

U.S. Department of Energy Office of Inspector General Office of Audits and Inspections

MANAGEMENT ALERT

Remediation of Selected Transuranic Waste Drums at Los Alamos National Laboratory – Potential Impact on the Shutdown of the Department's Waste Isolation Plant

DOE/IG-0922

September 2014



Department of Energy Washington, DC 20585

September 30, 2014

MEMORANDUM FOR THE SECRETARY

Gez Fiedman

FROM:

Gregory H. Friedman Inspector General

 SUBJECT:
 INFORMATION: Management Alert on "Remediation of Selected Transuranic Waste Drums at Los Alamos National Laboratory – Potential Impact on the Shutdown of the Department's Waste Isolation Pilot Plant"

BACKGROUND

The Department of Energy's (Department) Los Alamos National Laboratory (LANL), managed and operated by Los Alamos National Security, LLC is one of the Nation's premier national security laboratories. As part of its mission, LANL generated a large volume of transuranic (TRU) waste consisting mostly of radioactively contaminated clothing, tools, rags, debris and soil. In January 2012, a framework agreement was established between the Department and the New Mexico Environment Department (NMED) to ship 3,706 cubic meters of combustible and dispersible TRU waste from LANL to the Department's Waste Isolation Pilot Plant (WIPP) located in Carlsbad, New Mexico, for permanent disposal by June 30, 2014. The Department established the Central Characterization Project (CCP) to characterize and certify waste to help ensure that it met WIPP's waste acceptance criteria. Since the TRU waste campaign began, LANL reported that it had shipped TRU waste to WIPP and was on track to meet target disposal dates.

On February 14, 2014, a radiological release from one TRU waste drum was detected in the underground repository at WIPP. As a consequence, underground operations at WIPP were suspended and the Nation's only operating deep geologic repository for the permanent disposal of defense-related TRU waste was shut down for an indefinite period. The impact of the shutdown, both incurred to date and in the future, is valued in terms of tens of millions of dollars. In addition, the shutdown adversely impacts the remediation of numerous Department sites by delaying the permanent disposal of waste. The impact in both cases is highly significant. On May 15, 2014, visual evidence confirmed a breached container that originated from LANL.

We initiated a special inquiry to determine whether LANL appropriately managed the remediation and repackaging of waste shipped to WIPP.

IMMEDIATE CONCERN

The Department's separate accident investigation had not yet determined the cause of the radioactive release incident at WIPP. Our review, however, identified several weaknesses in

LANL's procedures for the development and approval of waste packaging and remediation techniques that may have contributed to the radiological event. Of particular concern, not all waste management procedures at LANL were properly vetted through the established procedure revision process nor did they conform to established environmental requirements. In our view, immediate action is necessary to ensure that these matters are addressed and fully resolved before TRU waste operations are resumed, or, for that matter, before future mixed radioactive hazardous waste operations are initiated.

In particular, we noted that:

- Despite specific direction to the contrary, LANL made a procedural change to its existing waste procedures that did not conform to technical guidance provided by the Department for the processing of nitrate salt waste; and
- Contractor officials failed to ensure that changes to waste treatment procedures were properly documented, reviewed and approved, and that they incorporated all environmental requirements for TRU waste processing.

These weaknesses led to an environment that permitted the introduction of potentially incompatible materials to TRU storage drums. Although yet to be finally confirmed, this action may have led to an adverse chemical reaction within the drums resulting in serious safety implications. Notably, Los Alamos National Security, LLC and its subcontractor, Energy Solutions, added potentially incompatible materials to waste stored in drums during the waste remediation process at LANL's Waste Characterization, Reduction and Repackaging Facility (WCRRF). Specifically:

- Organic absorbent material (organic kitty litter) was added to the waste stored in the drums, materials that may result in a chemical reaction; and
- Liquid acid neutralizers were also added to the drums, substances that were potentially incompatible with the stored waste.

LANL's waste processing and safety related control procedures should have prevented the addition of these potentially incompatible materials. However, the process failed in this matter. Specifically, LANL's procedure revision process failed to adequately analyze potential reactivity issues and/or provide sufficient detail in the waste remediation procedure. In addition, LANL violated established environmental requirements by treating a corrosive waste outside its environmental permit by adding neutralizers and absorbents to the waste.

As noted, the specific cause of the radioactive release at WIPP has not been determined. Yet, the addition of these potentially incompatible materials to nitrate bearing TRU waste drums during the waste remediation process has resulted in problems that the Department will ultimately need to address. Such actions, likely costly, will require additional efforts to examine the storage, relocation and processing of the remaining drums containing the potentially incompatible materials at LANL, WIPP and at a temporary waste storage facility the Department used when WIPP shipments were interrupted. The more pressing need, however, is to ensure that additional development or modification of existing waste treatment procedures is not undertaken without implementing an adequate review and approval process.

Changes to the Waste Remediation Process

LANL undertook revisions to its existing waste procedures without following Department direction or providing appropriate subject matter expert (SME) review. In particular, the process LANL used to modify its procedures failed to identify the hazards associated with the addition of potentially incompatible materials to the waste remediation process. Had LANL followed Department direction and provided appropriate SME reviews, it likely would have determined that the changes to its procedures would result in the introduction of potentially incompatible materials to the waste of this failure, LANL did not discover that the mixture of the waste and remediation materials it planned to add to TRU waste drums were known to be inherently hazardous.

LANL's procedure revision process failed to discover or properly evaluate chemical materials compatibility issues. For example, officials apparently did not consider readily available information on chemical reactions, such as an April 2000 Environmental Protection Agency (EPA) case study on waste fuel/oxidizer reaction hazards. Although the EPA case study did not specifically reference nitrate salts as an oxidizer, it stated that "Disposing of oxidizers by mixing them with organic solvents is generally recognized as inherently hazardous; and that common references warn against mixing oxidizers with organic or combustible materials." LANL also did not detect that the word "organic" had reportedly been inadvertently added to the WCRRF Waste Characterization Operations Procedure, an oversight that lead to the addition of potentially incompatible "organic" kitty litter to waste drums. LANL officials also approved the use of a neutralizer that was potentially incompatible without reviewing the chemical compatibility.

Use of Absorbents

LANL's process for updating operating procedures did not ensure that the procedure for remediating nitrate salt bearing TRU waste drums was revised according to a May 2012 technical paper (white paper) written by the LANL - Carlsbad Operations Difficult Waste Team (DWT). The white paper specified the use of "Kitty Litter/Zeolite clay" as an acceptable absorbent to be used with nitrate salts for WIPP. Ordinary kitty litter and Zeolite clay are inorganic dirt mixtures. Consistent with the direction in the white paper, in July 2012, LANL decided to revise the Procedure to implement the mixture of Kitty Litter/Zeolite and nitrate salts. We noted that both the white paper and LANL's decision document for updating the Procedure clearly identified the absorbent to be used was Kitty Litter/Zeolite. Neither the white paper nor the decision document mentioned using "organic" kitty litter. However, the Procedure was revised in August 2012 to incorporate "organic" kitty litter in the processing of waste with nitrate salts. According to an Energy Solutions official, during a meeting held to discuss the processing of nitrate salt waste, the DWT verbally approved using "organic" kitty litter. However, the DWT official informed us that the term "organic" was not used and that he did not believe that anyone else used that term. Despite the apparent disagreement regarding the verbal approval of "organic" kitty litter by the DWT, an Energy Solutions official stated that the company is only responsible for the execution of LANL policies and procedures and not for developing them. Although the Department directed LANL to follow the white paper, the LANL procedure writer stated that neither the white paper nor the decision document was provided for his review at the time of the revision. Instead, handwritten notes that called for an organic absorbent to process nitrate salt drums were improperly relied upon to revise the Procedure.

In addition, LANL's procedure revision process did not ensure that all of the appropriate organizations reviewed changes to the Procedure. According to LANL's directive for *Environmental Programs Procedure Preparation, Revision, Review, Approval and Use,* responsible line managers and document owners are to assign SMEs and designate the required review authorities. However, LANL did not require that an SME review the Procedure change for chemical reactivity. Further, LANL's Environmental organization was not included in the procedure revision process to review documents that described the handling and processing of hazardous chemicals and waste. A LANL official stated that in many instances, the signature page of the Procedure is prepopulated with the standard organizations which would need to review and concur on many of LANL's various procedures. Although a review was performed by LANL's Environmental Stewardship organization, its focus was reviewing for compliance with environmental permits (such as the *Resource Conservation and Recovery Act*). Despite documentation reviews from organizations such as Industrial Hygiene, Quality Assurance, Engineering and Radiation Protection, the direction to use "an organic absorbent (Kitty Litter/Zeolite)" in the Procedure was subsequently approved.

During the course of our review, we also noted that LANL had not documented in the Procedure the use of another organic absorbent (a carbon-based polymer), which it had used prior to the "organic" kitty litter. A DWT official informed us that the polymer was an organic material and that in 2012, LANL, the Carlsbad Field Office, and the Los Alamos Field Office were notified to discontinue using it as an absorbent with nitrate salts because of the possible dangers of mixing organic materials with nitrates. LANL officials could not provide documentation to us regarding the reason for the discontinued use of the polymer other than an e-mail from LANL directing a hold on all processing and characterization of salt bearing waste in March 2012. According to an Energy Solutions official, when the processing of nitrate salts resumed in August 2012, the Procedure specified the use of "organic" kitty litter. Prior versions of the Procedure did not mention the specific name of the polymer or its use.

Further, LANL missed an opportunity to identify the potential incompatibility of revised remediation materials. Under the CCP/LANL Interface Document, LANL has primary responsibility to notify CCP when there are changes to policies, processes or procedures that may affect CCP characterization activities or operations. However, the Interface Document does not require a response from CCP. According to LANL officials, while the CCP was made aware of the changes to the Procedure, including the use of the "organic" kitty litter to process nitrate salt drums, no concerns were identified by the CCP. A LANL official provided documentation that the CCP received a copy of the revised Procedure that incorporated the use of "organic" kitty litter in September 2012, to update its Acceptable Knowledge documents regarding the waste stream that contained the nitrate salts. However, we noted that while the CCP's Acceptable Knowledge documentation repeatedly referred to "kitty litter (clay)" as an absorbent associated with that particular waste stream, the term "organic" was not found. In May 2014, the Department informed NMED that the use of an organic kitty litter absorbent was being studied as a contributor to the possible container breach at WIPP.

Neutralizer

LANL approved using an acid neutralizer that was potentially incompatible with nitrate salts stored in the drums. In March 2013, LANL revised its treatment procedure to include the addition of a step to neutralize liquids. However, there was no mention of which neutralizer was

to be used. Subsequently, in September 2013, Los Alamos National Security, LLC and Energy Solutions began using a liquid acid neutralizer with an ingredient that was highly reactive with oxidizers and was, therefore, potentially incompatible with the nitrate salts. According to a Department official, the majority of the nitrate salt bearing drums that had liquids was neutralized with this particular liquid acid neutralizer. The neutralizer's material safety data sheet did not identify any incompatible materials. However, the neutralizer's material safety data sheet also stated that the data sheets of the chemicals used with the product must be reviewed completely and that precautions should be taken. We reviewed the individual data sheets for the neutralizer's ingredients, and confirmed that the ingredients were not compatible with oxidizers. Although required, LANL and Department officials acknowledged that a review of chemical ingredients for the neutralizers was not performed and that a weakness in the control process for the Procedure change had occurred. A Department official informed us that LANL's current chemistry analysis results do not indicate that the neutralizer is the sole mechanism that could explain the radiological release incident at WIPP.

Environmental Requirements

In addition to problems directly associated with the addition of possibly incompatible materials to TRU waste drums, we also discovered that LANL's review process failed to identify changes to its waste processing procedures that would result in non-compliance with existing environmental permits. On July 1, 2014, the Department and Los Alamos National Security, LLC issued an addendum to the NMED Permit to self-report that the processing of the nitrate salt waste drums was outside the permit exemptions for treatment activities as required by NMED rules, incorporating Federal hazardous waste regulations and environmental requirements, such as the Resource Conservation and Recovery Act. Specifically, the noncompliance involved neutralizing "corrosive waste" and then adding absorbents to waste that were assigned multiple EPA hazardous waste codes. The EPA hazardous waste codes describe what hazards are associated with specifics wastes, such as lead, mercury and ignitable waste. We noted that LANL's Procedure did not specify what materials they should recognize as "corrosive waste." In addition, the Procedure did not provide further instruction regarding what should be done in the event that the waste is corrosive. For example, according to the NMED Permit, waste processing should be stopped if the waste is assigned multiple EPA hazardous waste codes (and therefore, do not qualify for Permit exemptions).

Impacts

The Department and LANL told us that they have taken action since the radiological release at WIPP to ensure the safety and protection of human health and the environment. In addition to the pause of legacy TRU waste repackaging and treatment, LANL is working to address processing and/or treatment for the remaining nitrate salt-bearing drums that are currently in isolated storage. Further, LANL is working with experts from five other national laboratories to form a Technical Assessment Team to determine the cause of the radiological release in coordination with the Department's Accident Investigation Board. According to the Los Alamos Field Office, as of September 2014, there were a total of 713 nitrate salt-bearing waste drums, with 508 located at WIPP, 86 at LANL, and 119 at a temporary commercial waste storage facility.

Due to the WIPP closure, a contract was executed with a temporary commercial waste facility to store TRU waste from LANL. The waste to be shipped from LANL was the waste remaining from LANL's campaign to meet its commitment with NMED to remove the waste by June 30, 2014. The agreement called for the waste to be stored pending disposal at WIPP upon its resumption. The Department estimated that it will cost \$5.1 million for storage through the end of Fiscal Year (FY) 2014. This cost will be funded by LANL's Environmental Management budget for cleanup work.

In addition, LANL has incurred costs, above and beyond the \$19.9 million that was spent by WIPP, for its internal efforts related to the WIPP investigation and recovery actions. Specifically, LANL has spent \$1.1 million as of June 2014 for chemistry analysis, sampling, and Environment, Safety and Health. The Laboratory estimated that it will spend another \$3.6 million through FY 2014 for the Technical Assessment Team and additional storage costs. These costs are likely to increase significantly as LANL takes actions to address problems with a substantial number of waste drums that were processed with the organic material/potentially incompatible neutralizer. Notably, LANL acknowledged concerns in this area and recently notified NMED that it was provisionally reclassifying hundreds of similar waste drums as potentially containing ignitable or corrosive materials which may pose previously unrecognized safety issues.

Additionally, LANL could face enforcement actions taken by NMED for not completing major environmental cleanup operations and for noncompliance with its Hazardous Waste Facility Permit. In March 2005, LANL, the Department and NMED signed the Compliance Order on Consent (Order), where LANL agreed to a schedule for the completion of cleanup at various locations on the LANL site by 2015. The completion of the 3706 TRU waste campaign was vital to renegotiate cleanup deadlines. Although LANL had removed 3,328 cubic meters (90 percent) of TRU waste, LANL lost its primary tool to renegotiate the 2015 cleanup deadline for the bulk of the legacy waste with NMED. At this time, the enforcement actions that will be taken by NMED are unknown and have yet to be determined. The Order provides penalties for noncompliance with the cleanup milestones of up to \$3,000 per day for each day of noncompliance.

RECOMMENDATIONS

Due to the unusual circumstances of events leading up to the radiological release at WIPP, prompt and effective corrective actions are essential to ensure that LANL's processes to change operating procedures appropriately identify the hazards associated with those changes. To achieve this, we recommend that the Manager, Los Alamos Field Office direct LANL to:

- 1. Ensure all needed SME and organization reviews of procedure changes are performed, including those with a chemistry background;
- 2. Ensure that SME documents (e.g. white paper, solutions package), are provided to the procedure writer;
- 3. Ensure that added procedures include sufficient detail to perform the task (e.g. what neutralizer to use and to what level to neutralize the waste);

- 4. Consider notifying Environmental Management organizations, such as the Central Characterization Project and Difficult Waste Team, of all changes to LANL waste management procedures so that a WIPP acceptability impact review can be performed prior to issuing the changes;
- 5. Improve communication to procedure writers and reviewers concerning why a change is being made (e.g. to avoid combining organic materials with oxidizers in the waste stream); and
- 6. Reevaluate the waste characterization concerning the nitrate salt waste stream to address the noncompliance with the LANL Hazardous Waste Facility Permit.

MANAGEMENT REACTION

Management agreed with the findings and recommendations and proposed corrective actions. In addition to curtailing remediation operations in May 2014, management stated that it has instituted additional precautionary protective measures to ensure that workers, the public and the government are protected. Further, in order to align the focus of accountability of the legacy environmental cleanup within the Department's Environmental Management program, the Secretary has directed the development of a plan to transition this work from the National Nuclear Security Administration to the Office of Environmental Management. Both organizations will work together to evaluate all elements necessary for an effective transition, including federal oversight, acquisition strategies, and quality, safety and security. Management stated, however, that integration of all of these ongoing actions could impact the timeline for completing the specific actions that address the issues noted in this report. Finally, because the Department has yet to conclude its investigation, additional issues and corrective actions will be used as appropriate for accountability.

AUDITOR COMMENTS

Management's comments are attached and responsive to our recommendations. Management waived an exit conference.

Attachment

cc: Deputy Secretary Administrator, National Nuclear Security Administration Acting Assistant Secretary for Environmental Management Chief of Staff

MANAGEMENT COMMENTS



Department of Energy Under Secretary for Nuclear Security Administrator, National Nuclear Security Administration Washington, DC 20585



September 29, 2014

MEMORANDUM FOR GREGORY H. FRIEDMAN INSPECTOR GENERAL

FROM:

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FRANK G. KLOTZ JK_ 9/29/2014

SUBJECT:

Comments on the Office of Inspector General Draft Management Alert Titled "Remediation of Selected Transuranic Waste Drums at Los Alamos National Laboratory" (Job Code A13AL046 / IDRMS No. 2014-02286)

Thank you for the opportunity to review and comment on the subject draft report. The report provides six recommendations to the National Nuclear Security Administration (NNSA), focusing on enhancing LANL's processes for the development and approval of waste packaging and remediation policies and techniques.

The results of the Office of Inspector General (OIG) review are consistent with findings from internal assessments, and NNSA concurs with the recommendations provided in the draft report. The events at Waste Isolation Pilot Plant (WIPP) have the Department's full attention, and we have already initiated actions to address the underlying issues identified in this report and other assessments. As a result of initial findings, management made the decision to pause remediation and repackaging of legacy transuranic wastes in May 2014. These operations will not be resumed until there is a thorough understanding of the cause(s) of the errors and corrective actions have been completed to prevent a recurrence, including resolution of the recommendations in this report.

In addition to curtailing remediation operations, management has instituted additional precautionary protective measures to ensure our workers, the public, and the environment are protected. Elements of these measures are detailed in the *LANL Nitrate Salt Bearing Waste Container Isolation Plan*, and any changes are subject to review and approval by the New Mexico Environment Department. The remaining drums at LANL that contain a portion of the nitrate salts waste stream are currently managed in a conservative and protective manner. Key elements of the isolation plan include:

- Overpacking of each nitrate salt waste drum in a secondary protective package, or Standard Waste Box, and storing all the remaining drums that comprise the nitrate salts waste stream in radiological containment structures equipped with cascading ventilation and High Efficiency Particulate Air filtration;
- Conducting continuous radiological air monitoring;



- Managing wastes through storage in a climate controlled environment with the temperatures not to exceed 90⁰ F, and conducting daily thermographic monitoring. There has been no indication of temperature increases in any of the packages;
- Storing the remaining drums from the nitrate salts waste stream in structures that have active fire suppression systems; and
- · Conducting a 24 hour fire watch.

Finally, in order to align the focus and accountability of the legacy environmental cleanup within the Department's Environmental Management program, the Secretary of Energy has directed the development of a plan to transition this work from the NNSA to the Office of Environmental Management (EM). NNSA and EM will work together to evaluate all elements necessary for an effective transition including federal oversight, acquisition strategies, and quality, safety and security. However, the integration of all of these ongoing actions could impact the timeline for completing the specific actions that address the issues noted in the OIG report. As your auditors note, the Department has yet to conclude its investigation. Therefore, additional issues and corrective actions may also be identified beyond those contained in the report, and contract terms and conditions will be used as appropriate for accountability.

In closing, please be assured that the Department shares the concerns listed in the report and will keep your office informed of our progress in addressing the specific recommendations. The attachment to this memorandum provides the specific actions NNSA has already taken and plans to take to address each recommendation. If you have any questions, please contact Dean Childs, Director, Audit Coordination and Internal Affairs, at (301) 903-1341.

Attachment

Attachment

National Nuclear Security Administration (NNSA) Response to Draft Inspector General Management Alert Titled *"Remediation of Selected Transuranic Waste Drums at Los Alamos National Laboratory"*

The Office of Inspector General (OIG) recommended NNSA:

RECOMMENDATION 1: Ensure all needed subject matter expert (SME) and organization reviews of procedure changes are performed, including those with a chemistry background.

Management Decision: Concur

Management will ensure a protocol is developed for procedure development, issuance and cognizant organizational review. This will include procedure change reviews and approvals, and clarification of documents, organizations and SMEs needed for final review and approval. The protocol shall further define SME personnel requirements for approval authority.

RECOMMENDATION 2: Ensure that SME documents (e.g. white paper, solutions package) are provided to the procedure writer.

Management Decision: Concur

Internal investigations have also concluded that the SMEs who reviewed the procedure used to remediate the nitrate salts did not have the tools necessary to provide a comprehensive review. SMEs need to be provided the necessary documents and reference materials to ensure they have the knowledge to perform a competent review of the procedures. Management will ensure that the TRU Program has a current listing of acceptable SMEs, that those SMEs are given the proper written direction on the protocols for providing documentation to the procedure writer and to the appropriate project manager, and that procedures are not written until all appropriate documentation has been provided.

RECOMMENDATION 3: Ensure that added procedures include sufficient detail to perform the task (e.g. what neutralizer to use and to what level to neutralize the waste).

Management Decision: Concur

The procedure that prescribed the remediation of nitrate salts was written to encompass every waste form that Waste Characterization Repacking and Reduction Facility (WCRRF) processes and lacked the detail necessary to adequately process and document the steps of this specific operation. Procedures that support waste remediation and repackaging will be rewritten to ensure the proper level of detail is incorporated.

National Nuclear Security Administration (NNSA) Response to Draft Inspector General Management Alert Titled "Remediation of Selected Transuranic Waste Drums at Los Alamos National Laboratory"

RECOMMENDATION 4: Consider notifying Environmental Management organizations, such as the Central Characterization Project and Difficult Waste Team, of all changes to LANL waste management procedures so that a WIPP acceptability impact review can be performed prior to issuing the changes.

Management Decision: Concur

Any procedure changes should be managed through the federal TRU waste program officials who will coordinate review through the Central Characterization Project and Difficult Waste Team contractor organizations. WIPP TRU Waste related procedures that support remediation and repackaging of TRU Waste will require concurrence prior to final approval from the Central Characterization Project and/or the Carlsbad Operation's Difficult Waste Team as deemed appropriate by the Carlsbad Field Office

RECOMMENDATION 5: Improve communication to procedure writers and reviewers concerning why a change is being made (e.g. to avoid combining organic materials with oxidizers in the waste stream).

Management Decision: Concur

Prior to routing a procedure change for approval, a narrative explaining the reason for the change is to be developed and shall be attached to the procedure requiring the change. When the procedure writers deem it necessary, they shall be given the opportunity to ensure that the procedure can be executed in the field per the changes. Procedure changes will be reviewed for impacts related to work authorizations, including safety basis approval. Changes to procedures that affect work authorizations will be highlighted and elevated for management action prior to implementation.

RECOMMENDATION 6: Reevaluate the waste characterization concerning the nitrate salt waste stream to address the noncompliance with the LANL Hazardous Waste Facility Permit.

Management Decision: Concur

This action has already been completed. On July 30, 2014 LANS and the Department notified the State of New Mexico that we are adding an additional waste code to the 57 remediated and 29 un-remediated nitrate salt bearing waste containers based on additional information regarding the waste. Future remediation of this waste will not occur without the proper approvals from the New Mexico Environment Department.

Attachment

National Nuclear Security Administration (NNSA) Response to Draft Inspector General Management Alert Titled *"Remediation of Selected Transuranic Waste Drums at Los Alamos National Laboratory"*

Timeline for Addressing Recommendations

NNSA is committed to addressing each of the listed recommendations and is working with EM on a schedule that is not mature at this time. The need to integrate all planned corrective actions related to the WIPP event at LANL will impact the timeline for resolving the OIG recommendations. As a result, specific timelines will be identified at a later date. As noted earlier, remediation operations will not resume until all recommendations are addressed.

FEEDBACK

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Office of Inspector General (IG-12) Department of Energy Washington, DC 20585

If you want to discuss this report or your comments with a member of the Office of Inspector General staff, please contact our office at (202) 253-2162.