



OFFICE OF INSPECTOR GENERAL

U.S. Department of Energy

# AUDIT REPORT

DOE-OIG-18-04

October 2017

**MANAGEMENT OF THE NATIONAL  
IGNITION FACILITY AND THE  
ADVANCED RADIOGRAPHIC CAPABILITY**



**Department of Energy**  
Washington, DC 20585

October 27, 2017

MEMORANDUM FOR THE ADMINISTRATOR, NATIONAL NUCLEAR SECURITY  
ADMINISTRATION

*Michelle Anderson*

FROM: Michelle Anderson  
Deputy Inspector General  
for Audits and Inspections  
Office of Inspector General

SUBJECT: INFORMATION: Audit Report on “Management of the National  
Ignition Facility and the Advanced Radiographic Capability”

BACKGROUND

The Department of Energy’s National Ignition Facility (NIF), located at Lawrence Livermore National Laboratory (Livermore), is the world’s only operational megajoule-class laser facility. NIF is composed of 192 precision-aligned laser beamlines, a 10-meter-diameter target chamber with associated experimental and diagnostic equipment, and other supporting infrastructure. Livermore manages NIF as a facility which supports a large range of missions including the Stockpile Stewardship Program and the Department’s fundamental science and energy missions. The National Ignition Campaign (NIC) was established to achieve fusion ignition and support non-ignition stockpile stewardship experiments on NIF, and transition NIF to routine facility operations. The NIC ended in fiscal year (FY) 2012 and did not achieve fusion ignition. In FY 2015, NIF received approximately \$275 million in Department funding for operations and related activities.

Based on the results of the *2015 Review of the Inertial Confinement Fusion and High Energy Density Science Portfolio*, performed by the National Nuclear Security Administration (NNSA), achieving NIF’s mission of fusion ignition in the near term (1 or 2 years) is unlikely and is uncertain over the next 5 years. NNSA’s review found that while ignition remains a significant technical challenge, its pursuit and achievement remains important to the Stockpile Stewardship Program into the foreseeable future. Further, NNSA stated in its review that costs will continue to be incurred over the next 5 years in support of diagnostics and facility improvements. Due to NIF’s significance in support of various missions, we initiated this audit to determine if Livermore is effectively managing NIF.

RESULTS OF AUDIT

Nothing came to our attention to indicate that Livermore has not effectively managed NIF. However, we identified an opportunity to improve Livermore’s management and NNSA’s

oversight of capital asset projects such as the Advanced Radiographic Capability (ARC), a key NIF diagnostic tool. Specifically, we found that NIF users reported accomplishing nearly all NNSA Level 2 program milestones from FYs 2013 through 2015. NIF users were generally satisfied with how Livermore had overseen the scheduling and execution of experiments at NIF. In addition, Livermore reported that it significantly improved its target shot<sup>1</sup> rate, achieving a total of 417 shots in FY 2016, which was the most ever achieved in a single year at NIF. We also noted that in December 2015, Livermore performed its first programmatic experiments using ARC, one of NIF's key diagnostic tools. In FY 2016, ARC produced its first radiographs of NIF targets which demonstrate progress towards the quality imagery of the more complex NIF experiments that ARC is designed to produce. While ARC is expected to continue making progress that is relevant to understanding the operation of modern nuclear weapons, we noted that NNSA did not require Livermore to apply Department Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets* in ARC's development and installation efforts, and therefore did not receive complete transparency. Ultimately, ARC was commissioned nearly 5 years later than the original schedule, over its total planned cost and only providing 50 percent of its original planned capability.

### **Advanced Radiographic Capability**

ARC is one of the many diagnostic tools at NIF serving as part of NNSA's Stockpile Stewardship Program. ARC is the world's highest-energy short-pulse laser that enables acquisition of high resolution x-ray images at very high speeds and brightness under experimental conditions. Specifically, ARC is designed to generate x-rays to backlight and illuminate NIF targets as they implode. ARC is expected to produce multiple radiographic images, or "movie" frames, of nuclear fusion experiments. In addition, ARC is also essential for probing materials under high pressures for NNSA's Stockpile Stewardship Program. The initial development and installation efforts for ARC were originally a sub-element of the NIC. While the NIC had enhanced management controls in place, Livermore did not extend those controls to ARC's development and installation efforts. After the NIC ended in FY 2012, ARC was direct funded through NNSA's Inertial Confinement Fusion Program.

### **ARC's Planned Schedule, Cost, and Scope**

NNSA's decisions to approve ARC delays without complete transparency and the technical challenges faced once the project progressed, affected the final scope, cost, and schedule. Specifically, ARC was commissioned nearly 5 years later than its original schedule, approximately \$81 million over its total planned cost, and with only half of the originally planned capability. Livermore completed and installed ARC in the fourth quarter of FY 2015.

### **ARC Planned Schedule and Milestones**

ARC was delivered nearly 5 years behind its original schedule due to priority decisions and technical challenges that were not fully transparent to NNSA. In FY 2007, Livermore began its efforts to develop ARC. NNSA originally established a milestone for Livermore to make ARC operational in FY 2010. Livermore did not make ARC operational in that year because of

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<sup>1</sup> A NIF shot consists of a laser pulse split into 192 beamlines and amplified up to a total power of four million joules which is delivered to the center of a spherical target chamber.

competing priorities with NIC's first nuclear ignition attempt in FY 2010. NNSA cancelled ARC's original milestone and established a new milestone to operationally qualify the first ARC beamline by FY 2012. However, ARC's first beamline was not operational by FY 2012 because Livermore was focused on achieving nuclear fusion ignition to meet NIC's ultimate deadline of FY 2012. In fact, Livermore informed NNSA that ARC was the only major facility goal that was not completed when NIC ended in FY 2012. As a result, NNSA established another milestone to complete and install ARC beamlines by FY 2014. However, Livermore did not complete ARC in FY 2014 due to technical issues. Ultimately, Livermore completed and made ARC operational at the end of FY 2015, 5 years behind its original schedule, after a series of revised milestones authorized by NNSA.

Because of competing priorities, Livermore did not complete ARC in time for use in any of the fusion ignition experiments during NIC. An NNSA project manager stated that he was not fully aware of Livermore's reduced priority on ARC. However, in FY 2012, the same year that NIC ended without achieving its goal to achieve fusion ignition, a Livermore-led, multi-laboratory scientific panel stated that an important uncertainty in achieving ignition was instabilities on capsule implosion and such progress was somewhat hampered by the lack of adequate radiographic imaging. Livermore began addressing this concern by using radiographic imaging capabilities available at that time. Nevertheless, the scientific panel's report noted that radiographic imaging of the dense NIF targets, with sufficient resolution to reveal detailed structure, required new diagnostics such as ARC. Livermore had predicted this uncertainty 3 years earlier, in 2009, when they responded to a Government Accountability Office (GAO) information request stating that without ARC and two other diagnostics, Livermore would not have sufficient information to evaluate implosion conditions increasing the risk of not accomplishing fusion ignition scheduled for FY 2012. Livermore went on to state that a delay in ARC would also impact experiments in NNSA's Science Campaign for the Stockpile Stewardship Program. Although not completed in time for NIC, ARC is one of NIF's diagnostic tools for experiments that are essential to understanding the operation of modern nuclear weapons.

### **ARC Cost**

ARC was delivered approximately \$81 million over its total planned cost and NNSA was not fully aware of ARC's cost increases throughout its first 6 years. Although NNSA and Livermore could not provide an initial cost estimate for ARC when initiated in 2007, we found that in 2009, Livermore reported to GAO that ARC had a total planned cost of \$41.6 million. We further determined that Livermore had incurred a total of \$122.7 million on ARC up to the time it was operational in September 2015. Since NNSA provided funding for ARC at the NIC level, the total costs incurred for ARC throughout its first 6 years were not fully transparent to NNSA and Livermore could not provide detail to verify why the costs had increased. Rather Livermore gave general causes such as project delays, changes in scope, changes in overhead rates, and technical problems with a new technology. NNSA and Livermore further informed us that ARC did not have its own baseline and they could not identify a total estimate cost for ARC at the beginning of the effort in FY 2007 because Livermore managed ARC at a lower, non-reportable level within NIC. The earliest cost estimate Livermore could provide was documented in their response to a 2009 GAO questionnaire stating that ARC had a total planned cost of \$41.6 million. However by the end of FY 2012, Livermore had incurred \$55.2 million and reported to NNSA that it had not completed ARC.

Even though Livermore had spent more than the total planned cost by the end of FY 2012, Livermore stated that ARC was not completed because Livermore decided to provide low funding to ARC due to an increasing desire for capabilities that were more pressing for conducting the ignition experimental campaign. NNSA was not aware of Livermore's reduced priority for ARC at that time. However, in FY 2012, for the first time, NNSA requested Livermore to provide a cost estimate specifically for completing ARC. Livermore estimated that it would cost an additional \$45 million to deliver one ARC beamline by the end of FY 2014. However, Livermore spent an additional \$67.5 million for a total cost of \$122.7 million to deliver two beamlines by September 2015.

### **ARC Capability**

We found that ARC only provided half of its originally planned capability and Livermore had installed infrastructure and components that may not be used for radiographic imaging. In FY 2007, Livermore's original plan was to develop and install ARC and that it would be comprised of four NIF beamlines. As of February 2017, however, the completed ARC is only comprised of two NIF beamlines. NNSA stated that Livermore chose not to finish two of ARC's four beamlines due to anticipated budget reductions for FYs 2015 through 2018. Livermore stated they would evaluate the need to further build ARC to optimize its full planned capability, up to 4 beamlines, as a new separate effort if users determine there is a priority need. However, Livermore has already installed infrastructure and components for two of ARC's non-functional beamlines. Although Livermore explained that it was better business sense to complete infrastructure for four beamlines in one activity, the infrastructure and components for two of ARC's non-functional beamlines may not be used for radiographic imaging if a priority need for them is not identified.

In addition to its reduced capability, ARC's functional beamlines were administratively limited to operating at an energy level of 1.0 kilojoule instead of the expected energy level of 1.5 kilojoules. Livermore informed us that higher energy would damage three critical optics, although Livermore has developed a solution to operate at full expected energy level by re-coating them. However, Livermore stated that users are satisfied with the 1.0 kilojoule at this time and do not want to interrupt the ARC schedule for re-coating and installation procedures.

### **Project Management Controls**

In our opinion, the shortcomings in NNSA's oversight over ARC's development and installation efforts occurred because NNSA did not ensure Livermore managed ARC as a separate project under Order 413.3B. According to the Department's framework for successful project execution outlined in Order 413.3B, larger and more complex projects carry a higher probability of exceeding their baselines. The purpose of Order 413.3B is to provide NNSA with project management direction with the goal of delivering projects within the original performance baseline, cost, and schedule and fully capable of meeting mission performance. However, NNSA Officials noted that while the requirements of Order 413.3B are known, NNSA lacks a formal process for evaluating the applicability of Order 413.3B to capital asset-type activities, and a decision-making authority within NNSA.

During our fieldwork, NNSA technical experts confirmed that ARC meets the criteria of a capital asset and should have had well-defined requirements such as baseline change control,

monthly status reporting, and risk analysis at the rigor prescribed in Order 413.3B. Although Livermore had high level schedules and baselines which were reported to NNSA during the implementation of the NIC, those schedules and baselines did not have the detail and visibility for ARC that would have been required as a separate capital project managed under Order 413.3B. Since ARC was not managed as a separate capital project under Order 413.3B, NNSA did not have transparency into the technical and funding issues of ARC.

Further, a Livermore Field Office official stated that ARC was not managed as a project because ARC was a research and development diagnostic equipment effort, not the traditional line item construction project that NNSA has historically managed under the requirements of Order 413.3B. However, Order 413.3B (with its prior version when ARC began incurring costs) is not limited to just line-item funded capital projects but rather it establishes a total project cost threshold of \$20 million which was exceeded by ARC. In addition, NNSA's Office of Acquisition and Project Management did not interpret Order 413.3B to exclude capital assets that are not line item construction projects. We also noted that all previous planning and report documents refer to ARC as a development effort. Order 413.3B includes technical development in its definition of a project. As previously stated, NNSA technical experts confirmed that ARC meets the criteria of a capital asset and should have had well-defined requirements such as schedule, cost, and key design criteria as prescribed in Order 413.3B. Thus, while we recognize that new technology applications can lead to cost increases and schedule slippage, we also conclude that managing ARC as a separate project with controls listed in Order 413.3B would have increased NNSA's transparency into challenges faced by LLNL and enhanced NNSA's decision process regarding risks, budget, and performance goals.

### **ARC Schedule Controls**

Order 413.3B requires that significant changes to project baselines be addressed in a formal risk assessment. Order 413.3B also requires a series of design and technical reviews. In our opinion, these controls would have increased NNSA's understanding and awareness of the cost and technical challenges Livermore was experiencing with ARC. However, Order 413.3B requirements were not mandated by NNSA for ARC. Although Livermore had repeatedly made ARC a low priority and made significant changes to ARC's scheduled milestones, they could not provide any evidence of risk analysis for ARC until April 2013, 6 years after the start of the development and installation effort. For example, in FY 2012, Livermore submitted a baseline change control proposal stating that ARC would not be completed during the NIC and would not be available to support its users by the end of that year because they had priorities for other capabilities that were more pressing. However, this was not addressed in any risk assessment or prior design and technical review. In fact, an NNSA official informed us that they were not aware that Livermore had not made ARC a top priority at the time. In another example, Livermore did not complete ARC as planned in the fourth quarter of FY 2014 until a year later, the fourth quarter of FY 2015, due to technical risks related to ARC's early design. Specifically, modeling efforts demonstrated that Livermore selected a front end fiber technology that produced an unacceptable pre-pulse in the laser beamlines that could destroy the target before the primary pulse arrived. Livermore had identified pre-pulse risk as a critical concern during a presentation at Stanford University in FY 2010. Subsequent to our fieldwork, Livermore explained to us that the ultimate pre-pulse problem that impacted ARC's progress was a different type of pre-pulse risk than the risk presented to Stanford University, which Livermore believed could be addressed. However, as previously stated, Livermore did not communicate any risk

related to pre-pulse to NNSA until late FY 2013. This was a significant oversight because an NNSA Inertial Confinement Fusion Program official explained that he knew of a technically proven optical-based technology which was available and successfully commissioned in FY 2010 on another NNSA laser program. This was ultimately the same technology that Livermore applied to complete ARC in FY 2015.

### **ARC Cost Controls**

NNSA did not have a detailed awareness that ARC had exceeded its expected cost by approximately \$81 million because NNSA did not require Livermore to apply Order 413.3B cost controls. Specifically, Order 413.3B requires that baseline change proposals establish a new performance baseline (cost estimate) when a change in project scope, schedule and/or cost occurs. However, because NNSA did not require Livermore to manage ARC as a separate project under Order 413.3B, Livermore did not establish an initial cost baseline or cost baseline updates specifically for ARC until the end of NIC, 6 years into the effort. According to Livermore officials, NNSA provided funding at the NIC reporting level during FYs 2007 through 2012 and Livermore distributed the funding to sub-efforts such as ARC based on their priorities. Livermore's funding decisions at the sub-element level (such as for ARC) were not specifically reported to NNSA. Livermore further stated that they did not have current or historical data in the form of an Earned Value Management System for ARC at the task level. Because Livermore had not established a formal baseline and update process, NNSA was not aware of the total cost ARC had incurred from FY 2012 and prior. During FYs 2012 through FY 2015, NNSA was aware of ARC costs from year to year but was not able to evaluate the effort's cost performance as required for projects managed under Order 413.3B.

### **ARC Scope Controls**

NNSA did not require Livermore to apply project scope controls as outlined in Order 413.3B even though ARC's technical scope repeatedly changed during its development and installation. Had NNSA required Livermore to manage ARC in accordance with Order 413.3B, ARC would have had a risk-based performance baseline with a well-defined and managed technical scope that is feasible, approved, and documented. The performance baseline represents the Department's commitment to Congress to deliver the project within its defined scope. In addition, Order 413.3B would have required a project data sheet with a justification for the project scope and a project execution plan with documented minimum key performance parameters. Specifically, a key performance parameter could have been established when Livermore initially proposed that ARC would be expected to produce eight radiographic images per experimental shot. Nonetheless, NNSA accepted ARC as complete in September 2015 even though it has produced only two-frame images on a single shot. Since NNSA did not require Livermore to manage ARC as a project under Order 413.3B, Livermore did not provide NNSA with a clearly defined performance baseline including technical scope, clear justification, or the minimum key performance parameters for ARC.

### **ARC's Impact on the Stockpile Stewardship Program**

Ultimately, ARC was commissioned nearly 5 years later than the original schedule, had exceeded its total planned cost and only provided 50 percent of its original planned capability. We also concluded that the lack of controls from Order 413.3B impacted, at least in part, the

completion of ARC within its planned parameters. Although NNSA was aware and approved ARC milestone delays, the lack of transparency and risk analysis for ARC obscured NNSA's full awareness of the specific time and resources Livermore provided to ARC. For example, an October 2013 NNSA memorandum criticized Livermore for a lack of transparency into planning or the standing up of the various NIF governance activities. Specifically, the cost schedule and impact of ARC were not disclosed to NNSA and NNSA did not concur with the amount of facility time and resources that Livermore dedicated to ARC under the budget scenarios at that time.

The challenges Livermore experienced with ARC, in turn, impacted scientific advancements in support of the Stockpile Stewardship Program. Specifically, the schedule overrun delayed critical ignition and user experiments. Not all NNSA officials agree on the impact of ARC's delays or how cost overruns might have ultimately been used to address other program needs. However, an NNSA official directly responsible for the oversight of ARC during its development and installation efforts stated that had ARC met its original operational milestones, ARC could have assisted in understanding key ignition problems earlier. Further, he stated that the potential \$81 million cost overrun constrained the program from advancing other critical diagnostics needed to address Stockpile Stewardship science gaps. Without project management controls in place, efforts to develop new diagnostics may be at risk of not being delivered within schedule, cost, and scope. In fact, an NNSA official has identified another diagnostic equipment that potentially meets the definition of a capital asset but had not yet been placed under the requirements of Order 413.3B project management controls.

### **NNSA Oversight of User Community Time Allocations**

We found another opportunity to improve NNSA oversight through increased transparency of Livermore's allocation of time provided to its user community. In the FY 2012 Path Forward Report to Congress, NNSA began establishing user allocation goals for Livermore to further improve the efficient use of NIF by setting user allocations by numbers of days rather than shot allocations. Livermore stated this would provide users more incentive to make the most efficient use of NIF. The user allocations are re-established annually in the National Ignition Facility Use Plans. As part of our fieldwork, we attempted to verify Livermore's compliance with the 2015 Facility Use Plan allocations. However, we could not compare NIF's actual days used against the planned allocations in its 2015 Facility Use Plan because Livermore does not have a system for tracking and reporting the number of actual days provided to the members of its user community. When Livermore attempted to verify its compliance using their current scheduling systems, we noted significant inconsistencies in methodology from one NIF experiment to another which negatively impacted our confidence in their analysis. Their analysis also conflicted with our own analysis. While we commend Livermore for including time-based allocation goals for its NIF user community in its Facility Use Plan, we also encourage Livermore to develop a formal system to consistently track, verify, and report to NNSA the actual days used by the members of its user community in order to maximize NIF's effectiveness.

Livermore disagreed with our position stating that tracking actual time allocated to users would incentivize inefficiency by reducing efforts to maximize the amount of work done in parallel. However, in our opinion, this would only be a concern if time allocation was the exclusive



measure of performance. Thus, NNSA should consider using the actual usage of time as an additional data point when assessing the broad overall performance data set, in addition to other measures such as volume and quality of scientific data and number of shots.

## RECOMMENDATIONS

To address the issues we identified, we recommend that the Administrator, National Nuclear Security Administration:

1. Establish a formal process for evaluating the applicability of Order 413.3B to capital asset-type activities and assign a decision-making authority within NNSA;
2. Direct the Livermore Field Office to ensure that all ongoing and new capital asset projects at Livermore are managed in full compliance with Order 413.3B; and
3. Conduct an NNSA-wide analysis of capital asset activities in order to identify other potential projects that should be subject to Order 413.3B requirement.

## MANAGEMENT RESPONSE

Management concurred with the report's recommendations and indicated that NNSA will: a) Reemphasize program responsibility and accountability for properly identifying and categorizing capital assets as Order 413.3B management efforts, consistent with BOP-06.05, *Project Management for the Acquisition of Capital Assets*; b) Clarify the program vetting process for making and documenting applicability determinations; c) Document the decision making authority within the agency to resolve applicability issues; and d) Identify circumstances under which issues should be elevated for resolution and corporate decision. Management will further request an enterprise-wide analysis of potential capital asset activities to proactively identify any similar applicability issues. Management's comments are included as Attachment 4.

## AUDITOR COMMENTS

Management's comments and proposed actions are responsive to our finding and recommendations.

Attachments

cc: Deputy Secretary  
Chief of Staff

## **OTHER MATTER**

### **NIF Plutonium Experiments**

In May 2015, the Office of Inspector General received a concern from a local activist organization regarding the potential for plutonium contamination and Lawrence Livermore National Laboratory's plans to contain plutonium, absent a secondary containment vessel in the National Ignition Facility. Based on the results of our fieldwork, we concluded that Lawrence Livermore National Laboratory followed appropriate controls for the type of plutonium experiments being performed at National Ignition Facility. Specifically, the activist organization's concern originated from an approved environmental impact statement that committed Lawrence Livermore National Laboratory to build a secondary containment structure within the National Ignition Facility target chamber for weapons grade plutonium experiments. However, the same environmental impact statement stated that Lawrence Livermore National Laboratory would use small quantities of a specially prepared plutonium within the target chamber without use of secondary containment. Officials from Lawrence Livermore National Laboratory, Livermore Field Office, and Defense Nuclear Facilities Safety Board informed us that all plutonium experiments being performed at the National Ignition Facility use non-weapons grade plutonium at very low levels which complies with the environmental impact statement. We verified these statements by reviewing experiment radioactivity reports and concluding that the National Ignition Facility experiments used very minute quantities of plutonium that was not weapons grade. Finally, we verified that an independent committee had found that the contamination control systems, monitoring/measuring equipment and plans and procedures for managing plutonium operations were satisfactory.

## OBJECTIVE, SCOPE, AND METHODOLOGY

### OBJECTIVE

We conducted this audit to determine if Lawrence Livermore National Laboratory is effectively managing the National Ignition Facility (NIF).

### SCOPE

The audit was performed from September 2015 to October 2017, at Lawrence Livermore National Laboratory in Livermore, California. The audit scope included a review of activities related to the operations of NIF and the development and installation of the Advanced Radiographic Capability. We conducted this audit under Office of Inspector General project number A15LL055.

### METHODOLOGY

To accomplish our audit objective, we:

- Reviewed Federal and Department of Energy regulations and guidance related to project management;
- Reviewed Lawrence Livermore National Laboratory processes and procedures for scheduling users on the NIF;
- Reviewed and verified completion of user milestones related to NIF performance;
- Evaluated NIF user satisfaction in regards to NIF performance;
- Addressed a local activist complaint regarding containment controls for plutonium experiments at NIF;
- Evaluated the results of related audits and reviews;
- Interviewed key Department and contractor personnel; and
- Obtained the *Three Year National Ignition Facility Plan and Milestones on the Path to Ignition and Critical Experiments Needed to Support the Stockpile Stewardship Program Report to Congress, July 2015 and FYs 2013 through FY 2014 Program Implementation Plans* for three of NIF's four major user programs. Based on these documents, we identified 77 level 2 milestones for fiscal years (FYs) 2013 through 2015. The fourth user group did not have milestones because it consists of scientists external to the Department.

In addition, we reviewed all 77 level 2 milestones for completion memorandums, thus our sample universe was 77 level 2 milestones. We judgmentally selected 21 of the 77 milestones, based on exceptions we noted such as lacking completion memorandums, delayed completion, or a non-concurrence by the National Nuclear Security Administration, for further testing. A non-

statistical sample design was chosen because of the relatively small size of the universe. Because the selection was based on a judgmental sample, results and overall conclusions cannot be projected to the entire population or universe of milestones subject to audit.

We conducted this performance audit in accordance with generally accepted Government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objective. We believe the evidence obtained provides a reasonable basis for our conclusions based on our audit objective. The audit included tests of internal controls and compliance with the laws and regulations to the extent necessary to satisfy the audit objective. Additionally, we assessed the Department's implementation of the *GPR Modernization Act of 2010* as it relates to our audit objective and found that the Department had established performance measures to execute key experiments and shots on NIF in support of the National Nuclear Security Administration's Stockpile Stewardship Program.

Because our review was limited, it would not have necessarily disclosed all internal control deficiencies that may have existed at the time of our audit. We relied on computer-processed data to satisfy the audit objective. Based on recent reviews of Lawrence Livermore National Laboratory's information technology controls performed by KPMG, LLP, on behalf of the Office of Inspector General, we determined that the data was sufficiently reliable for the purposes of the audit. An exit conference was held on October 17, 2017.

## RELATED REPORTS

### Office of Inspector General

- Audit Report on the [National Nuclear Security Administration's Management of the B61-12 Life Extension Program](#) (DOE-OIG-16-15, August 2016). The audit found project management control issues that if not corrected could make it more difficult for the B61-12 Life Extension Program to proactively insure that its mission and functions are properly executed. The audit found that the Life Extension Program schedules contained multiple scheduling issues that limited the full potential of the program's earned value management system. Some risk mitigation actions were not integrated into site schedules or did not have specific and executable mitigation actions. And in some cases, quality assurance activities did not provide documented assurance that Life Extension Program components would address safety and reliability concerns. The report stated that by March 2015, Life Extension Program systems had improved in some areas but had declined or lost previous functionality in other areas and that work is still needed.
- Audit Report on the [Lawrence Livermore National Laboratory's Laser Inertial Fusion Energy Endeavor](#) (OAI-M-16-13, July 2016). The audit questioned approximately 23.3 million of Lawrence Livermore National Laboratory's expenditures for Laser Inertial Fusion Energy activities from fiscal year 2008 through 2013. Specifically, Lawrence Livermore National Laboratory incurred general and administrative costs for independent research and development activities outside its Laboratory Directed Research and Development program, which is expressly unallowable under the terms of its management and operating contract. Lawrence Livermore National Laboratory's management and operating contract only allows independent research and development expenditures through its Laboratory Directed Research and Development program, which has congressionally mandated cost limitations. In addition, Lawrence Livermore National Laboratory incurred general and administrative costs for Laser Inertial Fusion Energy activities that we determined did not meet the definition of general and administrative costs and are therefore questionable. Federal regulation requires general and administrative expenses to be incurred for managing and administering the entire business unit. The audit made four recommendations to strengthen controls, establish compliance with Federal Regulations and Cost Accounting Standards, and determine the allowability of the costs questioned in this report.
- Special Report on the [Office of Energy Efficiency and Renewable Energy's Integrated Resource and Information System](#) (DOE/IG-0905, April 2014). This review found that the Office of Energy Efficiency and Renewable Energy had not effectively managed the development and implementation of Integrated Resource and Information System. In particular, the Office of Energy Efficiency and Renewable Energy failed to follow the Department's structured capital planning and investment control process and had not provided effective monitoring of the project. For example, the Office of Energy Efficiency and Renewable Energy spent at least \$7 million to date on Integrated Resource and Information System development without the benefit of formalized project plans, schedules or budgets. Inadequate planning and identification of user requirements resulted in significant changes to the scope of the project and the acquisition of more software licenses than necessary. In addition, various scope and schedule changes were made during the Integrated Resource and Information System execution without the benefit of a formal change control process. The review concluded that without a well-defined project

planning and execution process that includes baselines and deliverables, the Office of Energy Efficiency and Renewable Energy cannot ensure that significant funds spent on Integrated Resource and Information System and other future Information Technology projects are used in a cost effective manner. To address these issues the report made several recommendations that, if fully implemented, should improve the Office of Energy Efficiency and Renewable Energy's ability to manage future Information Technology system development projects, improve the security posture of Integrated Resource and Information System and ensure that appropriate contract management practices are conducted.

### **Government Accountability Office**

- [\*Modernizing The Nuclear Security Enterprise: NNSA Increased Its Budget Estimates, but Estimates for Key Stockpile and Infrastructure Programs Need Improvement\*](#) (GAO-15-499, August 2015). The U.S. Government Accountability Office (GAO) found that near-term budget estimates for the cruise missile life extension program were not aligned with the National Nuclear Security Agency's 2015 plans because annual budget estimates are below the low point of the programs internally developed estimated cost range. A 2008 internal review of the National Nuclear Security Agency's project management stated that failure to request full funding can result in risks to programs' goals such as increased program costs and schedule delays. The report further stated that GAO's prior work has emphasized the importance of transparency in federal agencies' budget presentations because such information helps Congress understand how new funding request relate to program decisions. GAO's report noted that the National Ignition Facility's operations is solely incorporated in the Inertial Confinement Fusion Ignition and High Yield Campaign budget in the fiscal year 2015 budget.
- [\*Nuclear Weapons: Actions Needed to Address Scientific and Technical Challenges and Management Weaknesses at the National Ignitions Facility\*](#) (GAO-10-488, April 2010). GAO found that National Ignition Facility ignition efforts face difficult scientific and technical challenges which could limit the extreme temperatures and pressures that can be achieved. As a result, successful ignition at National Ignition Facility during the first attempt remained unlikely. GAO found that weak management by the National Nuclear Security Agency allowed the cost, schedule, and scope of ignition related activities to increase substantially. One example, was a key diagnostic instrument known as the Advanced Radiographic Capability, was not expected to be completed on time. It was expected to be completed in fiscal year 2011 at a cost of \$42 million. GAO's report stated that consequences of not achieving ignition, however, would become more serious over time, possibly reducing the National Nuclear Security Agency's confidence in the data it uses to certify the safety and reliability of the nuclear weapons stockpile.

## MANAGEMENT COMMENTS



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



September 11, 2017

MEMORANDUM FOR APRIL STEPHENSON  
ACTING INSPECTOR GENERAL

FROM: FRANK G. KLOTZ *FKL 9/11/2017*

SUBJECT: Comments on the Office of Inspector General Draft Report  
*Management of the National Ignition Facility and the Advanced Radiographic Capability* (NNSA-2017-001244 / A15LL055)

Thank you for the opportunity to review and comment on the subject draft report. We appreciate the Office of Inspector General's (OIG) acknowledgement of the National Nuclear Security Administration's (NNSA) effective management of the National Ignition Facility (NIF). The majority of the report focuses on the Advanced Radiographic Capability (ARC). NNSA agrees with the auditors' conclusion that DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, is applicable and should have been applied to ARC.

The auditors' observations reinforce NNSA's self-identified need to facilitate consistent interpretation of whether proposed activities meet the definition of a capital asset requiring the application of 413.3B, which led to the key report recommendations. NNSA will: a) reemphasize program responsibility and accountability for properly identifying and categorizing capital assets as 413.3B management efforts, consistent with BOP-06.05, *Project Management for the Acquisition of Capital Assets*; b) clarify the program vetting process for making and documenting applicability determinations; c) document the decision making authority within the agency to resolve applicability issues; and d) identify circumstances under which issues should be elevated for resolution and corporate decision. We will further request an enterprise-wide analysis of potential capital asset activities to proactively identify any similar applicability issues.

We have provided technical comments under separate cover for the auditors' consideration to improve the overall clarity and accuracy of the report. We appreciate the auditors' work which supports our ongoing efforts to effectively and consistently implement project management requirements. Should you have any questions, please contact Mr. Dean Childs, Director, Audits and Internal Affairs at 301-903-1341.

Attachment





**NATIONAL NUCLEAR SECURITY ADMINISTRATION**  
**Response to Report Recommendations**

Management of the National Ignition Facility and the Advanced Radiographic Capability  
(A15LL055)

To address the issues identified in the report, the IG recommend the Administrator, National Nuclear Security Administration:

**Recommendation 1:** Establish a formal process for evaluating the applicability of Order 413.3B to capital asset-type activities and assign a decision-making authority within NNSA.

**Management Response: Concur**

The recommendation reflects the self-identified need to facilitate consistent interpretation of whether potential activities meet the definition of a capital asset requiring the application of 413.3B that we discussed with the auditors during the report review and comment process. NNSA will: a) reemphasize program responsibility and accountability for properly identifying and categorizing capital assets as 413.3B management efforts; b) clarify the vetting process for making and documenting applicability determinations; c) document the decision making authority within the agency to resolve applicability issues; and d) identify the circumstances under which issues should be elevated for resolution and corporate decision. The estimated completion date for these actions is December 31, 2017.

**Recommendation 2:** Direct the Livermore Field Office to ensure that all ongoing and new capital asset projects at Livermore are managed in full compliance with Order 413.3B.

**Management Response: Concur**

Livermore Field Office will conduct an analysis of ongoing and planned capital asset activities as part of actions noted in recommendation 3. Livermore will ensure projects are managed in full compliance with Order 413.3B, as appropriate. In the case of ARC, the project is complete, therefore application of 413.3B is no longer possible. The estimated completion date for these activities is March 31, 2018.

**Recommendation 3:** Conduct an NNSA-wide analysis of capital asset activities in order to identify other potential projects that should be subject to Order 413.3B requirement.

**Management Response: Concur**

NNSA will request an Enterprise-wide analysis of on-going and planned capital asset activities to proactively identify any potential 413.3B applicability issues. Identified issues will be addressed through the approach referenced in response to recommendation 1. The fast gated complementary metal oxide semiconductor (CMOS) and Single Line of Sight Detectors referenced in the report will also be reviewed in this analysis. The estimated completion date for these activities is March 31, 2018.

## **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.