonium for counting. The hood where the work was performed was posted as a contamination area (CA) and the laboratory was posted as a radiological buffer area (RBA). While the researcher performed some operational monitoring during the work, a number of radiological practices were insufficient to prevent the possible, inadvertent spread of contamination from the CA. These insufficient radiological practices include:

  - Hands, arms, and torso areas were not monitored by the researcher upon each withdrawal from the hood. The IWS requires periodic and post-job monitoring as specified in the LLNL ES&H Manual.

  - Items such as pipettes and plastic trays holding plutonium solutions were placed down on the interior surface of the hood and later removed and placed on surfaces in the RBA without being controlled as potentially contaminated or otherwise surveyed and found to be clean, as required by Document 20.2 Section 7.2. Deficiencies occurred during such activities as installing new pipette tips following each Pu spike and adding scintillation cocktail to the containers outside the hood on a bench top that was not posted as a designated bench top radiological control area. In addition, filled scintillation vials in the plastic trays were also removed from the CA hood for transfer to the liquid scintillation counter in the RBA without radiological controls or survey.

- The spiked scintillation vials removed from the hood for counting were also not labelled or otherwise marked individually or in aggregate as radioactive material, as required by Document 20.2, Section 3.1.8, for quantities greater than 1 nanoCurie (nCi). No record of calculations supported the vials containing less than 1 nCi individually or in aggregate, and LSC results confirm that a number of individual vials exceeded this threshold.

- Requirements of Document 20.2, Section 6.4.3, for proper use of the hand and foot monitor including the need to contact the H&ST after two subsequent alarms, were not understood and implemented by PLS and hazards control personnel until questioned by the assessor. An operator aid with proper response was posted near the hand and foot monitor on a subsequent visit to the lab.

- A researcher working with a nonradioactive osmium target in a CA posted hood in Laboratory 1322 did not turn on or utilize the available survey instrument when withdrawing his hands from the hood, as required by IWS 11768.

- During housekeeping and cleanup of a CA posted hood in Building 235, Laboratory 1136, the researcher exercised some good practices including taping his gloves to his laboratory coat and donning an extra outer glove that was removed prior to withdrawing his hands from the hood. However, the individual did not conduct any radiological monitoring of hands, arms, and torso as required by IWS 11560. EA observed that the laboratory coat sleeve came into contact with the hood sash while the individual reached into the hood to retrieve waste.

- Contamination controls during tetra arc furnace operations in Building 235, Ion Beam Laboratory, were insufficiently defined and implemented, resulting in unnecessary PPE contamination during the work and the possibility for contamination to spread inadvertently to clean areas. The IWS inadequately conveyed the potential for appreciable contamination when opening the sample chamber and cleaning by wiping the interior. Cleaning required reaching into the upper portions of the chamber, which resulted in visible oxide material getting on the researcher's laboratory coat sleeve, and possibly the wrist as the gloves were not taped to the laboratory coat. Under normal conditions, no H&ST would have been present; however, EA and the ES&H team 2 health physicist requested the researcher perform alpha and beta gamma surveys, which confirmed the presence of contamination in excess of CA limits on the laboratory coat sleeve. No radiological surveys of the area are required following this work to verify the lack of contamination spread.

- In several labs including Building 151, Laboratories 1334 and 2318; Building 235, Laboratory 1130; various areas of contamination on floor surfaces have been taped over due to past contamination. The fixed contamination observed in these areas are legacy issues that have not been remediated due to presence of asbestos in the mastic used to secure the tiles to the floor. The fixed contamination is clearly identified and monitored, as required.

RHWM Storage Facilities

RHWM consists of several RHWM facilities operated by NMTP. Radiological hazards consist of possible internal and external exposures to radioactive materials and radiological contamination during various waste handling and processing operations. NMTP uses several mechanisms to address work scope definition, analyze hazards, and establish requisite controls at the facility and activity levels. These mechanisms include authorization basis documents for NMTP nuclear and radiological facilities (e.g. documented safety analysis, safety analysis report), and a combination of facility safety plans (FSPs),

OSPs, IWSs, and work permits for activity-level work. IWSs and work permits are also used at RHWM to define work scope, describe hazards, and establish requisite controls.

EA observed several work evolutions at RHWM where hazard controls were effectively implemented, including material movement, trouble shooting of waste treatment equipment, and H&ST coverage of work in CAs. Administrative access controls, TESA locks, dosimeter and work permit issuance, supervisory confirmation of training status and pre-job briefings prior to conduct of work are used to ensure that individuals are aware of and acknowledge requirements for safe conduct of radiological work.

The most recent (2011) independent oversight assessment indicated that in some cases, particularly when an IWS controlled work, RHWM work scopes were too broadly defined to allow effective analysis of hazards at the task level, resulting in inadequate specification of controls. Since the 2011 assessment, RHWM has developed and implemented additional work permits for many activities conducted at both RHWM facilities and in the field by technicians. In the NMTP work control process, work permits are used in lieu of IWS/OSP for short term work activities. Work permit planning provides the opportunity for facility management, the ES&H staff, and SMEs to meet and ensure that work scope is adequately defined and that hazards and controls are sufficiently and properly identified. The work permit planning and approval typically happens close to when the work is performed and appears to be a more controlled and efficient process than the IWS process. NMTP has historically used work permits during discrete operations with unique hazards, during startup of new activities, and also during restart of activities that were stood down for various reasons. Work permit meetings, planning efforts, and management approval provide the facility manager, responsible individual, and authorizing individual with additional assurance that the activities can be performed safely.

The decision by NMTP to use more work permits at RHWM was based on the following factors: 1) waste treatment activities are performed in campaign fashion, which requires frequent revisions to their work control documents, 2) the work permit process provides a very effective means to provide feedback on the work permit and make improvements where necessary, and 3) processing changes through the work permit system is more efficient than processing changes through the IWS system.

EA noted a few IWS concerns during this assessment including with IWS 15242.05 for container crushing. During the last independent oversight assessment in 2011, a predecessor to this IWS revision incorrectly combined both radiological and hazardous waste crushing activities as one task, even though the hazards and controls for operation of these units were different and required separate evaluation. While this condition was not evident during this assessment, EA noted other weaknesses in specifying controls, including the following: (See **OFI-LLNL-3**.)

- While the IWS addresses unexpected movement of the ram as a potential hazard during wipe cleaning or swiping of the inside of the drum crusher, and the operational procedure TRE-100 provides a sequence of actions to be followed by workers performing the assigned task, neither document requires initial lock-out/tag-out (LO/TO) of the crusher including zero energy verification, prior to workers conducting initial radiological monitoring of the internal surfaces of the drum crusher during their setup. The procedure, which is often referenced during operations and calls for completion of a checklist, contained testing and verification steps to confirm ram and interlock functionality; however, no steps were included for the initial isolation prior to workers conducting the entry into the crusher to perform radiological monitoring of surfaces.

- The IWS also contains a general discussion of hazards related to sharp edges (namely crushed drum surfaces and handling). However, during the radiological monitoring, an observer noted that a worker's head came into close proximity with an angular surface at the top ram plate (not discussed in the IWS). The observer expressed concern that this could result in a contaminated head wound. The

observer then brought this to the attention of RHWM supervision in the area. The RHWM supervisor appropriately paused work and obtained a hard hat for the worker, who donned the hat before resuming work.

In both IWSs and technical work documents, some radiological controls remain too broadly defined with little implementation information provided. These include statements such as "Health and Safety Technician shall be present" without specifying the type of coverage (e.g., continuous or intermittent). Another example is the frequent use of the term "Hold Point" in technical documents, without being tied to a required work step and/or conduct of a radiological measurement. LLNL ES&H Manual 20.2, section 5.1.2, *Hold Points*, states, "*Hold points are specific steps or conditions that require work to stop and a decision to be made in order for work to continue*." This section further state's, "*The radiological control hold point must state the criteria that must be met or action that must be taken to satisfy the hold point prior to continuing with subsequent steps in the planned activity*." The hold points as currently used are not really hold points as defined by Document 20.2, but essentially limiting conditions or void limits that reflect radiological contamination levels and/or exposure rates (which typically would exceed the area's radiological posting) where work is expected to stop. (See **OFI-LLNL-3**.)

While radiological controls observed at RHWM are generally effective, EA identified a few radiological controls that were ineffectively implemented or verified. (See **OFI-LLNL-3**.) For example:

- Waste Treatment technicians were preparing to conduct routine solidification activities in the Solidification Unit room under work permit number 695-D-13-0044. The area was posted as a CA with an adjacent Radiological Buffer Area. The room has a main entrance from the airlock (Room 1037) and a backdoor which is normally TESA locked and not used for access. During the set up the H&ST posted a "Caution: Contamination Area – Do Not Enter" sign on the back door. However, the EA assessor informed the H&ST that they had inadvertently posted the CA sign on the door to Room 1036 instead of 1038. Area supervision immediately corrected this error.

- During routine solidification activities in the Solidification Unit room under work permit number 695-D-13-0044, EA noted that a local ventilation trunk is supplied to the mixing unit as an engineering control for both potential radiological and hazardous materials. The mixing unit's face velocity or effectiveness (i.e., placement to support other activities within the room away from the mixer) has not been evaluated.

- During a waste sample collection evolution, EA observed a worker exhibiting poor contamination control technique when compacting waste into the container after doffing gloves. While contamination control practices were appropriate during the sampling activity, when the evolution concluded one individual who had removed his gloves used his bare hands to push the bag further into the bucket in order to place a lid on the bucket. This EA observation is consistent with the observation of a recent Joint Functional Area Manager (FAM)/Line Management Radiation Protection Assessment which stated: "*Instances of improper contamination practices were observed during each of the work observations*." The assessment further states: "*The less than adequate contamination controls would have resulted in an unnecessary spread of contamination and increased work to control or decontaminate areas or equipment if higher levels of dispersible contamination had been present during the work. RHWM needs to take effective actions to improve contamination control practices*."

- EA and other observers noted that non radiological controls could be deficient, such as an eye wash station in the drum crusher location, with visible rust in the water stream during pre-use inspection prior to drum crushing activities.

Superblock

EA's predecessor organizations reviewed Superblock, Building 332 during ISM assessments several times from 2000 to 2011 and concluded that work control and RP performance were generally effective. EA's primary plan for this assessment was to review NMTP work activities at RHWM as well as radiological work in other directorates, including follow-up to radiological concerns identified at RHWM during the 2011 LLNL ISM assessment. However, a Pu-238 contamination event at Building 332 occurred during this assessment, and EA decided to observe and evaluate NMTP response to and management of the event.

On March 3, 2014, the Building 332 Facility Manager was notified that a non-safety glovebox continuous air monitor (CAM) had alarmed in Room 1378, following receipt of material bagged out from a glovebox in Room 1321. LLNL determined that three individuals had alpha contamination on their PPE (5,000 cpm/probe alpha (10,000 dpm/probe alpha) was the highest level). Nasal swipes were negative (as well as subsequent bioassays), and no contamination was found on the individuals or personal clothing. Contamination was also detected on surfaces in other rooms within the same corridor. LLNL conducted a critique and developed a recovery plan. The Facility Manager determined that a management concern existed regarding the extent of the contamination event and entered it into the LLNL occurrence reporting and processing system /noncompliance tracking system reporting system. EA considered the impact of the event and the fact that a similar contamination event had recently occurred in June 2013 involving the same glovebox bagout port. EA decided to assess LLNL corrective measures, including observation of ongoing decontamination in Room 1321, as well as corrective measures and work planning associated with the future activities conducted in the glovebox associated with this event.

The affected areas were secured and efforts were initiated to examine the condition and to decontaminate the affected areas. A work permit (332-14-D-0100) was developed for H&STs and Fissile Material Handlers to decontaminate areas within four rooms (1321, 1337, 1378, and 1010). This permit also contained a note, stating, "NOTE: After handlers performed a bagout in Room 1321 and completed Room 1378 bagin, the Room 1378 CAM alarm led to discovering contamination on three handlers, Handlers had moved into Room 1010 and outside Room 1337. No loose or fixed contamination was found in the RMA [radiological material area] hallways." Based on initial radiological surveys, removable contamination was noted in Room 1378 and subsequent measurements discovered significant removable contamination on surfaces adjacent to the Room 1321 glovebox bagout port.

EA met with Superblock management the week of March 16, 2014, and discussed the following EA items of concern after conducting interviews and document review related to the contamination event:

- In anticipation of an increase in working with Pu-238, Superblock management appropriately conducted a benchmarking activity where a health physicist and operations representative visited the Savanna River Site and Los Alamos National Laboratory to review their Pu-238 protocols. A power point presentation was developed and presented to Superblock management following this benchmarking. While H&STs and Fissile Material Handlers received briefings on radiotoxicological hazards of Pu-238, no formal Pu-238 training was developed/given on properties of the material (e.g. mobility and contamination hazards).

- While OSP No. 332.209-03 contains statements that all bagout operations shall be performed by Fissile Material Handlers trained on the OSP and a H&ST shall be present, it sets no expectations for the level of support or actions to be taken by the H&ST during bagout of Pu-238.

- The 332 FSP requires glovebox workers to monitor their hands using portable alpha detectors each time they withdraw from the glovebox and after completing glovebox operation, including monitoring

of arms and torso before leaving the room. Workers are not required to immediately doff gloves if contamination is detected by portable instrumentation. The FSP requires the worker to contact an H&ST for assistance in removing the contaminated items. Detection sensitivity of portable rate meters is insufficient to detect removable contamination down to 20dpm/100 cm2, which is the threshold for CA posting.

- For Pu-238 work, rooms are not posted as CAs during bagout evolutions. Local CAs are not established around bagout ports during bagout/bagin activities, but are routinely established at other DOE facilities working with similar material.

- On March 6, 2014, a second unrelated low level contamination event (60 dpm alpha, presumed plutonium) on a junction box for a glovebox light, resulted in generation of an HP-FO-601 notification.

- First quarter of 2014 has seen a two fold increase (i.e., from 2 to 4) in contamination events in B332 over the previous quarter.

- While the reentry and decontamination work observed by the EA team indicated good survey conduct, the EA team noted that H&ST sometimes lends support to fissile material handlers conducting work activities, potentially impacting the quality and effectiveness of radiological support (which is the H&ST principal responsibility). EA also observed that workers did not doff their gloves prior to handling outer door surfaces and materials such as wipe sample envelopes. This increases the potential for unintentional spread of low level contamination, which cannot be detected during gloved hand frisks with portable radiological survey instrumentation.

The above items indicate that less than rigorous monitoring and doffing practices have resulted in the unnecessary spread of contamination and increased work to control and/or decontaminate areas or equipment.

On April 2, 2014, a workshop was conducted with representatives from facility management, program management, Health Physics, System Engineering, Nuclear Operations, and the Assurance Office in order to evaluate controls and actions, both short-term and long-term, to address the event. A "Deliberate Operations Plan (DOP) – Workstation 2111" was developed to address the equipment, personnel, and procedures activities to be conducted prior to and during Deliberate Operations observations.

The DOP identifies actions associated with equipment used directly or in support of Pu-238 handling and processing, including room ventilation, the WS2111 glovebox, and radiation monitoring instruments and monitors. Additionally, the DOP identifies the staffing and training activities associated with personnel who perform and support Pu-238 handling and processing. The DOP identifies evaluations to be performed in order to identify appropriate procedure revisions; additional management controls (i.e., oversight activities such as using Senior Supervisory Watch program); and requisite documentation/checklist to record completion of each activity/action specified in the DOP.

Following DOP observations, LLNL will issue a report to document the specific recommendations and actions to be taken, including delineation of the final set of controls that must be formalized in facility documents, such as OSP, the Building 332 FSP, or other documents.

While management response actions, including creation of the DOP, are prudent and appropriate, few operational changes have been defined and the DOP only commits SuperBlock to evaluating the need for Pu-238 related changes to prevent recurrence. The EA team considered several concerns discussed above

with facility management to be applicable to the current conditions at SuperBlock. Best practices currently in use at other DOE sites with transuranic glovebox lines have not been included as part of DOP or proposed future actions. The EA team is concerned that existing and/or revised controls established in response to needed changes in work practices with Pu-238 may not be sufficient to prevent the unnecessary spread of contamination from gloveboxes to other work areas. (See **Finding F-LLNL-1** and **OFI-LLNL-4**.)

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)

Radiological surveys and monitoring were generally being conducted appropriately at the LLNL facilities reviewed. Routine survey requirements and related radiological surveillance functions such as radiation and contamination surveys and air sample collection, including frequencies for performance and locations, are dictated by facility specific HP discipline action plans (HP-DAP), developed annually for each facility. EA viewed the existence and use of HP-DAPs LLNL as a positive attribute of the program which contributes to effective implementation of required radiological surveillances. Survey frequencies established in the DAPs were generally appropriate given the nature of the facilities, radiological status, and operations. However, EA expressed concerns that job coverage survey frequencies as specified in the HP-DAP and/or detailed work packages, may not be adequate based on EA observations of where worker contamination control practices did not meet expectations.

Radiological survey and monitoring instrumentation was appropriate for the radiation hazards. Alpha and beta-gamma handheld monitoring instruments were available in sufficient quantities to H&STs and workers who conduct operational monitoring at all locations reviewed. Handheld exposure rate monitoring equipment for beta-gamma and neutron radiation was also sufficient. Hand and shoe monitors were installed at the exits to RBAs controlled for contamination. Automated whole body counting systems were also installed at RHWM and Superblock. Dual alpha-beta portable swipe counters were also used at various locations.

Fixed air monitoring is used at selected locations in NMTP and PLS. At Superblock and PLS, air monitoring is accomplished through a system that consists of CAMs located in laboratory areas (positioned based on work activity, smoke testing, and/or known airflow). CAM filters are collected weekly or bi-weekly (i.e., twice per week) as required and counted in proportional counters. At NIF, airborne tritium concentrations are monitored by a network of fixed and portable tritium gas monitors in and around enclosures associated with the confinement envelope. At all locations where EA observed H&ST routine radiological surveillances, the surveillances were effectively performed. Survey documentation associated with these efforts was also thorough and complete.

NIF has implemented the "Distinguishable from background" approach for release of items that could be activated. This approach is documented in National Ignition Facility's (NIF) '*Indistinguishable from Background (IFB) Technical Basis Document* (TBD) (NIF-0117192-AD), and was peer-reviewed by DOE and adopted across LLNL. This formally documented process allows for the release of non-radiologically impacted equipment. Prior to implementation of this process, equipment exposed to a neutron flux could not be released from radiological controls.

A few potential weaknesses, vulnerabilities, or possible "added value" improvements associated with

surveys and monitoring were identified. These include: (See **OFI-LLNL-5**.)

- At Superblock and RHWM, the conduct of routine radiological area surveys (including those used for area down-posting) included large area wipes (LAWs). LAWs are usually collected and filed and sometimes evaluated in high background (high minimal detectable activity [MDA]) areas, before collecting technical smears at the same locations, in order to be counted in low background (low MDA) areas. LAWs are typically implemented using paper towel sheets. Periodically throughout the process, hand held detectors (typically alpha air proportional detectors for monitoring transuranics) are used to monitor any residual radiological contaminants adhered to the LAW. While appropriate for use as an indicator, comprehensive LAW use may mask identification of contamination by technical smears, through the cleaning effect of the LAW. As a result, the LAW may miss detection and/or trending of the spread of low level contamination below the MDA of hand held instrumentation, which could have been detected by technical smears prior to "cleaning" with a LAW.

- At RHWM, radiological monitoring conducted by workers as required by a LLNL procedure (i.e., TRE 100) is documented on form SDF 0006, and this data is verified by the Nuclear Facility Operations Supervisor. EA noted that the data recorded indicated background reading inconsistent with the normal functional parameters of the instrumentation used and for the area where the work was conducted. The recorded data included a beta-gamma background of 2 cpm and an alpha background of 20 cpm for the respective instrument. This inconsistency cannot be accounted for by transposition because the beta-gamma background would have been higher. EA expressed concern that the data suggests that instrumentation may not be functioning properly. The inconsistency in measurements or recording data was not called into question by the worker conducting the monitoring or by the Nuclear Facilities Operations Supervisor who verified completion of the form.

- At NIF, comprehensive routine radiological surveys are conducted in accordance with the NIF HP-DAP. Documentation of these surveys does not always include sufficient detail to permit identification of the original survey and sampling locations as required by Document 20.2, Section 6.2. Maps are not used for HP-DAP routine surveys, and the descriptions contain insufficient detail to determine specific survey locations. For example, "random surveys in the RBA" are not documented with the specific locations of the measurements.

As discussed in Section 5.2, EA observed contamination control weaknesses in some activities performed in NMTP and PLS and instances of unexpected contamination were identified. LLNL has traditionally determined that HP-DAP required routine surveys performed and documented by qualified H&STs are sufficient to demonstrate compliance with 10 CFR 835 requirements. LLNL considers radiological surveying performed between the DAP routines is to be operational monitoring performed by workers, and that such monitoring need not be documented. While workers can perform some operational monitoring as part of ongoing work and as low as reasonably achievable (ALARA) efforts, the lack of formal documented surveys immediately following work with the potential for contamination spread may not fully meet 10 CFR 835 expectations and could explain some of the findings of "legacy" contamination during HP-DAP routines. The sensitivity of operational monitoring by workers without removable contamination measurements is insufficient to detect removable alpha contamination at posting levels for CAs. Subpart L of 10 CFR 835 requires that *appropriate controls be maintained and verified which prevent the inadvertent transfer of removable contamination to locations outside of radiological areas under normal operating conditions*. 10 CFR 835.703 of Subpart H requires that *results of monitoring for radiation and radioactive material required by subpart L be documented and maintained*. Document 20.2, Section 6.1.2 c, General Work Controls supports these requirements and states, "*Appropriate controls (e.g., use of a hand and shoe monitor prior to entry, daily contamination surveys) must be in place to ensure the area remains uncontaminated.*" Document 20.1 is consistent with

the DOE Radcon Standard in so much as it requires radiological monitoring to be performed before, during, and after work that has the potential for causing changes in levels of radiation and radioactivity, but LLNL has not required such monitoring to be performed by qualified H&STs or documented, in apparent conflict with 10 CFR 835 Subparts H and L. (See **Finding F-LLNL-1** and **OFI-LLNL-6**.)

5.4 LFO Processes for Oversight of RPP Implementation

Inspection Criteria: *DOE field element line management has established and implemented oversight processes that evaluate contractor and DOE programs and management systems, including site assurance systems, for effectiveness of performance (including compliance with requirements). (DOE O 226.1B 4b (1))*

Inspection Criteria: *DOE field element line oversight program includes written plans and schedules for planned assessments, focus areas for operational oversight, and reviews of the contractor's self-assessment of processes and systems. (DOE O 226.1B 4b (2))*

Inspection Criteria: *Oversight processes are tailored according to the effectiveness of the laboratory assurance systems, the hazards at the site/activity, and the degree of risk, giving additional emphasis to potentially high consequence activities. (DOE O 226.1.B 4b (5))*

Inspection Criteria: *DOE field element staff are adequately trained and qualified to perform assigned oversight activities. (DOE O 226.1B, DOE O 360.1C, and DOE O 426.1 chg 1)*

Inspection Criteria: *There is adequate Facility Representative coverage for DOE facilities. Facility Representatives provide effective oversight to determine that the contractor is operating DOE facilities in a safe manner. (DOE-STD-1063-2011 sec. 5.1 and 4.1)*

Inspection Criteria: *Continuous improvement mechanisms have been established to improve the effectiveness and efficiency of oversight programs and site operations. (DOE O 226.1B 4a (2))*

The results of this EA assessment are organized to address the following aspects of LFO oversight processes and procedures for ensuring the effectiveness of the flowdown of laboratory occupational RP requirements to work planning, control, and execution processes:

- LFO Program Plans and Processes.
- LFO RP FAM Oversight Activities.
- LFO Facility Representative (FR) Activities.
- Assessments of LFO Radiation Program Oversight Program.

LFO Program Plans, Processes, and Assessments

LFO has established and implemented processes and procedures to effectively conduct oversight of LLNL RPP performance. The LSO Integrated Management System Manual, M 414.1, Revision 2, describes the functions, responsibilities, authorities, and LFO processes and procedures for day-to-day oversight of laboratory activities. LFO uses a risk-based approach to conduct oversight defined in LFO Process 226.1, *Risk Based Oversight and LFO Work Instruction (WI) 226.1.2, Oversight Planning.* The *LFO Safety Management Program Description Document, Radiation Safety Program Oversight,* defines LFO approach for conducting oversight of the LLNL RPP. LFO RP oversight assessment activities are determined annually based on laboratory performance, planned external reviews, and applicable standards and requirements, and is documented in a master assessment plan (MAP) and a master assessment

schedule (MAS). LFO has one SME serving as the LFO RP FAM who performs oversight of LLNL RPP implementation.

LFO RP FAM indicated the RP MAP is broken down into ten RP elements corresponding to the major RPP program areas for review. The MAP identifies the requirements document, base coverage period, and most recent coverage of the MAP element. Activities with potentially high consequences and activities conducted in facilities required to have an emergency planning hazards assessment are given higher priority and emphasis. In addition, facilities where the RP program is designated a credited control in their safety basis are given higher emphasis. Based on the most recent coverage and base coverage period, RP elements are incorporated into the MAS for that fiscal year (FY). For FY 2014 MAP, the ALARA program, emergency and special exposures, and RP elements were scheduled for review.

With the exception of radiation safety training (last reviewed in September 2010), EA determined that assessments were being conducted consistent with the base coverage periodicity defined in the FY 2014 MAP. In discussions with EA, the LFO RP FAM indicated that LFO management had directed more increased emphasis be placed on verifying credited radiation safety administrative controls for nuclear facilities. The LFO RP FAM indicated that this shift in oversight priorities and other aspects discussed below has impacted his ability to maintain assessment schedules per the MAP.

EA reviewed the most recent LFO assessment reports covering the RPP areas (e.g. organization and administration, area/workplace monitoring, and radiological control) covered by this assessment. Most reports reviewed tended to focus on management systems and processes with limited observations of work performance and not identified issues and/or findings. The LFO RP FAM indicated that LLNL had a mature and compliant RPP and that there were no open RP findings requiring corrective action, so significant transactional oversight was not a high priority. (See **OFI-LFO-1**.)

LFO RP Functional Area Manager Oversight Activities

In addition to conducting independent functional area reviews and surveillances based on MAP RP elements, the LFO RP FAM has shadowed and participated in LLNL joint FAM/line management self-assessments of RPP compliance with 10 CFR 835 and LLNL ES&H Manual requirements. The LFO RP FAM is also tasked to participate on safety basis review teams for review of Superblock and RHWM nuclear facility documented safety analysis reviews. Other activities performed by the LFO RP FAM to maintain operational awareness include conducting walkthroughs (typically monthly) of facilities; attending weekly NIF operations safety meetings, biweekly Superblock safety feedback and improvement meetings, and weekly permit meetings; conducting periodic meetings with LLNL RP FAM on radiological issues and events; and participating in periodic LFO operations team meetings.

EA reviewed ePegasus records for the past year and found that the LFO RP FAM has conducted a majority of his walkthroughs at NIF to observe ongoing radiation work practices, housekeeping, and radiation postings. The LFO RP FAM noted minor storage and radiation posting deficiencies and communicated them to the responsible LLNL facility health physicist. The LFO RP FAM conducted one walkthrough at the RHWM storage facilities in conjunction with a LLNL joint FAM/line management self-assessment observing radioactive waste drum crushing operations. No issues were noted in ePegasus records reviewed.

As previously discussed, a Pu-238 contamination event at Building 332 occurred during this assessment, causing EA to decide to observe and evaluate NMTP response to and management of the event. EA noted that LFO RP FAM did not shift his emphasis to oversee laboratory response to a potentially significant contamination event as expected, but rather continued to focus on observing NIF radiological work activities with the other EA team members. Follow-on discussions with the LFO RP FAM

indicated that he normally does not get involved in event critiques unless otherwise requested by LFO management and that given his other duties (e.g., review of technical documents such as safety basis) and trying to complete assigned assessments leaves limited time to devote being actively involved in other activities. In addition, the LFO RP FAM indicated that he had not conducted any oversight activities related to the Pu-238 operations ongoing at Superblock, even though a previous Pu-238 contamination event had occurred about 8 months ago. (See **OFI-LFO-2**.)

EA reviewed the LFO staffing plans and the LFO RP FAM training and qualification records and found no concerns. The LFO RP FAM, a certified health physicist, is currently qualified in the DOE technical qualification program in the RP functional area. Training records indicate that the LFO RP FAM is maintaining his continuing functional area training requirements for his position. At the time of this assessment, the LFO RP FAM was in the process of requalifying his respirator training and was in the process of taking additional training to enable unescorted access to work areas at the Superblock, Building 332 facility. The LFO RP FAM was qualified for facility access at NIF and the Superblock, Building 331 facility. EA noted that the LFO RP FAM had allowed his hazardous waste operations and emergency response (HAZWOPER) training certification, a prerequisite for facility access to the RHWM storage facilities, to lapse several years ago. The LFO RP FAM subsequently recertified his HAZWOPER training requirements during this assessment. (See **OFI-LFO-3**.)

LFO Facility Representative Oversight Activities

LFO operational awareness activities for activity-level LLNL RPP implementation are also performed by assigned LFO FRs. With regard to the facilities in the scope of this assessment, LFO had one FR assigned to cover RHWM storage facilities, one FR assigned to cover research and development activities conducted in PLS Directorate Buildings 235 and 151, and one FR assigned to cover the Superblock facilities. No FR was assigned coverage for NIF. The RHWM FR told EA that he previously covered NIF, but stopped in April 2013. Currently, this FR is in the process of qualifying on Superblock facilities, including Building 332.

Based on discussions, EA determined that FRs assigned coverage for RHWM and PLS Directorate facilities were familiar with the operations and activities ongoing within their facilities. EA observed that most work activities were performed in accordance with controls specified in IWSs and work permits, including radiological controls. For example, the RHWM FR had observed most types of different work activities within his facilities, including those observed by EA. EA identified no issues in radiological work performance observed. With one exception, discussions with the FR assigned coverage for PLS Directorate indicated that no recent issues were identified in the work observations of research and development work activities for the facilities included in the scope of these assessments. In April 2013, the FR identified two workers authorized to conduct “all tasks” identified within an IWS without required radiological training for the activity. During this assessment, EA also identified similar concerns related to broad scope IWSs that have contributed to observed weaknesses in the area of contamination control during research activities at the same facilities.

EA also held discussions with the FR assigned to Superblock and found the FR had conducted work observations regarding ongoing work activities related to the Pu-238 operations. Specifically, the FR had conducted periodic walkthroughs to review the work station performing Pu-238 activities and observed a handler hurrying through his work activities because he had concerns about excessive radiological exposure. The FR brought the issue to the attention of the Superblock facility management and indicated that current efforts were inadequate to ensure worker exposure were ALARA. Superblock management promptly took appropriate action to reduce the accumulation of materials stored in the glovebox and improve the use of shielding. Follow-up review by the FR revealed that management’s actions had reduced the total worker’s dose by about half while improving work flow of materials.

FRs are required to conduct and document quarterly work observations as part of their oversight and operational awareness activities. FRs also formally documents a summary of their operational awareness activities in a bi-weekly report. Review of a sample of quarterly work observations and biweekly reports provided evidence that FRs were appropriately conducting work observations of radiological work. Verifying controls were also being appropriately implemented in accordance with associated IWSs and/or work permits.

EA reviewed the LFO staffing plans and LFO FR training and qualification records for FRs assigned to RHWM, PLS Directorate and Superblock and found no concerns. All FRs are fully qualified, have considerable experience in their positions (all have been in their same positions since 2007), and are currently up for five year re-qualification in 2015. LFO management plans to revisit the basis for assigning FR coverage and were considering rotating FR assignments and placing increased emphasis on cross/dual qualification of FR to provide increased flexibility. Discussions with LFO FRs and the LFO RP FAM indicated that FRs and SMEs rarely conduct joint walkthroughs, surveillances, or other types of coordinated oversight activities, minimizing the potential for lessons learned and "fresh eyes" in overseeing facility operations and work activities. (See **OFI-LFO-4**.)

NNSA Headquarters Assessments of LFO Radiation Program Oversight Program

In October 2011, an NNSA Headquarters biennial review of site nuclear safety performance of LFO concluded LFO had developed processes for implementing adequate oversight of the LLNL RPP that appropriately addressed planning, scheduling, conduct, documentation, and implementation of corrective actions. The NNSA team identified one OFI related to the ongoing verification of credited radiation safety administration controls, and recommended that planned surveillances are formally scheduled and tracked to ensure that are systematically completed. In addition, the NNSA team expressed a concern that one health physicist may not be adequate to cover the work scope currently required of the position.

Discussions with LFO management indicated that since the October 2011 biennial review, LFO management implemented several actions to strengthen operational awareness of their staff, including significantly reducing reliance on external NNSA resources to perform routine required MAP assessments and other technical document reviews that should be performed internally, and requiring their staff to obtain necessary unescorted access to key high priority facilities to efficiently perform operational awareness and oversight activities in order to minimize reliance on other LFO staff (e.g. FRs) to escort personnel. In addition, in response to the NNSA Headquarters biennial review, one nuclear facility each year would be scheduled for an RPP implementation review. LFO reviewed the Plutonium Facility in FY 2013, and has scheduled the Tritium Facility for review in FY 2014. LFO management was aware of the continuing concerns expressed by the LFO RP FAM regarding workload issues and was considering several options, including evaluating additional resource needs and working with the LFO RP FAM to help prioritize his RPP oversight activities.

LFO also conducted a self-assessment of LFO oversight of the RPP Functional area in September 2013, which focused on LFO processes and procedures. With the exception of several concerns raised regarding the lack of sufficient expectations for and quality and consistency of input into ePegasus, LFO concluded that the RPP oversight processes were being adequately performed.

6.0 CONCLUSIONS

LLNL maintains an effective RP infrastructure staffed by qualified, experienced personnel, many of whom have advanced degrees, professional certifications, and years of applied experience. This infrastructure includes an appropriate RPP document hierarchy consisting of ES&H manual requirements,

implementing procedures, and TBDs. ES&H teams consisting of health physicists and H&STs are effectively deployed to LLNL line organizations to assist line management in implementation of RP and ES&H requirements.

Radiological work at LLNL requires an IWS or equivalent written work authorization that provides for analysis of hazards and specification of radiological controls. Recently implemented requirements for a task based format for work control documents have resulted in some improvement in specification of controls. However, weaknesses in programs and implementation were evident. Some task descriptions were still too broad to effectively convey radiological hazards and controls for specific work activities at facilities assessed. Contamination controls and radiological surveys during work at NMTP and PLS were insufficient to prevent the potential for inadvertent spread of contamination to clean areas. Additional management attention is warranted in ensuring proper implementation and verification of effectiveness of intended contamination controls during and upon completion of radiological work.

Overall, EA found that the LFO has established and implemented processes and procedures to effectively conduct oversight of performance. Operational awareness activities performed by facility representatives are adequately addressing activity-level implementation. The LFO RP FAM demonstrated an adequate operational awareness of ongoing LLNL RP institutional activities and has established a positive working relationship with the LLNL FAM RP manager; however, the LFO RP FAM did not have a sufficient level of facility-specific operational awareness of ongoing radiological work activities within Superblock, and did not display an active engagement in event investigation and follow-up to potentially significant events. LFO management needs to ensure that sufficient resources and priority are placed on LFO RP FAM oversight of facility-specific radiological work activities, including the Superblock Building 332 facility, and that more efforts are devoted to observation of work, and event investigation and follow-up for significant events.

7.0 FINDINGS

As defined in DOE O227.1 Independent Oversight Program, "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 DOE policy or Federal regulation. Corrective action plans must be developed and implemented for EA appraisal findings. Cognizant DOE managers must use site- and program-specific issues management processes and systems developed in accordance with DOE O 227.1 to manage these corrective action plans and track them to completion.

Finding F-LLNL-1: LLNL line management has not ensured that sufficient contamination controls and radiological surveys are implemented during radiological work within PLS and NMTP, as needed to prevent the potential for inadvertent spread of contamination to clean areas.

8.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified ten OFIs. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are suggestions offered by the EA assessment team that may assist site management in implementing best practices, or provide potential solutions to minor issues identified during the assessment. In some cases, OFIs address areas where program or process improvements can be achieved through minimal effort. EA 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.

LLNL

OFI-LLNL-1: Establish formal linkage between LLNLs RPP document hierarchy and the formally documented RPP. Specifically, revise the existing RPP to include graphical and/or narrative depiction of the relationship between the RPP and LLNL radiological document hierarchy, including the existing LLNL crosswalk of RPP Requirements and LLNL Documentation, which shows the linkage and flowdown of each compliance commitment to specific implementing mechanisms and TBDs. The relationship description should include a statement that revisions to subordinate implementing mechanisms need not constitute a revision to the RPP requiring DOE approval. (NOTE: This OFI applies both to LLNL RPP managers and DOE management reviewers/approvers).

OFI-LLNL-2: Increase emphasis at NIF on creation and use of clear task based RWPs that are tailored to the specific work being performed, expected hazards, and needed controls. Specific actions to consider include:

- Subdivide broad scope RWPs into one or more RWPs so as to limit the excessive use of conditional statements. This could be accomplished by making more effective use of the task breakdown feature in the NIF sentinel RWP system.

- To the extent practical, include descriptions of expected radiological conditions in addition to the limiting or worst case conditions.

- Ensure accuracy of RWP information on hold points and limiting conditions such as beta-gamma airborne activity and beryllium contamination levels when these hazards are not expected to exist during a particular evolution, as specific hold points criteria are expected to be monitored and evaluated during work.

OFI-LLNL-3: Continue efforts toward improving work scope definition and specification and implementation of radiological controls during work governed by task based IWSs. Specific actions to consider include:

- Adding a Radiological Work Planner position to support to line management and ES&H team health physicists with institutional oversight and assistance in radiological work planning; such a position could include responsibility for review and approval of radiological IWSs and a focus on consistent definition of radiological controls.

- Review existing IWSs, work permits, and technical work documents for appropriate use of terms such as “hold point” to ensure use is consistent with institutional definitions in the ES&H Manual.

- Provide additional training to ES&H team health physicists on expectations of HP-FO-103 regarding open ended authorizations and Document 20.2 criteria regarding proper use of hold points.

- Establishing subordinate radiological work authorizations (experiment safety summaries or similar) to be used in conjunction with broad scope IWSs at PLS, to better define and tailor necessary radiological controls to the specific scope of work being performed.

- Benchmarking with other DOE sites that perform research to evaluate radiological work authorization processes and any best practices that may be applicable to LLNL operations.

- Revising existing RHWM technical work documents, i.e., procedures and checklists to include work step prerequisites such as LO/TO and zero energy verification.

- Reviewing existing RHWM IWSs and/or work permits to ensure all potential hazards and requisite controls are addressed, e.g., sharp surfaces/hard hats, stored energy/bump testing.

- Ensuring engineering controls in use at RHWM that provide (i.e., adequate flow-rate of local ventilation collection point) provided for mitigation of radiological contaminants are verified prior to commencement of work.

OFI-LLNL-4: Increase emphasis at PLS and NMTP on improving contamination control practices. Specific actions to consider include:

- Scheduling a LANL peer review of Pu-238 work activity as part of the DOP for resumption of Pu-238 work.

- Providing additional training to workers and researchers on the meaning of a radiological buffer area, its regulatory status as a clean area, and the relationship to a CA, including radiological survey and control requirements when transferring materials from a CA to an RBA.

- Increasing rigor of controls concerning glove use and re-use, given the potential for transfer of low levels of contamination below the detection sensitivity of hand held instrumentation to clean areas.

- Evaluate the benefits of a requirement for up-posting rooms or establishing localized CAs at glovebox locations during bagin/bagout evolutions and in front of laboratory hoods and work areas where work with dispersible radioactive materials is performed.

- Reviewing and revising existing OSPs, FSPs, and IWSs in NMTP to ensure that requisite H&ST or NRCT coverage, surveys, and/or monitoring activities are appropriately assigned to authorized tasks.

OFI-LLNL-5: **Enhance radiological survey and monitoring practices in a few areas.** Specific actions to consider include:

- Evaluating current practices concerning the use of LAWs followed by technical smears, and the potential for masking low levels of contamination through the cleaning effect of LAWs.

- Ensuring survey maps are used or descriptions of survey locations are sufficient to determine the specific locations where measurements were taken.

- Establishing a program of periodic surveillances by qualified health and safety personnel to observe and provide feedback on operational radiological monitoring practices being conducted by workers and researchers.

OFI-LLNL-6: Revise institutional requirements to increase the frequency of performing documented radiological surveys as necessary to verify effectiveness of controls during and after work that has the potential for spread of contamination to clean areas. Revise ES&H Manual chapters and HP-FOs as appropriate to drive proper implementation.

LFO

OFI-LFO-1: Increase focus of RPP oversight assessment activities on performance of work observations.

OFI-LFO-2: Re-evaluate guidance for oversight of the LLNL RPP to ensure appropriate SME involvement occurs in response to significant radiological event critiques and follow-on recovery plans and that operations having potential high radiological consequences (e.g., Pu-238 operations) are being appropriately reviewed periodically and following significant events.

OFI-LFO-3: Ensure SMEs are maintaining appropriate training and qualifications for facility access in order to facilitate efficiencies in the conduct of oversight activities and increased operational awareness to high-priority facilities.

OFI-LFO-4: Increase joint FR and SME involvement for routine (i.e. walkthroughs, surveillances of work planning and control) oversight activities to improve and promote more of a team approach.

9.0 ITEMS FOR FOLLOW-UP

EA will continue to follow up on actions and satisfactory closure of the findings identified in this report. In particular, because EA is concerned that existing and/or revised controls established in response to needed changes in work practices with Pu-238 may not be sufficient to prevent the inadvertent spread of contamination from gloveboxes to other work areas, EA will plan to conduct a follow-on onsite assessment of Pu-238 work radiological work activities either as a standalone targeted assessment or as part of the EA planned targeted assessment of work planning and control area.

APPENDIX A
Supplemental Information

Review Dates

March 3-21, 2014, and May 12-16, 2014

Office of Enterprise Assessments Management

Glenn S. Podonsky, Director, Office of Enterprise Assessments
William A. Eckroade, Deputy Director, Office of Enterprise Assessments
Thomas R. Staker, Director, Office of Environment, Safety and Health Assessments
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APPENDIX B
Documents Reviewed

- LLNL-MI-525891, LLNL Radiation Protection Program (RPP) Rev 9.3, Implementation of 10 CFR 835, 'Occupational Radiation Protection'
- UCRL-AM-133867-VOL-2-PT-20.1-2013, ES&H Manual Document 20.1, Occupational Radiation Protection
- UCRL-AM-133867-VOL-2-PT-20.2-2013, ES&H Manual Document 20.2, LLNL Radiological Safety Program for Radioactive Materials
- UCRL-AM-133867-VOL-2-PT-20.3-2009, ES&H Manual Document 20.3, LLNL Radiological Safety Program for Radiation Generating Devices
- UCRL-AM-133867, ES&H Manual Document 22.6, Exposure to Radiation in an Emergency
- UCRL-AM-133867, ES&H Manual Document 3.3, Facility Safety Plans and Integration Work Sheets with Safety Plans
- LLNL-AM-409863, ES&H Manual Document 2.2, LLNL Institution-Wide Work Planning and Control Process
- LLNL-TM-407875, LLNL Technical Basis Manual for Internal Dosimetry (1/1/09)
- LLNL-TM-565620, Internal Dosimetry and Monitoring for Special Tritium Compounds (STCs) (7/20/12)
- LLNL External Dosimetry Technical Basis Document, Revision 3 (11/3/10)
- ED-TBD-TASL, Rev 0, TASL CR-39 System Technical Basis Document (7/22/13)
- LLNL Air Sampling Technical Bases Document (9/29/06)
- 10 CFR 835 and RCS Crosswalk, RCS Crosswalk (9-30-2009)
- Crosswalk of RPP Requirements and LLNL Documentation (11-12-13)
- Rev 54, November 1, 2013, LLNL Org Chart (11/1/13)
- Rev 21, June 28, 2013, ES&H Org Chart (6/28/13)
- NIF-1208-15757r22, NIF Org Chart (1/30/14)
- Rev. 13, January 27, 2014, PLS Org Chart (1/27/14)
- (CMMD) Condensed Matter & Materials Division Org Chart (2/3/14)
- RHWM Org Chart
- Radiation Protection Functional Area Org Chart (Feb 2014)
- LLNL Road Maps (2/18/14)
- ESH-RP-2011-064, Focused Assessment of National Ignition Facility (NIF) Radiation Generating Devices (RGDs) and Radioactive Materials (9/28/11)
- RSS-10-057, Focused Audit of Physical and Life Sciences Directorate Facilities B132N and B235 Radiation Generating Devices (RGDs), Sealed Radioactive Sources (SRSs), and Radioactive Material (3/31/10)
- ESH-RP-2013-075, Comprehensive Assessment of Radioactive and Hazardous Waste Management (RHWM) Complex B695, B696, B625, B612, B693 (9/19/13)
- MAS-13-029, Internal Independent Assessment ITS #34638 Radiation Protection Program (6/26/13)
- ESH-RP-2013-097, Management Self-Assessment of the Lawrence Livermore National Laboratory (LLNL) Radiation Protection Program (12/31/13)
- National Ignition Facility Radiation Protection Review (May 2011)
- Status of Findings from LSO Rad Protection Program Review (3/21/14)
- LLNL-TR-647801, Internal Dose Assessment 2013-006 (12/17/13)
- Listing of special bioassay samples taken (event, location, assigned dose) past two years (as of 2/11/14)
- HP-DAP NIF 9.0 (01/31/2014), 2014 HP DAP NIF Site
- HP-DAP NIF 13.0 (01/21/2014), 2014 HP DAP NIF Programs Signature

- HP-DAP CS 11.1 (02/12/2014), 2014 HP DAP PLS 151 B152 B154 (Revised 2-12-14)
- HP-DAP CS 11.0 (01/31/2014), 2014 HP DAP PLS 151 B152 B154 (Signature Page)
- HP-DAP CMM - B235 13.1 (02/12/2014), 2014 HP DAP PLS B235 (Revised 2-12-14)
- HP-DAP CMM-B235 13.0 (01/21/2014), 2014 HP DAP PLS B235 (Signature Page)
- HP-DAP RHWM 10.0 (02/12/2013), RHWM HP-DAP 2013 (5/1/13)
- Health Physics Field Operations Procedure Index (2/20/14)
- HP-FO-003, Rev 0, Air Flow Studies in Radioactive Material Areas (Last Reviewed 9/28/09)
- HP-FO-004, Rev 1, Placement and Use of Air Samplers and/or Real Time (Continuous) Air Monitors for Routine Monitoring for Airborne Radioactivity (Last Reviewed 1/27/11)
- HP-FO-103, Rev 1.1, Radiological Review of Technical Work Documents (1/28/14)
- HP-FO-120, Rev 2.1, Completing the Radiation/Contamination Survey Form (4/15/13)
- HP-FO-201, Rev 1.0, Conducting Radiation Exposure Investigations (2/22/12)
- HP-FO-401, Rev 0.1, Postings, Signs, and Labels for Radiological Control (12/1/11)
- HP-FO-450, Rev 3.4, Release of Items from Radiological Control (11/1/13)
- HP-FO-451, Rev 2.0, Posting and Down-posting Radiologically Controlled Areas (4/15/13)
- HP-FO-501, Rev 0.1, Conducting Radiation Surveys (9/1/12)
- HP-FO-502, Rev 1.0, Conducting Contamination Surveys (11/1/12)
- HP-FO-550, Rev 0.1, Portable Radiological Survey Instrument Use (9/1/12)
- HP-FO-601, Rev 0, Identification and Response to Unexpected Radiological Conditions (6/1/11)
- LLNL-TM-407876, LLNL Internal Dosimetry Program Manual, Rev 3.0 (1/1/09)
- ITS #34584.11, RHWM - Issues Tracking System #34584.11 - Assessment
- ITS #34584, RHWM - Issues Tracking System #34584 - Assessment
- ITS #31169, ITS Summary #31169
- ITS #34584, ITS Summary #34584
- Unusual Events-B332 CAM Alarm & Response, ORPS Report-Requested on 3/4/14
- 332-14-D-0100, B332 Work Permit 332-14-D-0100 (Approved 3-4-14)
- LLNL-MI-652222, Critique Report Contamination Event in B332 R1378
- B332 FSP Excerpt
- R1321 OSP Excerpt
- B332 Contamination Events, January 2012 to Date (By Quarter)-chart
- LLNL-PRES-652221, Pu-238 Best Practices Benchmark (presentation)-May 9, 2013
- LLNL-PRES-652223, OUO Safety Feedback & Improvement Meeting (3/14/14)
- Unusual Events-HP-FO-601 (March 3-20, 2014)
- B132S R2723 Am-241 SRS Response - HP-FO-601 Email Notification (3/4/14) (3/5/14)
- B132S R2723 LSC Results (3-4-14)
- B132S R2723 Am-241 SRS Response - Rad/Contamination Survey Form (3/4/14) (3/5/14)
- B696 Deteriorated Radioactive Waste Drum - HP-FO-601 Email Notification (3/5/14)
- B332 CAM Alarm and Contamination Event in B332 RMA - HP FO-601 Email Notification (3/5/14)
- B695 Inadequate Radiological Posting - HP-FO-601 Email Notification (3/7/14)
- B332 Contamination Event - HP-FO-601 Email Notification (3/5/15)
- B332 Contamination on WS 6906 - HP-FO-601 Email Notification (3/6/14)
- B332 (Update) CAM Alarm and Contamination Event in B332 RMA- HP-FO-601 Email Notification (3/11/14)
- B121 Tc-99 Package Event - HP-FO-601 Email Notification (3/12/14)
- B381 Contamination Event - HP-FO-601 Email Notification (3/13/14)
- ESH-RP-2012-038, 2012 First Quarter Summary of Unexpected Radiological Conditions (4/17/12)
- ESH-RP-2012-063, 2012 Second Quarter Summary of Unexpected Radiological Conditions (7/30/12)
- ESH-RP-2012-083, 2012 Third Quarter Summary of Unexpected Radiological Conditions (11/27/12)

- ESH-RP-2013-018, 2012 Fourth Quarter Summary of Unexpected Radiological Conditions (2/4/13)
- ESH-RP-2013-045, 2013 First Quarter Summary of Unexpected Radiological Conditions (5/10/13)
- ESH-RP-2013-069, 2013 Second Quarter Summary of Unexpected Radiological Conditions (8/14/13)
- ESH-RP-2013-085, 2013 Third Quarter Summary of Unexpected Radiological Conditions (11/8/13)
- ESH-RP-2014-011, 2013 Fourth Quarter Summary of Unexpected Radiological Conditions (2/6/14)
- 10439.15 r3, PLS IWS #10439, (2-13-14)
- Attachments for IWS 10439 (PLS)
- ADFM File 183 Alternate RATS Receipt Process for Mark Wall (Memo for G. Cooper to distribution) (9/29/11)
- Glove Box Qualification (Worker/trainee sign-off sheet for R1130 Glove Box Operations Qualification)
- Glove Use Recommendations and Requirements (IWS 10439.XX) (6/19/08)
- DOE-HDBK-1081-94, DOE Handbook - Primer on Spontaneous Heating and Pyrophoricity (December 1994)
- He Purge Setup (2/16/05)
- IWS 10439 Hazard Assessment & Control (HAC) (2/24/14)
- R1130 Startup Checklist (5/21/12)
- Room Entry Qualification 10439 r02 (OJT for B235 R1130 Entry Qualification [IWS 10439])
- Table 1. Criticality Safety Mass Limit for B235 Rooms 1121, 1125, 1130, 1132
- Waste Solidification Procedure #4 for IWS 10439.XX, B235, R1130 (Effective 01/06)
- Waste Solidification Procedure #5 for IWS 10439.XX, B235, R1130 (Effective 01/06)
- X-ray Specimen Holder
- 17370 r11, PLS B151 IWS #17370 R11 - Radioactive Gas Sample Analysis
- LLNL-AM-479191 REV 1, NMTP Work Planning and Control Manual-Internal Use Only (February 2012)
- 1345.10 r118, RHWM IWS #1345 - Waste Sampling
- Work Permit #: 695-13-D-0044 RHWM Work Permit - Stabilization (B695)
- TRE 122 Rev 2, RHWM TRE 122
- 15242.05, RHWM IWS #15242.05 - Container Crushing Unit Operations
- (RHWM) Facility Safety Plan, Waste Storage Facilities (July 30, 2013)
- Work Permit #: RHWM-13-B-0130, RHWM Work Permit - Waste Sampling
- RWP 13-004r4, NIF RWP 13-004r4 DIM and SXI Operations
- RWP 13-006r2, NIF RWP 13-006r2 Walk-in and Benchtop CZs
- RWP 13-009r3, NIF RWP 13-009r3 Cryo Operations
- Work Permit ID: 584930 NIF Work Permit ID 584930 Target Operations
- Work Permit ID: 610690 NIF Work Permit ID 610690 Diagnostics Factory
- Work Permit ID: 614220 NIF Work Permit ID 614220 Diagnostic Snout and Imaging
- Procedure 5.8, NIF-5018626-AL NIF Management Procedure-NIF Work Permits
- Team 2-PLS Work Observations B235-1130
- LLNL-MI-651812, ES&H Team 2 - PLS Work Observations B235, The annual report for B235 (February 2013 letter)
- LLNL-MI-651812, ES&H Team 2 - PLS Work Observations B235, Informal (e-mail) information sent to Program staff graphing air results
- LLNL-MI-651812, ES&H Team 2 - PLS Work Observations B235, Informal (e-mail) notifications to the RI (in this case, Mark Wall) conveying survey results and recommended actions
- LLNL-MI-651812, ES&H Team 2 - PLS Work Observations B235, Team 2 IWS 12463
- LLNL-MI-651812, ES&H Team 2 - PLS Work Observations B235, HP-6W, HP-83M, HP-16W, HP-10M (2 examples of weekly and 1 monthly)

- PLS - List of CSD IWSs
- PLS - List of CMMD IWSs
- RHWM - Drum Crush Forms (3/6/14)
- LLNL-TR-651515, PLS - B235 Facility Safety Plan (FSP)
- IM-771207-1, NIF - Pictures of HS-45 and LLNL Personnel
- LLNL-MI-651643, NIF - Radiological Survey Information
- LLNL-MI-651672, NIF - Radiation Safety and Training Procedures
- LLNL-MI-651641, NIF - Radiological Work Permits and Example of SPA (Work Control Documents)
- LLNL-MI-651653, NIF - NNSA Sustainability Award - Waste Reduction Effort
- PLS - B151, B152, B154 Facility Safety Plan
- PLS IWS 11768.07 r27, PLS IWS 11768.07 r27 Radiochemistry Chemical Separations
- PLS IWS 11801.07 r26, PLS IWS 11801.07 r26 Sample Digestion and Preparation for B151 Mass Spectrometry
- PLS IWS 11806.05 R53, PLS IWS 11806.05 r53 Glenn T. Seaborg Institute for Transactinium Science Laboratory Operations
- PLS IWS 11807.03r3, PLS IWS 11807.03r3 General Radiochemical Laboratory Operations
- PLS IWS 17879 r1, PLS IWS 17879 r1 Plutonium Metal Formation
- PLS IWS 11560.10 r5, PLS IWS 11560.10 r5 Sample preparation and Electronic Microscopy Characterization
- PLS IWS 13650.02 r16, PLS IWS 13650.02 r16 Sample Preparation and Analysis in the Environmental Monitoring Radioanalytical Laboratory (EMRL)
- PLS IWS 14332.07, PLS IWS 14332.07 General Inorganic Analysis and Sample Preparation
- PLS IWS 10882.06 r1, PLS IWS 10882.06 r1 Metallography
- PLS IWS 11086.03 r16, PLS IWS 11086.03 r16 B321A Forming Processes
- WIC 111, Rev 5, RHWM Division Procedure WIC 111 Sampling Liquid Waste
- RHWM IWS 1266.11r124, RHWM IWS 1266.11 r124 RHWM Field Technician Services at S200
- GS IWS 13807.02 r18, Global Security IWS 13807.02 R18 Detector Development and Electronics Library
- GS IWS 15158.04 r3, Global Security IWS 15158.04 r3 Packaging and Transportation of Radioactive Materials On and Off Site
- WPT 108 Rev 11, RHWM WPT 108 Rev 11 Transferring Hazardous or Radioactive Waste/Materials Onsite
- WPT 104 Rev 12, RHWM WPT 104 Rev 12 Packaging of Low-level Waste for Treatment, Storage and Disposal Facilities Other than Nevada National Security Site
- RHWM-13-C-0164, RHWM Work Permit RHWM-13-C-0164 RHWM Field Technician Services at Site 200
- RHWM Checklist for Onsite Transporation Activities
- PLS IWS 16789.04, PLS IWS 16789.04 High Temperature Sample Synthesis
- PLS IWS 17352 r16, PLS IWS 17352 r16 Tetra-Arc Furnace
- PLS IWS 14415.06 r38, PLS IWS 14415.06 r38 Dynamic Transmission Electron Microscope (DTEM)
- PLS IWS 11561.06 r34, PLS IWS 11561.06 r34 4MV Accelerator System
- PLS IWS 10881.06 r14, PLS IWS 10881.06 r14 X-ray Diffraction Characterization of Materials
- GS IWS 11396.07, Global Security IWS 11396.08 B262
- LLNL-MI-652229, CryoTARPOS-copy of the survey for the job (March 26, 2014)
- LLNL-MI-652696, NIF-ES&H MOU
- IM-772451-1, NIF B381 Corridor Locker Contamination Survey and Follow Up Survey

- PLS B151 Survey 20157659 2013 12 094812
- PLS B151 Survey 20159508 2014 03 155507
- PLS B151 Survey HP01-Q.1 (20157659) (12-9-13) (12-12-2013)
- PLS B151 Survey HP01-Q.1 (20159508) (3-6-14) (3-19-2014)
- PLS B151 Rm 2326 Hood 39L (5-21-13)
- PLS B151 Rm 2326 Hood 39R (5-21-13)
- PLS B151 Rm 2326 Hood 49L (5-21-13)
- PLS B151 Rm 2326 Hood 49L Rev 1 (6-5-13)
- PLS B151 Rm 2326 Hood 49R (5-21-13)
- PLS B151 Rm 2326A Hood 40 Rev 1 (6-5-13)
- PLS B151 Rm 2326, 2326A Hoods 6-13
- PLS B151 Rms 2318 to 2326 ventsurvey 5-13
- GS B262 Sealed Source Inventory Forms and Survey Results
- PLS IWS 11396.08 r13, Nuclear & Radiological Countermeasures Operations in Building 262
- PLS IWS 11817.5 Nuclear Chemistry Counting Facilities
- PLS IWS 11768.7r32 Radiochemistry Chemical Separations
- PLS IWS 11801.7 r29 Sample Digestion and Preparation for B151 Mass Spectrometry
- PLS IWS 10737.08 Operation of the X-ray Diffractormeter (XRD) and X-ray Flourescence Spectrometry
- PLS IWS 14332.06r56 General Inorganic Analysis & Sample Preparation
- PLS Sample Counting Results - March 19, 2014 (Exp40 031814-2) from previous visit
- CryoTARPOS under RWP-13-009-last 6 months of "dates submitted" for bioassay frequency
- WCI Deliberate Operations Plan, Workstation 2111
- OSP 332.209-03, WCI Operational Safety Plan No. 332.209-03, May 2014
- 332-14-D-0156, WCI SuperBlock Work Permit
- WCI Deliberate Ops Training, Doff PPE, Survey, Hand & Foot Counter Signatures
- WCI 332-209 OSP Cold Glove box Review Session Signatures
- WCI Appendix A, OSP Training Form Annual Review (Hydrofluoric Acid/Be Worker Training) Signatures
- PLS Follow-up swipes of B151-2318 LSC vials
- PLS IWS 16789 High-temperature Sample Synthesis
- PLS IWS 11560 Sample Preparation and Electron Microscopy Characterization
- Source Leak Check Surveys from B132S, Rm2761 Alcove (HP)
- PLS IWS 17352 r16 Tetra-Arc Furnace
- PLS RGD Survey, not DAP, from B151, Rm 1143 (HP)
- PLS Results of Hood Surveys from B151, Rm 2326 (HP)
- PLS DAP and Results of Hood Surveys from B151, Rm 2326
- PLS Surveys for B190 High Rad Area Characterization Survey During Exclusion Op
- PLS Surveys for B190 Last Monthly Radiation Area Survey
- Livermore Site Integrated Assessment Plan FY 2014, October 11, 2013
- LFO Master Assessment Plan FY 2014, November 5, 2013
- LFO P 226.2, Operations Teams, Rev. 1, March 3, 2013
- LFO WI 226.1.4, Periodic Issues Report, Rev 2, July 7, 2013
- LFO M 414.1, Integrated Management System Manual, Rev. 2, December 2012
- LSO WI 226.1.1, Writing and Managing Contractor Assessments, Issues, and Corrective Action Plans in ePegasus, Rev. 3, July 3, 2012
- LSO WI 226.1.2, Oversight Planning, Rev. 3, August 3, 2011
- LFO WI 414.9.1, Writing and Managing Assessments of Livermore Field Office Issues, and

Corrective Action Plans in ePegasus, Rev. 3, April 16, 2013

- LFO Safety Management Program Description Document, Radiation Safety Program Oversight FY2014, September 2013
- LFO Radiation Protection Master Assessment Plan FY2014, September 12, 2013
- LFO Radiation Protection Master Assessment Plan FY2013, September 12, 2012
- LFO Radiation Protection Master Assessment Plan FY2012, September 2011
- LFO Master Assessment Schedule FY2014, Version 3, AMESH
- FY2013 Radiation Protection Functional Area Performance Evaluation Plan Final Rating
- FY2013 Third Quarter Radiation Protection Functional Area Performance Evaluation Plan Rating
- FY2013 Second Quarter Radiation Protection Functional Area Performance Evaluation Plan Rating
- LLNL Radiation Protection Zipper Meeting Presentation, December 5, 2012
- FY2013 LLNL Fourth Quarter Radiation Protection Zipper Meeting Presentation
- NNSA Headquarters Biennial review of Site Nuclear Safety Performance for Livermore Site Office, October 2011
- ASRP-MO-11.22.2011-401155, Headquarter Biennial Review of Site Nuclear Safety Performance Corrective Actions.
- ASM-ESH-10.27.2011-394767, Functional Area Review RP - Organization and Administration
- ASRP-TS-11.4.2010-298797, Functional Area Review RP – ALARA Program
- ASRP-ESH-10.10.2012-472087, Functional Area Review RP – External Dosimetry
- ASRP-TS-9.10.2010-281848, Functional Area Review RP – Radiation Safety Training
- ASRP-ESH-9.9.2013-533939, Self-assessment of Livermore Field Office Oversight of Radiation Protection Program Functional Area
- ASM-ESH-10.5.2012-471269, Radiation Safety Program in Building 332, LFO Assessment Report Implementation of Requirements 10 CFR 835, 830 and Applicable Portions of DOE Order 458.1 in Building 332
- ASM-ESH-10.5.2012-472384, Assessment of Implementation of the Requirements of DOE Order 458.1 (Radiation Protection of the Public and the Environment) at the Lawrence Livermore National Laboratory
- LLNL Joint Functional Area Manager/Line Management Self-Assessment of Internal Dosimetry Program, August 4, 2011
- ASM-ESH-10.10.2013-541502, Functional Area Review – LLNL RP ALARA Program
- LFO Facility Representative Work Planning and Control Surveillances
  - ASRP-FO-4.3.2012-430389
  - ASRP-FO-4.15.2013-505878
  - ASRP-FO-5.9.2012-438472
  - ASRP-FO-6.11.2013-515803
  - ASRP-FO-7.13.2012-452066
  - ASRP-FO-8.21.2013-530200
  - ASRP-FO-8.31.2012-462378
  - ASRP-FO-11.19.2013-547974
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  - ASRP-FO-3.29.2012-429161
  - ASRP-FO-4.13.2012-432491
  - ASRP-FO-6.28.2013-519712
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  - ASRP-FO-6.28.2012-449314
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  - ASRP-FO-8.30.2012-462289
  - ASRP-FO-9.26.2013-537722
  - ASRP-FO-12.18.2012-486280
  - ASRP-FO-12.18.2013-553385
- List, LFO Walkthroughs January 2012 - March 2014
- List, LFO RP FAM Assessments/Reports January 2012 – December 2013
- List, LFO RP FAM Actions January 2012 – December 2013
- Printout, LFO Training and Qualification Program Status, Second Quarter FY2013
- Selected LFO staff Training and Qualification Records