



**OFFICE OF INSPECTOR GENERAL**

U.S. Department of Energy

# INSPECTION REPORT

DOE-OIG-20-53

September 2020

**THE DEPARTMENT OF ENERGY'S  
MANAGEMENT OF  
EXPLOSIVE MATERIALS AT  
LAWRENCE LIVERMORE NATIONAL  
LABORATORY**



**Department of Energy**  
Washington, DC 20585

September 9, 2020

MEMORANDUM FOR THE MANAGER, LIVERMORE FIELD OFFICE

*Deborah Thomas*

FROM: Deborah M. Thomas  
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for Inspections, Intelligence Oversight,  
and Special Projects  
Office of Inspector General

SUBJECT: INFORMATION: Inspection Report on “The Department of Energy’s  
Management of Explosive Materials at Lawrence Livermore National  
Laboratory”

RESULTS IN BRIEF

We found that Lawrence Livermore National Laboratory (LLNL) managers adequately tracked and stored their explosives but did not fully comply with Federal and Departmental requirements. Specifically, LLNL did not adhere to 41 Code of Federal Regulations, Subpart 109, *Department of Energy Property Management Regulations* (41 CFR, Subpart 109), since it did not have detailed procedures for conducting physical inventories of explosive materials and did not have personnel other than the custodians of the explosive materials conduct the required annual inventory. We found that LLNL operated multiple inventory systems, and the use of differently formatted systems may not demonstrate efficient operations. We also observed signs of physical deterioration at Site 300 and that LLNL may incur future storage space challenges if not actively managed. Based on assurances that the Department is addressing the issues identified in this report through ongoing actions in response to a previously issued audit report, *The Department of Energy’s Storage and Disposition of Explosives Material at Selected Sites* (DOE-OIG-20-50, July 2020), we are not making recommendations at this time. We identified the need for the development of procedures for conducting physical inventories of explosive materials and for ensuring that the inventories are performed by personnel other than the custodians of the explosives. We also suggest that LLNL consider standardizing the inventory systems across the different operational programs to track high explosives inventories, take proactive steps to maintain the physical conditions of storage facilities, and actively manage the amount of explosives stored in magazines in order to address potential physical storage challenges.

## BACKGROUND

The Department of Energy manages high explosives across its complex of National Laboratories and other facilities to carry out elements of its mission. Lawrence Livermore National Laboratory (LLNL), under its Weapons Complex Integration Program, conducts non-nuclear explosives testing for nuclear weapon detonation research, as well as the Stockpile Stewardship Program. As such, LLNL conducts high explosives research and experiments at the High Explosive Application Facility (HEAF), Site 300, and the Joint Laboratory Office – Nevada at the Nevada National Security Site (NNSS).

HEAF is an indoor facility located at LLNL that stores small quantities of different explosives to conduct small scale explosive experiments using up to 10 kilograms of material. Site 300 is an explosives test and storage facility located 15 miles southeast of LLNL. Site 300 stores the majority of LLNL's explosives, and conducts indoor and outdoor explosives testing of up to 100 pounds per day and 1,000 pounds per year of material.

NNSS is located 65 miles northwest of Las Vegas, Nevada, and is the only location where National Laboratories can conduct experiments that combine high explosives with special nuclear materials. The management and operations contractor at NNSS, Mission Support and Test Services, manages the explosives storage facilities and maintains the inventory of record at NNSS, including the LLNL explosives at NNSS.

LLNL is required to adhere to the personal property management regulations set forth by 41 Code of Federal Regulations, Subpart 109, *Department of Energy Property Management Regulations* (41 CFR, Subpart 109), and the safety standards set forth by DOE Standard 1212, *Explosives Safety* (DOE-STD-1212).<sup>1</sup> LLNL is also required to adhere to local policies and procedures, specifically Volume II, Part 17 of LLNL's Environment, Safety, and Health Manual. Additionally, Department Order 430.1C, *Real Property Asset Management*, establishes a data-driven, risk-informed, performance-based approach to the management of real property assets for the Department.

We conducted this inspection to determine whether LLNL is managing and storing explosive materials in accordance with Federal and Department requirements.

## RESULTS OF INSPECTION

We found that LLNL did not fully comply with Federal and Departmental requirements, but managers adequately tracked and stored their explosives. Specifically, LLNL did not adhere to 41 CFR, Subpart 109, since it did not have detailed procedures for conducting physical inventories of explosive materials and did not have personnel other than the custodians of the explosive materials conduct the required annual inventory. Although LLNL did not fully adhere to 41 CFR, Subpart 109, we found that LLNL adequately tracked its explosives with a minor amount of discrepancies between the information on the inventory and the information on the explosives label. However, we found that LLNL operated multiple inventory systems and that

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<sup>1</sup> During our inspection, the Department revised the DOE Standard 1212-2012, *Explosives Safety*, to the DOE Standard 1212-2019, *Explosives Safety*.

the use of differently formatted systems may not demonstrate efficient operations. We found that LLNL adequately stored its explosives, but we observed facility degradation and identified possible future storage space challenges.

Specifically, some of LLNL's explosives storage facilities showed signs of physical deterioration at Site 300. Based on the amount of explosives in some magazines, LLNL may incur future storage space challenges if officials do not actively manage the amount of explosives in the magazines.

### **Code of Federal Regulations Noncompliance**

LLNL did not fully adhere to 41 CFR, Subpart 109, since it did not have detailed procedures for conducting physical inventories of explosive materials, and the custodians of the explosive materials, as opposed to independent staff, conducted the required annual inventory. During our inspection at HEAF and Site 300, we identified that none of the personnel charged with conducting annual inventories of explosives followed a detailed written procedure or could provide a written procedure to us. Additionally, the custodians of the explosives, those charged with the day-to-day management and maintenance of the explosives material, conducted the annual inventory of the items in their own magazines.

41 CFR, Subpart 109, lists explosives as sensitive items that require an annual inventory for 100 percent inventory accuracy. 41 CFR, Subpart 109, states that "detailed procedures for the taking of physical inventories shall be developed for each Department office and designated contractor, and that the Organizational Property Management Officer or Property Administrator shall review and approve the Department's and contractor procedures." Additionally, it states that "physical inventories shall be performed by the use of personnel other than the custodians of the property."

We interviewed eight officials responsible for explosives management at HEAF and Site 300, and upon our request none provided us with detailed inventory procedures. The custodians stated that they follow DOE Standard 1212, *Explosives Safety*, and other local policies for conducting an annual inventory. However, DOE-STD-1212 only requires an inventory of the weight in each magazine to ensure that the magazine's safety limit has not been exceeded. In fact, the custodians not only checked the weight of their explosives for the magazines, each stated that they conducted their inventory by comparing the current inventory list to the corresponding explosives containers. Additionally, we spoke to LLNL property management officials, including the National Nuclear Security Administration (NNSA) Organizational Property Management Official, who are responsible for establishing and implementing procedures that address storage and inventory of property at LLNL. The officials stated that they did not review or approve any explosives inventory procedures, as required by 41 CFR, Subpart 109, and did not play any role in the oversight of explosives.

In addition, the explosives custodians each conducted their own inventories without clear verification by another individual. As noted above, 41 CFR, Subpart 109, states "that physical inventories shall be performed by the use of personnel other than the custodians of the property," and where that is not possible, "the inventory may be performed by the custodian with verification by a second party." All of the custodians stated that they, and their immediate staff,

conducted the annual inventories. During the inspection, it was evident that management compiled the annual weight inventories, but it was not evident that sufficient verification occurred for property management.

Throughout our inspection, explosives custodians stated that they followed safety requirements and not the property management requirements of 41 CFR, Subpart 109. All of the explosives custodians we interviewed stated that they followed a combination of the safety guidelines for explosives, including DOE-STD-1212, the LLNL Environment, Safety, and Health Manual, site facility safety plans, and local policies and procedures. Because these officials followed safety standards and not 41 CFR, Subpart 109, there were no detailed policies and procedures that required custodians to follow property management regulations. Specifically, detailed procedures did not exist for conducting inventory or doing so with the use of personnel other than the custodians. By not requiring custodians to follow property management regulations and without the custodians knowing the requirements, LLNL is not in compliance with 41 CFR, Subpart 109. In addition, the absence of these procedures may lead to programs conducting inventories differently and the use of multiple inventory systems.

### **Adequate Tracking, But Lacked Standardized Inventory Management System**

We found that LLNL adequately tracked its explosives with minor discrepancies, which did not pose safety or security risks. However, we found that LLNL did not have a standardized inventory system across its different operational programs. Specifically, we found that LLNL operated seven separate inventory systems for programs at Site 300 and a separate system at HEAF.

### **LLNL Adequately Tracked Its Explosives**

To conduct our inspection, we selected a statistical sample from the full population of LLNL's explosives. We then compared our sample from the inventories provided by the explosives custodians to the physical explosives located in the storage magazines. The comparison included the type of explosive material, its weight, quantity, owner, compatibility group, and hazard classification. The compatibility group defines which explosives may be stored together without increasing the risk of initiation, while the hazard classification indicates the initiation effects of the explosives. Custodians use these two attributes to help ensure the safe storage of explosives.

During our inspection at Site 300 and NNSS, we found that LLNL readily located all of the sampled explosives in the magazines' corresponding inventory. However, there were some minor weight discrepancies between the explosives labels and inventories, which appeared to be administrative errors that posed no real safety or security risks. Specifically, we found 7 weight discrepancy occurrences out of 125 sampled items at Site 300 (Group 1); and 4 occurrences out of 63 sampled items at NNSS. These errors appeared to be mostly administrative in nature and illustrated a need for more care by the custodians when entering information into the inventories.

## **LLNL Lacked a Standardized Inventory Management System**

Although LLNL demonstrated that it adequately tracked its explosives, we found that LLNL operated differently formatted inventory systems for each program or site rather than a standardized system or format. Site 300 operated seven different inventory systems and HEAF operated its own proprietary database, all of which were maintained by the individual program custodians in different sophistication levels and formats, and tracked different information. For example:

- The inventory systems varied in format:
  - One inventory system had programmed drop-down options for each category, while others did not; and
  - One inventory system had calculation and conversion formulas built into the excel sheet, while others did not.
  
- The inventory systems tracked different information across programs:
  - One program tracked weight information using the metric system, while others used the imperial system; and
  - Different programs used different tracking numbers; and
  - One program tracked owners by the individual's name, while another program did not track owners.

According to 41 CFR, Subpart 109, contractors shall establish, implement, and maintain a system that provides for an efficient personal property management program. In our opinion, there are opportunities for improvement; although LLNL has systems in place for tracking explosives, the use of non-standardized systems may not demonstrate the establishment of an efficient system.

Magazine custodians stated that they did not have any written or formal guidance from management or local procedures on inventory management system requirements. Consequently, the lack of formal guidance from management and a lack of a standardized system contributed to the multiple different inventories across programs at LLNL. Without formal guidance from management, it is unclear what characteristics officials should track and what information should be standard across all inventories. The use of non-standard inventory systems across LLNL may not demonstrate efficient operations when personnel outside of the program need to conduct work or take an inventory of the explosives, particularly since 41 CFR, Subpart 109, requires LLNL to have personnel other than the property custodians perform the inventory. We believe standardization of the inventories and the adoption of best features may help to limit label and inventory discrepancies in the future. For example, we discerned that six weight discrepancies at NNS were due to numeral rounding conversions and not administrative mistakes since it

tracked weights in both units of measurement. If measurement units were standard across all operations, or conversion formulas were standard within the inventory systems, officials may be able to avoid the discrepancies or quickly identify discrepancies from rounding conversions.

### **Storage of Explosives Adequate, Minor Degradation of the Facilities Observed**

We found that LLNL stored its explosives adequately with minor storage container and facilities issues. Specifically, we observed two damaged storage containers, one having a broken handle, and the other partially damaged, unsealed, and infested with insects. According to DOE-STD-1212, explosives shall be properly packaged and stored in either Department of Transportation approved manufacturer's containers or in specified onsite containers. Specifically, explosives containers should not leak and closures should protect the contents from spilling; open containers shall not be stored in magazines; and damaged containers shall be repaired or transferred to an undamaged container. In response to our observations, LLNL officials immediately replaced the insect-infested container with an approved onsite container. Officials also replaced the container with a broken handle with an appropriate undamaged container.

In addition, we observed that some of LLNL's explosives storage facilities showed signs of physical deterioration at Site 300. For example, 14 storage facilities at Site 300 had peeling interior paint, and another had a severe mice infestation that prevented us from entering the magazine until it was decontaminated. The mice-infested magazine also had wide gaps around the doorway, which may have been a contributing factor to rodent infestation. As previously mentioned, we also identified an insect infestation inside an explosives container stored within a magazine at Site 300.

According to the Department Order 430.1C, *Real Property Asset Management*, Department real property assets must be sustained by maintenance, repair, and renovation activities. Department Order 430.1C also defines facilities management and operations as activities associated with operating real property and providing facility-related services including janitorial services, pest control, roads and grounds management, and other similar services incurred to use a facility. Additionally, 41 CFR, Subpart 109, states that property in storage must be protected from deterioration or destruction, and certain items must be protected from vermin infestation. Although the storage facilities observations and occurrences did not pose immediate safety and security risks, there are potential future risk implications if the storage facilities are not actively managed.

### **Potential Future Storage Challenges**

Although LLNL maintained explosives in its possession safely and securely, it may incur future storage challenges if officials do not actively manage the amount of explosives in the magazines. During our inspection, we identified older and legacy materials that programs do not plan to use in the future. Officials stated that physical storage space is crowded and one official stated that more storage space may be necessary for new work on life extension programs.

During our inspection at HEAF and Site 300, four of the explosives management officials we spoke to stated that the storage magazines were becoming crowded. With the exception of one

magazine, none were in danger of exceeding the safety weight limits, but we observed that some magazines were physically crowded. For example, we observed two magazines at Site 300 that were crowded to the point that no additional explosives could be stored there.

We also observed explosives material in different magazines, including old ammunition that officials stated they are unlikely to use in the future. Officials noted that there were a number of older materials at HEAF and Site 300 that they wanted to dispose of due to physical storage space challenges. An LLNL management official noted that there are programmatic reasons to maintain the older and legacy materials.

Another issue that aided in the creation of excess explosive materials is that custodians may not be the owners of the material. The custodians are the explosives handlers tasked with the day-to-day management of the explosives and storage spaces, while the owners of the explosives may not be managing the explosives within the storage space. The owners are the ones that have the final determination in the disposition of the material, and the custodians act according to the owner's decision. However, since the owners do not manage the storage space, they may hold onto the material for longer than necessary for program or project need, and may even pass that material to their coworkers when they move or retire. During our inspection of the Site 300 (Group 1) sample, we observed 38 out of 125 different items where the owner on the explosive label was not the current owner of the material and a new owner was listed on the inventory, or it was unclear whether the owner was adequately tracked on the inventory. As materials pass from owner to owner, they may remain in the storage area with no plans for use. Two officials stated that researchers were reluctant to dispose of explosives that they used in the past.

In response to the limited availability of space, LLNL officials stated that it does not have a formal plan to manage the space in the future, but it actively attempts to mitigate the situation through the disposition of older material and the use of the older material in training and cleaning shots. However, there are a number of limitations that slow the disposition and use of older material. Due to California air quality restrictions, Site 300 is only permitted to expend 1,000 pounds of explosives each year in the open air and must follow specific guidance based on environmental concerns. An official stated that LLNL shipped some explosives offsite for disposition in the past 2 years, but due to security concerns there are limitations for the remaining materials. If LLNL continues to work on life extension programs in the near future, then it is necessary that the explosive managers actively manage the stockpile now to provide room for future material.

#### PATH FORWARD AND SUGGESTED ACTIONS

Based on the Department's assurances that it is addressing issues identified in a previously issued audit report, *The Department of Energy's Storage and Disposition of Explosives Material at Selected Sites* (DOE-OIG-20-50, July 2020), we are not making recommendations. We believe that the ongoing actions, if fully implemented, should help to address the similar issues identified during this review. In response to our report, an NNSA official stated that they are going to take an NNSA-wide approach to provide guidance for ensuring that all NNSA sites meet the requirements in 41 CFR, Subpart 109. Specifically, the ongoing actions should address the need to:



- Develop detailed written procedures for conducting physical inventories of explosive materials and ensure that those procedures are approved by the Property Administrator in order to comply with 41 CFR, Subpart 109; and
- Provide clear guidance and implement the requirement that annual physical inventories are performed by personnel other than the custodians of the explosives in order to fully comply with 41 CFR, Subpart 109.

In addition, to address our observations identified in this report at Lawrence Livermore National Laboratory, we suggest that the Manager, Livermore Field Office consider taking proactive steps to:

- Develop a standardized inventory system across different operational programs to track high explosives inventories at Site 300 and HEAF. The standardized inventory system may include the required information to be tracked, in addition to formulas for the weight conversion from metric to imperial.
- Maintain the physical conditions of storage facilities such that physical deterioration and pest infestations inside the storage facilities are addressed and prevented.
- Manage the amount of explosives stored in magazines in order to address potential physical storage space challenges. This includes the disposition of old and legacy materials to provide adequate storage for new explosive operations.

#### MANAGEMENT RESPONSE

Management stated that it would consider the report suggestions as ongoing actions are implemented.

cc: Deputy Secretary of Energy  
Chief of Staff  
Director, Office of Audits and Internal Affairs

## **OBJECTIVE, SCOPE, AND METHODOLOGY**

### OBJECTIVE

We conducted this inspection to determine whether Lawrence Livermore National Laboratory (LLNL) is managing and storing explosive materials in accordance with Federal and Department of Energy requirements.

### SCOPE

The inspection examined the management of explosives materials, specifically explosives controls, inventory, and storage from fiscal year 2016 through 2019. There were 4 selection groups with the total population of 6,419 explosive materials. The inspection was performed from July 2019 through August 2020. We conducted the inspection at LLNL in Livermore, California and the Nevada National Security Site outside of Las Vegas, Nevada. The inspection was conducted under Office of Inspector General project number S19IS004.

### METHODOLOGY

To accomplish the inspection objective, we:

- Reviewed applicable policies, procedures, laws, and regulations pertaining to the Department's management and storage of explosive materials.
- Interviewed Department and contractor officials with relevant knowledge to obtain an understanding of the management and storage of explosive materials.
- Obtained information regarding LLNL's Explosive Safety Committee, recent audits, recent reviews and assessments, quality assurance plans, annual inventories, safety and security incidents, storage review program, and current inventories.
- Selected a stratified sample from LLNL's explosive materials stored at each of the different LLNL sites.
- Conducted an inspection to verify that the explosive materials were readily located in the correct magazines, stored in compliance with the Department standards and local policies, properly labelled, and properly tracked within the inventory.
- For the statistical sample, we divided the explosive materials inventory population into four subpopulations based on site location and security classification. We randomly selected a sample to ensure a 95% confidence level, +/- 4% precision, and an expected error rate of 5%. The sample was not projected onto the whole population for reporting purposes due to the administrative nature of the errors. The subpopulations and associated sample sizes are:

<b>Selection Group</b>	<b>Subpopulation</b>	<b>Sample Size</b>
<b>HEAF</b>	2,888	112
<b>Site 300 Group 1</b>	1,452	125
<b>Site 300 Group 2</b>	1,976	109
<b>NNSS</b>	103	63

We conducted this inspection in accordance with the Council of the Inspectors General on Integrity and Efficiency's *Quality Standards for Inspection and Evaluation*. Those standards require that we plan and perform the inspection to obtain sufficient, appropriate evidence to provide a reasonable basis for our conclusions and observations based on our inspection objective. We believe that the evidence obtained provides a reasonable basis for our conclusions and observations based on our inspection objective. Accordingly, the inspection included tests of controls and compliance with laws and regulations to the extent necessary to satisfy the inspection objective. Because our review was limited, it would not necessarily have disclosed all internal control deficiencies that may have existed at the time of our inspection. We relied on computer-processed data to satisfy our objective. We conducted a reliability assessment of computer-processed data relevant to our inspection objective by comparing a sample to corroborating evidence. We deemed the data sufficiently reliable for our purposes.

An exit conference was held with management officials on August 13, 2020.

## PRIOR REPORTS

- Audit Report on [\*The Department of Energy's Storage and Disposition of Explosives Material at Selected Sites\*](#) (DOE-OIG-20-50, July 2020). The audit found that three National Nuclear Security Administration sites were generally storing and disposing of explosives material in accordance with Federal and Department requirements. However, the audit identified weaknesses at every site that potentially limit the effectiveness of explosives material control, accountability, and safety. The audit recommended that the National Nuclear Security Administration maintain comprehensive database and inventory systems, establish steps to meet the requirements of conducting a physical inventory, develop processes to regularly update or replace explosives labels, develop procedures to ensure that incompatible explosives material are not stored in prohibited areas, and consider designating a storage review committee at the sites.
- Inspection Report on [\*Accountability and Control of Explosives at Lawrence Livermore National Laboratory's High Explosives Application Facility\*](#) (INS-O-13-06, September 2013). The inspection substantiated allegations regarding weaknesses with controls over access and inventory of explosive materials. The inspection found individuals had potential access to areas without specific authorization, training, or official need; the High Explosive Application Facility's training did not adequately address requirements for unescorted access to workrooms; and a tracking and inventory system did not exist.
- Inspection Report on [\*Management of Explosives at Selected Department Sites\*](#) (INS-O-12-02, July 2012). The inspection identified problems with handling and storing explosives at Savannah River Site, Idaho National Laboratory, Sandia National Laboratories, and Los Alamos National Laboratory. The inspection found that officials received shipments of explosives at populated main gates rather than remote gates or during off-peak times, officials did not perform required safety determinations prior to the return of explosives remains to storage, excess combustible and non-combustible materials were stored in magazines with explosives, and contractors did not properly implement safety protocols.

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