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AUDIT REPORT

OFFICE OF AUDITS

REVIEW OF THE JET PROPULSION LABORATORY'S OCCUPATIONAL SAFETY PROGRAM

OFFICE OF INSPECTOR GENERAL



National Aeronautics and
Space Administration

Final report released by:

A handwritten signature in black ink, appearing to read 'P.K. Martin'.

Paul K. Martin
Inspector General

Acronyms

AOA	Annual Operating Agreement
C.F.R.	Code of Federal Regulations
FY	Fiscal Year
IFO	Institutional/Facilities/Operational
IRIS	Incident Reporting Information System
JPL	Jet Propulsion Laboratory
NASA	National Aeronautics and Space Administration
NPD	NASA Policy Directive
NPR	NASA Procedural Requirements
OIG	Office of Inspector General
OSHA	Occupational Safety and Health Administration
OSMA	Office of Safety and Mission Assurance

OVERVIEW

REVIEW OF THE JET PROPULSION LABORATORY'S OCCUPATIONAL SAFETY PROGRAM

The Issue

Working in the construction industry is one of the most dangerous occupations in the United States. According to the Bureau of Labor Statistics, 969 construction workers died from work-related injuries in 2008, and these deaths accounted for 19 percent of all work-related fatalities.¹ During that same year, 322,700 non-fatal construction injuries occurred, which account for 7 percent of all work-related injuries. The most common construction hazards are falls, both in place and from height; electrocution; malfunctioning equipment (e.g., cranes, forklifts, and other machinery); and trench cave-ins.²

We initiated this audit in response to a series of mishaps and employee allegations of unsafe and unhealthful working conditions during construction operations at the Jet Propulsion Laboratory (JPL), a federally funded research and development center owned by NASA and operated pursuant to contract by the California Institute of Technology (Caltech).³ In one instance brought to our attention, eight subcontractor employees entered a collapsed and unprotected trench to repair a damaged communications conduit (see Figure 1). This unsafe act placed the workers at risk of serious injury or loss of life due to the potential for additional collapse of the trench and raised serious questions about the oversight and supervision of construction safety at JPL.

Figure 1. Workers in Collapsed, Unprotected Trench at JPL



Source: Vanir Construction Management, Inc. (July 18, 2008)

The overall objective of this audit was to determine whether JPL had implemented appropriate internal controls related to oversight of contractors and subcontractors who

¹ U.S. Department of Labor, Bureau of Labor Statistics, USDL 09-0979, August 20, 2009. News Release, "National Census of Fatal Occupational Injuries in 2008."

² Occupational Safety and Health Administration (OSHA), OSHA Compliance Assistance Quick Start for the Construction Industry, OSHA Publications 3146, 3252, 3075, 3215, and 2226.

³ Prime contract NAS7-03001, effective October 1, 2003.

perform on-site construction projects. Specifically, we examined whether the JPL Occupational Safety Program Office (JPL Occupational Safety Office) had implemented an effective process to report, investigate, and document mishaps, close calls, and lessons learned.⁴ We also evaluated whether JPL and its subcontractors were compliant with Federal, state, and local laws and regulations, as well as contractually mandated safety requirements. During the course of the audit, we expanded our audit objectives to determine whether the two NASA offices with oversight responsibility for worker safety – the NASA Management Office and the Office of Safety and Mission Assurance (OSMA) – had conducted sufficient oversight of the JPL Occupational Safety Office to ensure that contractually mandated occupational safety and health requirements were effectively implemented at JPL. Additional details of the audit’s scope and methodology are in Appendix A.

Results

We found that the JPL Occupational Safety Office had ineffective management systems and controls for construction safety. We also found that although OSMA had procedures in place intended to ensure that JPL had implemented contractually mandated safety requirements, it failed to follow those procedures. In addition, the NASA Management Office did not have policies or procedures to ensure that JPL had fully implemented contractually mandated safety requirements. As a result, OSMA and NASA Management Office personnel did not identify the JPL Occupational Safety Office’s internal control deficiencies and NASA management did not have the information required to make knowledgeable risk acceptance and mitigation decisions, which in turn placed JPL personnel and facilities at increased risk.

The JPL Occupational Safety Office Did Not Effectively Identify Occupational Safety Program Budget Requirements. The JPL Occupational Safety Office develops requirements and provides budget and resource estimates to the JPL Office of Safety and Mission Success. However, the JPL Occupational Safety Office’s budget management process lacked the detail necessary to identify, prioritize, track, monitor, or assess progress for functions related to construction safety. Moreover, the JPL Occupational Safety Office’s annual operating budget was inconsistent with the provisions defined in JPL’s Annual Operating Agreement (AOA).⁵ As a result, the JPL Occupational Safety Office’s budget management process was ineffective in measuring performance for construction safety-related functions such as confined space entry, asbestos and lead abatement, fall protection, and construction drawing reviews. In addition, there was no

⁴ NASA defines a mishap as an unplanned event that results in injury to personnel or damage to property. NASA categorizes mishaps based on the severity of injury to personnel or total cost of damage to property. Mishap classifications range from a Type A Mishap, the most severe, to a close call, the least severe.

⁵ An AOA is a management plan that defines Center safety and health requirements and the resources required to meet those requirements. In addition, the AOA defines the metrics used to measure the effectiveness of safety and mission assurance processes.

assurance that the resources allocated to the JPL Occupational Safety Office were sufficient to perform construction safety inspections and other programmatic oversight.

The JPL Occupational Safety Office’s Construction Safety Oversight Was Ineffective. We found that the JPL Occupational Safety Office’s oversight process for construction safety was ineffective in identifying unsafe acts or unhealthful conditions. The oversight process was hampered by the Occupational Safety Office’s practice of assigning construction supervisors and safety personnel to its Construction Safety Group on a rotational basis, which resulted in high personnel turnover and a loss of project knowledge. In addition, as safety personnel rotated into and out of the Construction Safety Group, they did not receive sufficient training to educate them in identifying and abating hazards typically found during construction projects. As a result, safety hazards were not recognized during the construction design review process, the building and structural inspection process, or the hazard abatement process. For example, in 2009 the JPL Occupational Safety Office reviewed and approved design drawings and accepted a building that was constructed with a rooftop parapet that was not in compliance with California Occupational Safety and Health Administration (OSHA) standards. As a result, NASA spent an additional \$11,836 to build guardrails to abate fall hazards.

Additionally, the oversight process did not comply with JPL internal standard operating procedures that require the use of a standardized checklist during inspections and did not comply with the inspection requirements in NASA Procedural Requirements (NPR) 8715.1, Chapter 4, “Inspection and Abatement.”⁶ The NPR requires that all inspections be documented and an abatement plan developed for conditions that take more than 30 calendar days to correct, that a summary of all open abatement plans be submitted as part of JPL’s input to NASA’s annual reporting requirements, and that a risk assessment process be used to analyze and evaluate overall risk potential.⁷

In addition, the JPL Occupational Safety Office did not document risk assessments or the prioritization of reported hazards stemming from employee complaints. We reviewed the 95 unsafe or unhealthful incidents reported to that office by JPL employees from October 2007 through early July 2009 and found that in only 2 instances was there any evidence that the JPL Occupational Safety Office had conducted any kind of risk assessment or hazard prioritization. Further, of those 95 reported incidents, only 7 showed that the Office had conducted additional inspections to ensure that the hazard was abated and only 8 showed that the office had provided follow-up information to the reporting employees affected by the reported hazard.

⁶ On March 30, 2004, NASA renamed NASA Procedures and Guidelines 8715.1 as NPR 8715.1, “NASA Occupational Health and Safety Programs,” without substantially changing its substance. Hereafter, we refer to the NASA Procedures and Guidelines as the NPR.

⁷ NPR 8715.3C, “NASA General Safety Program Requirements (w/Change 4 dated 7/20/09),” defines risk management as an organized, systematic decision-making process that efficiently identifies, analyzes, plans, tracks, controls, communicates, and documents risk to increase the likelihood of achieving project goals. The NPR defines risk assessment as a process of qualitative risk categorization or quantitative risk (safety) estimation, followed by the evaluation of risk significance.

The JPL Occupational Safety Office’s Mishap, Close Call, and Hazard Reporting Processes Are Inefficient, Incomplete, and Untimely. We found that the JPL Occupational Safety Office did not implement an efficient and effective mishap, close call, and hazard reporting system as required by the prime contract. The reporting system involved multiple reporting processes that were inefficient in consolidating incident data to perform trending and root cause analysis for recurring problems and subsequently communicating lessons learned.⁸ In addition, the reporting process did not ensure that mishaps and close calls were documented and all incident data were recorded in a timely manner into the NASA Incident Reporting Information System (IRIS). For example, the collapse of a construction trench described previously, which caused approximately \$329,000 of damage to JPL communication lines, was not reported to the JPL Occupational Safety Office within 24 hours as required by the prime contract. In fact, this serious incident was not reported to the JPL Occupational Safety Office until 3 days after it occurred, causing subcontractor employees to continue to be exposed to hazardous conditions when they entered the unshored trench. Had the JPL Occupational Safety Office been notified in a timely manner as required, JPL Occupational Safety Office personnel would have been able to respond to the scene and make recommendations for safe entry into the collapsed trench.

The NASA Management Office and OSMA Did Not Effectively Oversee the JPL Occupational Safety Office. We found that the NASA Management Office and OSMA did not provide sufficient oversight to ensure programmatic compliance by the JPL Occupational Safety Office. First, the NASA Management Office did not develop plans or resource requirements to oversee JPL’s short-term and long-term operations or coordinate oversight activities with OSMA strategic audit plans for JPL. Specifically, the NASA Management Office and OSMA did not coordinate their review of the JPL Occupational Safety Office’s corrective action plan in response to audit findings or their activities to verify that the JPL Occupational Safety Office had taken the specified corrective actions. Second, periodic oversight audits by OSMA did not identify instances in which the JPL Occupational Safety Office was not in compliance with NPR 8715.1. This inadequate oversight was caused, at least in part, by the absence of clearly defined oversight roles and responsibilities between the NASA Management Office and OSMA.

Although the NASA Management Office safety official had developed a list of 166 duties, we found that the NASA Management Office did not have a documented policy for safety oversight procedures that defined the NASA Management Office’s oversight roles and responsibilities. The Management Office had not assessed resource requirements to fulfill its oversight responsibilities at JPL and had no strategic plan to oversee JPL safety activities. Moreover, the NASA Management Office had only one civil service employee to perform all activities related to overseeing the safety of approximately 5,000 NASA employees and contractors on the 155-acre JPL campus,

⁸ Root cause analysis is a structured evaluation method that identifies the root causes of an undesired outcome and the actions required to prevent recurrence. Root cause analysis helps determine what happened, how it happened, and why it happened and the identification of appropriate corrective actions to prevent recurrence.

which contains 136 buildings and 61 structures. In our judgment, one person cannot effectively provide reasonable assurance that the requirements of NPR 8715.1 are being met at a facility as large as JPL.

In addition, although OSMA conducted periodic Institutional/Facilities/Operational (IFO) audits intended to provide independent verification that JPL's facilities and operations were in compliance with applicable NASA safety requirements, these audits did not identify instances of program noncompliance. Specifically, we found that the most recent IFO audit addressed only 9 of the 142 requirements (less than 7 percent) contained in NPR 8715.1 and excluded such key topics as financial management, inspection and abatement, safety and health training, recordkeeping, reporting requirements, and Center self-evaluation of occupational safety and health programs. In our judgment, it is essential to address these topics in order to independently verify that JPL is compliant with NASA safety requirements.

Furthermore, OSMA did not use JPL's AOA as a means to validate program resources. An AOA identifies a Center's safety and health requirements and the resources required to meet these requirements. Although there was no contractual requirement for JPL to submit an AOA, JPL has submitted an AOA to OSMA since 2006. However, JPL management did not include in these AOAs all of the elements requested of Centers by OSMA. In addition, OSMA did not request any supporting documentation of JPL's annual cost estimate and self-evaluation and did not follow the Headquarters Office Work Instruction 8700-GB05, Rev. E, "Development and Utilization of Annual Operating Agreements," January 26, 2009, to evaluate whether the AOA included all of NASA's safety and budgetary requirements. Had OSMA performed its evaluation of the JPL AOA in accordance with the Work Instruction, it would likely have identified the deficiencies in the JPL Occupational Safety Office's budget management process previously discussed.

Management Action

During the course of our audit, the JPL Occupational Safety Office took steps to improve its hazard reporting processes, including incorporating a risk assessment process when responding to employee reports of unsafe or unhealthful conditions and creating 24-hour telephone and Web access for JPL personnel to report mishaps, close calls, and unhealthful or unsafe conditions. In addition to the actions management has already taken, OSMA, the NASA Management Office, and the JPL Occupational Safety Office should take the following steps, which we believe will help ensure compliance with contractual safety requirements and reduce risk to personnel and facilities.

Specifically, we recommended that the JPL Office of Safety and Mission Success reassess the JPL Occupational Safety Office resource planning process to maintain consistency with NPR 8715.1, to include implementing a budgetary process that prioritizes and establishes measurable and attainable program goals using a risk assessment process. In addition, the JPL Office of Safety and Mission Success should

reassess labor resource and training requirements to ensure compliance with the prime contract and maintain staff competency.

To improve management of the construction safety program and hazard reporting processes, the JPL Occupational Safety Office should implement a standardized construction safety inspection process that complies with JPL's own internal operating procedures and NASA Procedural Requirements. The JPL Occupational Safety Office should also establish procedures that will improve its internal oversight of subcontractor safety plans and engineering design drawings and review employee competencies and develop training requirements that ensure that Construction Safety Group members obtain the training necessary.

To improve the JPL mishap, close call, and employee hazard reporting system, the JPL Occupational Safety Office should reassess its reporting system to improve timeliness and completeness and ensure compliance with NPR 8715.1, establish procedures for documenting and disseminating lessons learned, conduct employee training to provide guidance on proper identification of root causes, and reinforce the concept of sharing lessons learned.

To ensure compliance with contractual safety requirements and reduce risk to personnel and facilities, NASA should clearly define the roles and responsibilities of the NASA Management Office and OSMA in providing oversight of the JPL occupational safety program. In addition, the NASA Management Office should establish a written safety oversight policy and assess resource requirements to ensure that it has adequate resources to meet its responsibilities.

Finally, OSMA should revise its audit processes to include steps that will ensure JPL's compliance with NPR 8715.1 requirements and coordinate with the NASA Management Office to establish a contractual requirement for JPL to execute an effective AOA that complies with NASA procedures.

We submitted a draft of this report to NASA and JPL management on September 24, 2010, and requested a single, coordinated response to our recommendations. However, we received separate comments from NASA and JPL. Moreover, NASA's comments were further divided into separate responses from the NASA Management Office and OSMA (see Appendix B).

JPL and the NASA Management Office concurred with the majority of our recommendations and stated they would take steps to:

- reassess labor resource and training requirements to ensure compliance with the prime contract and maintain staff competency;
- implement a standardized construction safety inspection process that complies with internal operating procedures and NASA Procedural Requirements;

- establish procedures that will improve internal oversight of subcontractor safety plans and engineering design drawings;
- review employee competencies and develop training requirements that ensure that Construction Safety Group members obtain necessary training;
- reassess the JPL Occupational Safety Office's reporting system to improve timeliness and completeness and reinforce the concept of sharing lessons learned;
- clearly define the roles and responsibilities of the NASA Management Office and OSMA in providing oversight of the JPL occupational safety program; and
- establish a written safety oversight policy and assess resource requirements to ensure that the NASA Management Office has adequate resources to meet its responsibilities.

These planned actions are responsive to our corresponding recommendations, and accordingly we consider these recommendations to be resolved. We will close these recommendations upon completion and verification of the proposed corrective actions.

However, the comments provided by JPL to one recommendation and the comments provided by OSMA were unresponsive to our recommendations to:

- implement a budgetary process that prioritizes and establishes measurable and attainable program goals using a risk assessment process;
- assess internal audit processes and include steps to ensure JPL's compliance with safety requirements;
- review JPL's compliance with safety program requirements; and
- coordinate with the NASA Management Office to establish a contractual requirement for JPL to annually submit an AOA and ensure that future Agreements are reviewed in accordance with the applicable work instruction.

Accordingly, we consider these recommendations to be unresolved.

With respect to our recommendation regarding the budgetary process, JPL stated that the occupational safety budget process already uses risk assessments and has established measurable and attainable program goals that comply with safety program requirements. However, during our review we found no evidence of risk assessments being used to support budgetary decisions. Rather, we found that the JPL Occupational Safety Office budget was negotiated informally during "round table discussions." In our judgment, JPL needs a formal, documented risk assessment process to effectively allocate funding to program elements based on prioritized risks.

JPL also stated that construction safety elements were assigned a unique project/task number in order to capture all related cost activities and the safety budget was distributed by expenditure type, such as labor and purchase order. In our judgment, this budgeting methodology does not lend itself to effective evaluation of whether functional areas like construction oversight, construction job walks, construction drawing review, fall protection, and safety and health training were adequately staffed and supported or whether sufficient funds were allocated to accomplish individual tasks.

In response to our recommendations that the Chief of Safety and Mission Assurance assess the IFO audit processes and include steps to ensure JPL's compliance with NPR 8715.1 and to review JPL's compliance with NPR 8715.1, OSMA stated that the NPR is not applicable to contractor employees, including employees of JPL/Caltech, and therefore the criteria we cite for conducting the audit is not applicable. OSMA also stated that its requirements for the performance of IFO audits at JPL are contained within NPR 8705.6A, "Safety and Mission Assurance Audits, Reviews, and Assessments," April 9, 2009, and only applicable specifically to the NASA Management Office. Further, OSMA stated that it was unfortunate that the predecessor to NPR 8715.1 was applied to the JPL contract because it has created confusion. OSMA concluded that, in order to avoid future misinterpretations regarding these requirements, it will review the applicable NPRs and the JPL prime contract to determine whether additional clarifying modifications are appropriate.

In our judgment, NPR 8715.1 does apply to JPL because it is a federally funded research and development center wholly owned by the Federal Government. NPR 8715.1 states that the NPR is applicable to all NASA Centers and Component Facilities and to all NASA organizations, equipment, property, and facilities. OSMA's implication that the most comprehensive NPR on safety requirements was included in the JPL contract by mistake and that the IFO audit process should only apply to the NASA Management Office at JPL does little to bolster our confidence in NASA's oversight of the JPL safety program.

In response to our recommendation that the Chief of Safety and Mission Assurance coordinate with the NASA Management Office to establish a contractual requirement for JPL to submit an AOA and ensure that future Agreements are reviewed in accordance with the applicable work instruction, OSMA stated that there are no established requirements for AOAs and that the call letter requesting Centers to submit the AOA provides guidance rather than a requirement. OSMA also stated that because the AOA is used to provide insight into the process and not as an oversight mechanism, making it a contractual requirement may be detrimental to open communication between JPL and NASA. These comments do not address our conclusion that had the AOA been reviewed using OSMA's internal work instruction, the deficiencies in the budget management process we noted would likely have been discovered.

Moreover, we disagree with OSMA's assertion that the AOA is not intended as an oversight mechanism. The guidance provided in the July 2009 call letter states that "the completed AOA provides the Chief, SMA [Safety and Mission Assurance], with an

oversight tool to understand customer requirements at individual Centers and to establish a baseline to assess the effectiveness of the Center’s functional SMA [safety and mission assurance] processes.” In addition, the AOA JPL submitted provides that it establishes an agreement between the Director of JPL, the Director for the JPL Office of Safety and Mission Success, the NASA Chief of Safety and Mission Assurance, and the NASA Associate Administrator regarding Office of Safety and Mission Success services to be provided to JPL programs/projects, including goals and metrics, and the Office of Safety and Mission Assurance-funded tasks. The Chief of Safety and Mission Assurance’s signature on the AOA attesting to concurrence and the Associate Administrator’s signature attesting to approval implies that the document was reviewed and used as an oversight tool by OSMA.

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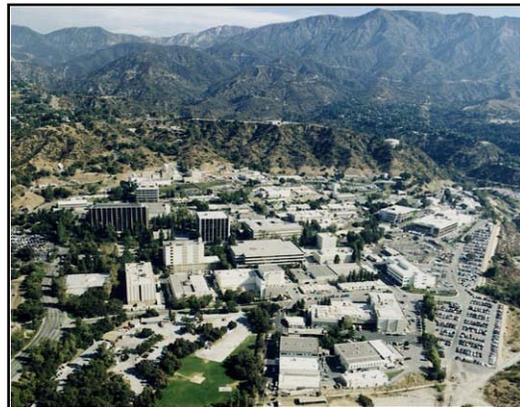
INTRODUCTION

Background

The Jet Propulsion Laboratory (JPL) is a federally funded research and development center owned by NASA and operated pursuant to contract by the California Institute of Technology (Caltech), a private nonprofit research university located in Pasadena, California. The primary mission of JPL is to conduct Earth science and deep space and interplanetary exploration.

The prime contract between NASA and Caltech was awarded in November 2002 and was initially valued at approximately \$7.5 billion.⁹ The contract covers all JPL research and development activities as well as the management and institutional operation of JPL. The JPL Director is a Caltech employee, appointed by the Caltech president with concurrence from the NASA Administrator. JPL has an annual budget of approximately \$1.6 billion and a workforce of approximately 5,000 employees, of which about 50 are full-time civil service employees. The JPL Director oversees land, buildings, and structures (see Figure 2) with a value exceeding \$1.7 billion.¹⁰

Figure 2. NASA's Jet Propulsion Laboratory



NASA's Office of Safety and Mission Assurance (OSMA) is the NASA Headquarters office responsible for policy direction, functional oversight, and assessment of safety activities at NASA Centers and facilities. The organizations responsible for safety and health at JPL include the NASA Management Office and the JPL Office of Safety and Mission Success. The NASA Management Office reports to NASA's Agency Operations and is staffed by civil service personnel who oversee the prime contract for NASA. The JPL Office of Safety and Mission Success is staffed by Caltech employees and is responsible for assessing and reducing mission risk and ensuring JPL compliance with Federal, state, and local laws and regulations, as well as contractually mandated safety requirements.

⁹ Through award fees and term extensions, the total contract value is potentially \$15 billion, as described in the OIG audit report "NASA Should Reconsider the Award Evaluation Process and Contract Type for the Operation of the Jet Propulsion Laboratory (Redacted)" (IG-09-022-R, September 25, 2009).

¹⁰ Property replacement value as of October 26, 2009, for properties located in the United States. On-site property includes 197 buildings and structures throughout 212 acres.

The JPL Office of Safety and Mission Success manages JPL's Occupational Safety Program Office (JPL Occupational Safety Office). Within the JPL Occupational Safety Office is a Construction Safety Program Group (Construction Safety Group), which oversees construction project safety at JPL. JPL Occupational Safety Office personnel work with designers, facilities construction managers, coordinators, subcontractors, and contract personnel to assist them in complying with safety requirements from project preparation to project completion. The Construction Safety Group provides safety oversight during all phases of construction by identifying and correcting potential safety and health-related problems.

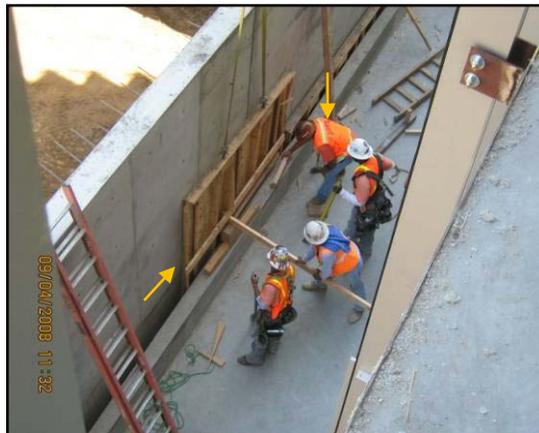
Figure 3. Workers in Collapsed, Unshored Trench at JPL



Source: Vanir Construction Management, Inc. (July 18, 2008)

From October 2006 through March 2009, JPL initiated 773 construction projects with a total cost of approximately \$130 million. The most significant project was the construction of the Flight Projects Center, with an estimated cost of \$66 million over a 2-year period. In January 2009, the NASA Office of Inspector General (OIG) received information regarding two mishaps that occurred during construction of the Flight Projects Center. The first incident was a trench collapse during excavation that damaged critical fiber-optic telecommunication cables and exposed workers to a potential engulfment hazard during repair work (see Figure 3). The second incident occurred during the removal of concrete forms (see Figure 4), when a worker's finger was crushed between a concrete form and wall resulting in the partial amputation of the finger.

Figure 4. Workers Removing Concrete Forms



Source: Vanir Construction Management, Inc. (September 4, 2008)

Objectives

The audit's overall objective was to determine whether JPL implemented appropriate internal controls to provide effective oversight of contractors and subcontractors performing on-site construction projects. Specifically, we examined whether the JPL Occupational Safety Office had

- implemented an effective process to report, investigate, and document mishaps and close calls and to communicate lessons learned; and

- established adequate oversight procedures to ensure contractor and subcontractor compliance with Federal, state, and NASA safety requirements.

During the course of our fieldwork, we found that OSMA had not closed fiscal year (FY) 2007 audit findings concerning facility safety, lifting devices such as cranes, and mishap reporting, and we noted that similar deficiencies remained. As a result, we expanded our audit objectives to determine whether NASA conducted sufficient oversight of the JPL Occupational Safety Office to ensure that contractually mandated occupational safety and health requirements were effectively implemented at JPL.

THE JPL OCCUPATIONAL SAFETY OFFICE DID NOT EFFECTIVELY IDENTIFY OCCUPATIONAL SAFETY PROGRAM BUDGET REQUIREMENTS

We found that the JPL Occupational Safety Office did not effectively identify and monitor safety-related budget resource requirements for JPL. NASA Procedural Requirements (NPR) 8715.1 requires Centers' budget submissions to include appropriate financial estimates to effectively administer NASA's Occupational Safety and Health Program.¹¹ However, the JPL Occupational Safety Office's budget management process did not prioritize safety-related tasks; did not identify, track, monitor, or assess progress on construction safety-related functions; and could not be used to determine whether the staff resources dedicated to safety-related functions were sufficient. Consequently, JPL officials had no assurance that they allocated sufficient resources to perform construction safety inspections and other programmatic oversight.

Contract and Policy Requirements for Allocation of Resources to the Occupational Safety Program

The JPL prime contract requires that JPL management ensure that resources are allocated effectively to address environmental, safety and health, programmatic, and operational considerations.¹² The contract also requires JPL management to protect the public and employees from injury or illness and facilities and work products from damage, as well as ensure that JPL's environmental, safety, and health system is integrated with business processes for work planning, budgeting, authorization, execution, and change control.¹³ In addition, the prime contract requires that JPL's budget submission include appropriate resources to effectively implement and administer NASA's Occupational Safety and Health Program, including sufficient personnel, abatement of unsafe or unhealthful working conditions, safety and health equipment, contracts to identify or evaluate unsafe working conditions, promotional cost, technical information, medical surveillance programs, and safety and health training, in addition to inspectors having sufficient training and experience in safety and health to recognize and abate safety and health hazards.¹⁴

¹¹ NPR 8715.1, "NASA Occupational Health and Safety Programs w/Change 3 (02/13/06)."

¹² Section H-46, "Integration of Environment, Safety, and Health, into the Contractor's Management System."

¹³ Change control is the methodical way of documenting changes in activities, policies, procedures, and requirements and of keeping up-to-date records available for all concerned personnel.

¹⁴ NPR 8715.1, Section 2.9, "Financial Management."

Budget Management Process Lacked the Ability to Identify, Track, Monitor, and Assess JPL's Occupational Safety Program

Our review of the JPL Occupational Safety Office's FY 2007 through FY 2009 annual budget plans found no documentation linking the budget to the Office's areas of responsibility. For example, in FY 2009 the \$424,000 the JPL Occupational Safety Office budgeted for the Construction Safety Group was distributed by expenditure type – such as labor, purchase order, consulting and professional services, training, and travel – rather than according to the functions identified in JPL's FY 2009 Annual Operating Agreement (AOA): confined space entry, asbestos and lead oversight, fall protection, construction drawing reviews, construction job walks, construction oversight, and safety and health training. An AOA defines a Center's safety and health requirements and the resources required to meet those requirements, as well as the metrics used to measure the effectiveness and efficacy of safety and mission assurance processes. Because the JPL Occupational Safety Office did not align its resources with the functions identified in the JPL AOA, it could not effectively evaluate whether these functions were adequately staffed and supported or whether sufficient funds had been allocated to accomplish them. Moreover, the JPL Occupational Safety Office did not use a risk assessment to determine resource requirements or document any budget or personnel resource shortages.¹⁵ This increased the potential that contractors, subcontractors, and facilities would be placed at risk of personal injury or property damage.

Resources Were Not Effectively Managed to Fulfill Essential Tasks

The JPL Occupational Safety Office was unable to determine whether allocated funding was sufficient to meet the requirements of the prime contract. Specifically, there was no assurance that an adequate number of qualified safety professionals were available to perform construction safety oversight inspections and other programmatic oversight functions such as fall protection, construction drawing review, and construction job walks. In addition, we found a lack of planning to ensure that Construction Safety Group members received the necessary training to adequately perform their oversight duties during construction of the Flight Projects Center.

Staffing Concerns. In FY 2009, the Occupational Safety Office's annual budget reflected \$424,000 for the Construction Safety Group, including labor costs of \$365,000 for three full-time staff members – one supervisor and two construction safety specialists. These two specialists were responsible for supporting seven major functions within three diverse safety programs (confined space entry, asbestos and lead oversight, fall protection) and four oversight responsibilities (construction drawing review,

¹⁵ NPR 8715.3C states that the primary purpose of risk assessment is to identify and evaluate risks to help guide decision making and risk management regarding actions to ensure safety and mission success. Risk assessment should use the most appropriate methods that adequately characterize the probability, consequence severities, and uncertainty of undesired events and scenarios.

construction job walks, construction safety oversight, and safety and health training), as well as responding to calls from employees reporting unsafe and unhealthful conditions. In our judgment, two construction safety specialists are not sufficient to cover all required safety functions given JPL's size and the scope of construction projects at the Center.¹⁶

Training Concerns. The lack of planning was also evident in the JPL Occupational Safety Office's budgeting for training. As of July 2009, the JPL Occupational Safety Office had budgeted \$5,000 but expended \$14,000 for the training of 24 staff members. This equated to an average of about \$200 planned and \$583 spent per employee. As evidenced by the amount spent as compared to planned, in our judgment, the average planned amount was insufficient to train all staff members and to ensure that the Construction Safety Group's specialists received adequate training to maintain the competency to fulfill their inspection and oversight responsibilities. For example, the tuition for the Occupational Safety and Health Administration (OSHA) Training Institute's Concrete, Forms, and Shoring course is \$800 alone, not including travel and per diem.¹⁷

Recommendation, Management's Response, and Evaluation of Management's Response

Recommendation 1. We recommended that the Director of the JPL Office of Safety and Mission Success reassess the JPL Occupational Safety Office's resource planning process to maintain consistency with NPR 8715.1 and the AOA functional requirements, to include the following actions:

- a. implement a budgetary process that uses risk assessments and establishes measurable and attainable program goals based on NPR 8715.1 safety program requirements;
- b. reassess labor resource requirements to ensure that JPL's safety program is implemented in accordance with the prime contract; and
- c. evaluate funding requirements and allocate sufficient funding to provide training to develop and maintain staff competency.

Management's Response. JPL management responded with comments provided by the Manager of the Finance and Contract Management Division. With regard to recommendation 1.a, JPL stated that the occupational safety budget process already uses

¹⁶ We note that OSMA's March 2007 Institutional/Facilities/Operational (IFO) Audit of the Occupational Safety Program Office also contains a finding that questions the adequacy of staffing for facilities design review for all of the ongoing projects at JPL.

¹⁷ This course introduces the student to principles of forms and shoring and the quality of concrete, hot and cold weather placing practices, and inspection procedures. Topics include relevant OSHA standards, curing of concrete, form removal, and American Society for Testing and Materials (ASTM) standards on sampling concrete.

risk assessments and has established measurable and attainable program goals that comply with safety program requirements of NASA Procedures and Guidelines 8715.1;¹⁸ that an annual gap analysis is performed relative to the JPL prime contract requirements, industry standards, and other regulatory requirements and is used to support budget strategy and specific funding needs; and that construction safety elements were assigned a unique project/task number in order to capture all related costs, such as personnel staffing, training, testing, publication, and document costs. With regard to the other parts of our recommendation, JPL stated that it will reassess labor resource requirements annually to ensure that the JPL safety program is implemented in accordance with the prime contract and that annual funding requirements will be reevaluated and additional training provided to develop and maintain staff competency.

Evaluation of Management’s Response. We find JPL’s comments to recommendation 1.a to be nonresponsive and consider the recommendation to be unresolved. During our review of the JPL safety budget process we found no evidence of risk assessments being used to support budgetary decisions. Rather, we found that the JPL Occupational Safety Office budget was developed during informal “round table discussions.” In our judgment, JPL needs a formal, documented risk assessment process in order to effectively allocate funding to program elements based on prioritized risks. In addition, we do not believe that assigning unique project/task numbers and distributing the safety budget by expenditure type is sufficient to allow the JPL Occupational Safety Office to effectively evaluate whether sufficient funds have been allocated to support such functional areas as construction oversight, construction job walks, construction drawing review, fall protection, and safety and health training.

We find management’s planned actions in regard to recommendations 1.b and 1.c to be responsive. Accordingly, these recommendations are resolved and will be closed upon completion and verification of management’s corrective action.

¹⁸ On March 30, 2004, NASA renamed NASA Procedures and Guidelines 8715.1 as NPR 8715.1, “NASA Occupational Health and Safety Programs,” without substantially changing its substance. Hereafter, we refer to the NASA Procedures and Guidelines as the NPR.

THE JPL OCCUPATIONAL SAFETY OFFICE'S CONSTRUCTION SAFETY OVERSIGHT WAS INEFFECTIVE IN IDENTIFYING UNSAFE ACTS AND UNHEALTHFUL CONDITIONS

We found that the JPL Occupational Safety Office's construction safety oversight was ineffective in identifying unsafe acts and unhealthful conditions. The oversight processes did not follow NPR 8715.1 requirements to identify, disposition, track, and abate safety and health concerns or JPL internal procedures for construction site inspections. We attribute this ineffectiveness to high turnover within the Construction Safety Group and a lack of sufficient training for Group members. In addition, we found that JPL's reviews of construction documents overlooked unsafe designs and accordingly JPL accepted structures that were not built in compliance with California OSHA standards. Consequently, NASA incurred additional costs to correct these unsafe conditions.

JPL Standardized Inspection Process

NPR 8715.1, Chapter 4, "Inspection and Abatement," includes inspection requirements for both construction projects and employee-reported unsafe and unhealthful conditions. The NPR requires all inspections to be documented and unsafe or unhealthful conditions to be documented on a standardized form, "Notice of Unsafe or Unhealthful Condition" (NASA Form 1390), or an equivalent form approved by the Designated Agency Safety and Health Official.¹⁹ An abatement plan is required for conditions that take more than 30 calendar days to correct. A summary of all open abatement plans and a listing of those closed during the reporting period are to be provided to the Designated Agency Safety and Health Official or designee as part of the Center's input to the "Annual Summary - Occupational Injuries/Illnesses Report" required by NPR 8715.1. The NPR also requires that a risk assessment process that considers the elements of severity and probability of occurrence be used to analyze and evaluate overall risk potential. In addition, the NPR states that safety and health inspectors are required to have sufficient documented training and experience to recognize and evaluate safety and health hazards in the workplace and suggest corrective actions.

¹⁹ NPR 8715.1, paragraph 2.1.2, states that the Designated Agency Safety and Health Official is the Chief Health and Medical Officer. The NPR cites OSHA as defining a Designated Agency Safety and Health Official as an official designated by the agency head with sufficient authority and responsibility to effectively represent the interest of, and support the agency head in the management and administration of, the agency's occupational safety and health program. The Designated Agency Safety and Health Official is responsible for ensuring that safety and health officials are appointed at appropriate levels with adequate budgets and staffs to implement occupational safety and health programs at all operational levels as required by the OSHA provisions set forth in Part 1960 of Title 29 of the Code of Federal Regulations (C.F.R.); specifically, Part 1960.6, paragraph (c).

JPL's internal procedures for the construction oversight process require all inspectors to use a standardized checklist and require the Construction Safety Group to:

- document any deficiencies observed on construction sites using the Construction Safety Inspection Report;
- use the data in the inspection database to track trends and leading indicators;
- communicate trends and leading indicators to the Facilities Construction and Engineering Group; and
- conduct a follow-up inspection to ensure that all noted observations have been corrected.²⁰

JPL Occupational Safety Office Inspections and Document Reviews Did Not Detect Workplace Hazards

The JPL Occupational Safety Office did not apply consistent oversight procedures to review subcontractor safety plans and engineering drawings for compliance with safety standards. In addition, JPL Occupational Safety Office inspectors did not recognize safety hazards during the document review process, the building and structural inspection process, and the hazard abatement process.

We reviewed subcontractor safety plans for five construction and facility projects at JPL that were active since October 2006 and found that two of these projects were not adequately reviewed by the Construction Safety Group. For example, in 2009 JPL completed construction of Building 224, a sewage lifting station. The Construction Safety Group reviewed and approved the project's design drawings and accepted the facility as built. However, we found that the building was designed and constructed with a rooftop parapet less than 36 inches in height, which does not comply with California OSHA standards requiring 42-inch guardrails.²¹ As a result, JPL was required to spend an additional \$11,836 to build guardrails to abate a potential fall hazard.

In another case, JPL subcontracted a roof replacement project for 13 buildings. The Construction Safety Group reviewed and approved the subcontractor safety plan for installing the rooftop fall restraint/arrest systems. However, when we compared the installed systems with the manufacturer's installation guide, we found that they had not been installed in accordance with manufacturer recommendations. We contacted the manufacturer and confirmed our concerns regarding the hardware used and the

²⁰ JPL Rules DocID 45420, "Safety Inspections," and Occupational Safety Program Office, "Internal Procedures for Inspections of Construction Sites," July 21, 2006.

²¹ California OSHA standards require 42-inch guardrails (or fall restraint/fall arrest systems) at working levels more than 30 inches above the floor (California Code of Regulations, Title 8, Chapter 4, Subchapter 7, "General Industry Safety Orders," §3207 and §3210).

placement of the anchor points (see Figure 5). The placement allows the cable to rub against the sharp, inside edge of the anchor point eyelets, which places additional stress on the restraint/arrest cable. Over time, this additional stress could damage the cable and lead to the failure of the system.

Figure 5. Rooftop of Building 156
Rooftop Fall Restraint System



Source: Kari Helman of Helman Architects (February 24, 2009)

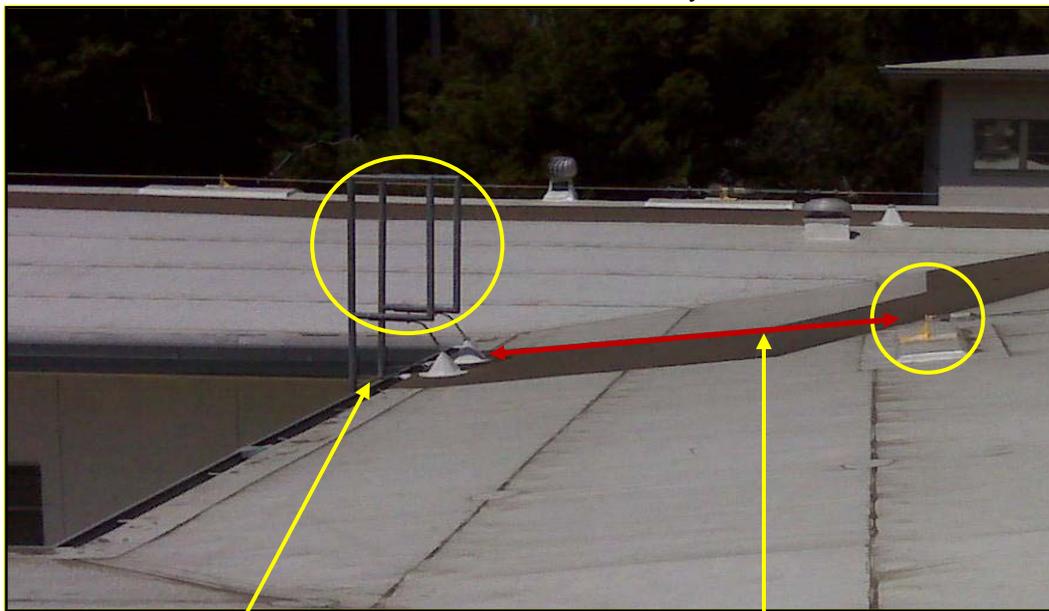
Workers have to connect/disconnect their safety harness lanyard from the lifeline while traveling between the rooftop anchors (illustrated by yellow circles), which were improperly installed.

According to the manufacturer, this faulty installation voided the manufacturer's warranty and placed personnel at increased risk of injury. In addition to the manufacturer's concerns, we also observed that the system was installed in a way that required workers to disconnect their safety harness lanyard and then reconnect it at each intermediate anchor point. In our judgment, this disconnecting and reconnecting increases the potential for a slip and fall. To prevent the likelihood of a slip and fall, a double lanyard system needs to be used: workers would attach their first lanyard to the restraint/arrest cable; upon arrival at the next intermediate anchor point, workers would simply connect their second lanyard ahead of that anchor point before disconnecting their first lanyard from the restraint/arrest cable. This process would be repeated as they

traveled along the restraint/arrest cable, thus ensuring continuous protection from a slip and fall.

When we notified the JPL Office of Safety and Mission Success of these issues, it directed the JPL Occupational Safety Office to correct the problem. However, in our judgment, the JPL Occupational Safety Office's efforts were inadequate because the corrective action it implemented still left employees with no fall protection within 6 feet of the roof's edge (see Figure 6). In addition, the JPL Occupational Safety Office did not correct the placement of the cable shock absorber, which had been improperly installed on the down-slope side of the rooftop and could not absorb the energy generated by a fall.

Figure 6. Rooftop of Building 161 – Rooftop Access and Distance to Fall Restraint System



Source: NASA OIG (July 23, 2009)

(a) Inadequate fall restraint system to prevent an employee from reaching a fall point. The most commonly used fall protection system is standard guardrails and ladders with self-closing gates or a properly installed personal fall arrest system with documented procedures and training.

(b) Note distance (red arrow) from ladder and edge of roof to the nearest fall arrest system (in yellow circle at right), which is more than 6 feet from roof edge. Employees accessing this area have no fall protection from the ladder (yellow circle at left) to the fall arrest system noted by the yellow circle at right, which is an end point of the cable lifeline, with a shock absorber. However, the shock absorber is improperly installed on the down-slope end of the cable instead of the up-slope end of the cable. If an employee was attached to the cable and fell off the roof edge, the shock absorber would not absorb the shock of the fall.

These rooftop hazards were part of 47 rooftop hazards identified in a 2003 study of JPL by American Safety & Emergency Response.²² However, there was insufficient documentation for us to determine whether all of the hazards in the report had been adequately addressed at the time of our audit.

Effective Inspection Process Should Identify and Prevent Hazards

An effective hazard control program should include an inspection process that identifies hazards in the workplace. Periodic inspections should identify existing or potential hazards and provide strategies to eliminate or control them. Construction Safety Group members are tasked with conducting inspections routinely for construction-related work as well as inspections of employee-reported unsafe and unhealthful conditions. However, we found that this inspection process was inadequate.

Flight Projects Center Construction Inspections Were Inconsistent. We found that safety representatives performed their inspections inconsistently and sporadically. The Flight Projects Center was under construction from April 2007 through May 2009. During this 2-year period, five safety representatives and three supervisors rotated into and out of the Construction Safety Group and inspections were not performed routinely, as required by JPL internal procedures: 1 inspection was performed in June 2007, 1 in October 2007, and 47 between November 2007 and April 2008. There was no record of any other site visits until July 2008, and inspections of the site after July 2008 were recorded as part of inspectors' daily JPL-wide construction site visits.

In addition, the inspectors did not follow a consistent practice of recording and following up on inspection results. JPL's internal procedures require inspectors to use a standardized checklist to ensure all safety concerns are addressed. However, only 9 of the 49 inspections of the Flight Projects Center were documented on this checklist. Although the remaining inspection records contained pictures and written descriptions of noted safety concerns, without the checklists there was no assurance that all relevant areas had been inspected. In addition, recording inspection results on a uniform checklist provides a mechanism for accumulating data in a consistent manner so that recurring acts and conditions can be identified.

We also found that there was no consistent practice for resolving unsafe conditions that the inspectors noted. We found that after inspection results were provided to Caltech personnel, there was no follow-up process to track and obtain resolution of the noted conditions. As a result, JPL and NASA had no assurance that the subcontractor was notified of the inspection results or took steps to abate the unsafe conditions. This lack of follow-up minimized the effectiveness of the inspection process.

²² Assessment of Building Rooftops for Fall Protection and Fall Protection Systems Phases I & II, Contract #1252375, as prepared by American Safety & Emergency Response, conducted June–November 2003.

The JPL Occupational Safety Office Did Not Consistently Perform Objective Assessments of Employee-Reported Safety Hazards. We determined that the actions the JPL Occupational Safety Office took in response to employee-reported incidents of unsafe acts were not in accordance with NPR 8715.1 requirements and that the Occupational Safety Office did not consistently inform the reporting employees that the unsafe acts or conditions had been addressed. The NPR requires Centers to conduct inspections as soon as possible but no later than 3 days after notification of serious conditions or 20 days after notification of less serious conditions. The NPR defines a serious condition as a hazard, violation, or condition for which there is a substantial probability that death or serious physical harm could result. The NPR also requires the use of a risk assessment process to analyze and classify overall risk potential, abate and report those conditions that were abated within 30 days, prepare abatement plans for those conditions requiring more than 30 days to correct, and establish a closed-loop process to provide assurance to the reporting employees that the unsafe act or condition was successfully mitigated.

For example, the JPL Occupational Safety Office received two reports from employees that an overhead construction crane extended into pedestrian and vehicle traffic in 2008. In response to these reports, the Occupational Safety Office raised the matter with the subcontractor, which claimed that it was unsure whether the crane was physically able to extend over the road and sidewalk and that in any event the crane was not carrying a load at the time of the report. Based on the subcontractor's response, the JPL Occupational Safety Office discounted the employees' reports as a "perception issue." In reaching this conclusion, the JPL Occupational Safety Office did not record any objective investigation that would validate the subcontractor's explanation regarding the length of the crane's extension or assess whether the crane arm itself, even in the absence of a load, was a potential hazard to pedestrian and vehicle traffic.

Figure 7. Crane Operations



Source: Undated photo provided anonymously by a JPL employee in May 2009.

Note: For purposes of illustration, the crane cable is colored green, while the red line shows that the load was directly above roadway.

A JPL employee provided the NASA OIG with a photograph (see Figure 7) that showed the crane extending beyond the construction site into the road and sidewalk. However, the JPL Occupational Safety Office took no steps to investigate the matter beyond speaking with the subcontractor operating the crane. In our judgment, the JPL Occupational Safety Office's dismissal of the employees' concerns without further inspection left a potential hazard unmitigated and served to discourage employees from reporting unsafe and hazardous conditions in the future.

Employee-Reported Incidents and Inspection Findings Were Not Prioritized and Properly Addressed. NPR 8715.1 requirements are designed to ensure that safety resources address unsafe conditions and hazards reported by employees. Once potential hazards have been brought to the attention of the safety office, they are required to be assessed commensurate with their degree of risk. Risk is determined by assessing the severity of the hazard and the likelihood of occurrence. NPR 8715.1 states that imminent hazardous conditions (the highest degree of risk) must be addressed within 24 hours, serious conditions within 3 working days, and less than serious conditions within 20 working days of being reported. We found that in the majority of cases, JPL addressed all reported hazards as though they were of equal risk. For example, we reviewed the 95 unsafe or unhealthful incidents reported by JPL employees from October 1, 2007, through July 9, 2009, and found that in only 2 instances was there any evidence that the JPL Occupational Safety Office had conducted any kind of risk assessment or hazard prioritization. Further, of those 95 reported incidents, only 7 showed that the Office had conducted additional inspections to ensure that the hazard was abated and only 8 showed that the office had provided follow-up information to the reporting employees affected by the reported hazard. In the absence of an effective risk management process, the JPL Occupational Safety Office cannot ensure that reported safety hazards are assessed and addressed in a timely and effective manner.

Employee Turnover and Insufficient Training Contributed to the Inspection Deficiencies

High employee turnover within the Construction Safety Group resulted in the loss of project knowledge. In addition, safety representatives did not receive sufficient training to educate them in identifying and abating the types of hazards typically found during construction projects.

Since October 2006, three Construction Safety Group supervisors have been reassigned to other groups. The duration of the tenures of these supervisors ranged from 6 to 17 months. During construction of the Flight Projects Center, five different safety representatives were assigned to the project, with the length of their assignments ranging from 2 weeks to 12 months. In our judgment, the short duration of these assignments contributed to deficiencies in the JPL Occupational Safety Office's inspection program because the safety representatives were provided inconsistent direction and possessed varying levels of expertise.

Moreover, Construction Safety Group members received minimal training related to construction safety. We reviewed the training records of the four most recent construction safety representatives. Collectively, they received about 600 hours of training, half of which was safety-related. However, only two of their courses were construction-related and neither appeared to be training specifically designed to educate safety professionals in identifying and abating the types of hazards typically found during construction projects.²³

Recommendations, Management's Response, and Evaluation of Management's Response

Recommendation 2. We recommended that the JPL Occupational Safety Program Office Manager implement a standardized safety inspection process that meets JPL Internal Standard Operating Procedures and NASA Procedural Requirements for construction safety.

Management's Response. JPL management responded with comments provided by the Manager of the Finance and Contract Management Division. JPL partially disagreed with the findings that led to our recommendation, stating that the safety inspections performed during construction of the Flight Projects Center were consistent with applicable guidelines and that inspections by the JPL Occupational Safety Office were augmented by subcontractor inspections. Nevertheless, JPL agreed to take corrective action, stating that it would reassess its compliance with its internal operating procedures and reinstitute use of the standardized checklist to document inspections and deficiencies and track unsafe conditions. Management expects to complete the proposed actions by December 30, 2010.

Evaluation of Management's Response. As discussed in our report, we found no standardized method to document safety deficiencies. In addition, the frequency of the inspections performed as well as how the deficiencies were documented varied with each inspector. JPL's internal procedures require inspectors to use a standardized checklist to ensure all safety concerns are addressed. However, only 9 of the 49 inspections we reviewed were documented using this checklist. In addition, we found that JPL had no formal follow-up process to track and obtain resolution of unsafe conditions. As a result, JPL could not provide assurance that deficiencies were always communicated to the subcontractor or that the subcontractor had taken appropriate steps to abate unsafe conditions.

Although we do not agree with JPL management's factual assertions, we find the proposed actions to be responsive to our recommendation and therefore consider the recommendation to be resolved. We will close the recommendation upon completion and verification of the proposed corrective actions.

²³ For example, the inspectors could have taken courses offered by the OSHA Training Institute such as Cranes and Rigging Safety for Construction; Excavation, Trenching and Soil Mechanics; Concrete, Forms, and Shoring; Principles of Scaffolding; and Fall Arrest Systems.

Recommendation 3. We recommended that the JPL Occupational Safety Program Office Manager implement procedures that will improve internal oversight for reviewing subcontractor safety plans, engineering design drawings, and conducting final inspections.

Management's Response. JPL management partially disagreed with the findings that led to this recommendation but agreed to take corrective action. JPL agreed that the construction of Building 224 was noncompliant with California OSHA regulations and that the fall protection system was not installed in accordance with the manufacturer's recommendations. However, JPL insisted that it provided consistent oversight of subcontractor safety plans and engineering drawings and that the JPL Occupational Safety Office was not responsible for the installation methods or specifications of the rooftop fall restraint and arrest system.

With regard to corrective action, JPL management stated that it will work more closely with the JPL Facilities Division and the System Safety Program Office to improve the oversight process for reviewing subcontractor safety plans and engineering design drawings and for conducting final inspections. In addition, JPL stated that design review procedures have been revised to improve the review process.

Evaluation of Management's Response. Although we disagree with JPL's assessment of its oversight responsibilities, we find its proposed corrective action to be responsive to our recommendation. Accordingly, the recommendation is resolved and will be closed upon completion and verification of the proposed corrective action.

Recommendation 4. We recommended that the JPL Occupational Safety Program Office Manager review employee competencies and develop training requirements that ensure that Construction Safety Group members obtain the training necessary to gain and maintain professional competency.

Management's Response. JPL management disagreed that the Construction Safety Group lacked sufficient training, but nevertheless agreed to take corrective action, stating that it will ensure that qualified safety professionals are hired and that construction safety personnel receive a minimum of 100 hours of construction safety-related training and professional development. JPL also said that it will ensure that its employees are cross-trained and that continuous training is provided to all personnel.

Evaluation of Management's Response. As discussed in our report, we found that the four most recent construction safety representatives had collectively received about 600 hours of training, half of which was safety-related. However, only two courses were construction-related and neither appeared to be training that was specifically designed to educate safety professionals in identifying and abating the types of hazards typically found during construction projects. In our judgment, the lack of specific training contributed to safety inspection program deficiencies.

Despite this factual disagreement, we find JPL's proposed action to be responsive to our recommendation. Accordingly, the recommendation is resolved and will be closed upon completion and verification of the proposed corrective action.

THE JPL OCCUPATIONAL SAFETY OFFICE'S MISHAP, CLOSE CALL, AND HAZARD REPORTING PROCESSES ARE INEFFICIENT, INCOMPLETE, AND UNTIMELY

We found that the JPL Occupational Safety Office did not implement an efficient and effective mishap, close call, and hazard reporting system in accordance with prime contract requirements. The JPL Occupational Safety Office's reporting system involved multiple reporting processes and, therefore, did not efficiently consolidate incident data so that recurring problems could be identified. In addition, because the JPL Occupational Safety Office did not identify the root causes of reported incidents it could not effectively recognize and apply lessons learned. Finally, the JPL Occupational Safety Office did not ensure that mishaps and close calls were properly documented and that all incident data was timely recorded in the NASA Incident Reporting Information System (IRIS). IRIS is the Agency-mandated system for reporting, recording, and tracking all NASA mishaps, close calls, and post-incident corrective actions. The untimely reporting of safety incidents reduces the effectiveness of IRIS and limits the capability of other NASA Centers to prevent similar hazardous conditions.

NASA Requires Timely and Accurate Reporting of Mishaps, Close Calls, and Hazards

NASA reporting requirements are applicable to JPL via the contract between NASA and Caltech.²⁴ The purpose of the NASA reporting system is to report, investigate, and document mishaps, close calls, and previously unidentified serious workplace hazards to prevent recurrence of similar accidents.²⁵ The reporting requirements specify how to respond to mishaps or close calls from discovery through corrective action and closure; contain requirements for classifying mishaps, establishing investigation authorities, and performing investigations; formalize notification, analysis, and reporting obligations; describe roles and responsibilities; provide instruction on release of information to the public; and specify the interaction between NASA, Federal and state occupational safety

²⁴ Relative to mishap, close calls, and hazard reporting, the contract between NASA and Caltech incorporated the following reporting requirements applicable to JPL. Center (to include Caltech and its subcontractors) reporting requirements are per NPD 8621.1H, "NASA Mishap and Close Call Reporting, Investigation, and Recordkeeping," June 2, 2000, which is incorporated in accordance with contract clause H-7(d)(3). Employee reporting of mishap, close call, and hazards was incorporated in the prime contract based on requirements in NPR 8715.1, which is incorporated in accordance with contract clause H-27(a)(18).

²⁵ NASA defines a mishap as an unplanned event that results in injury to personnel or damage to property. NASA categorizes mishaps based on the severity of injury to personnel or total cost of damage to property. Mishap classifications range from a Type A Mishap, which is the most severe, to a close call, which is the least severe.

and health administrations, the National Transportation Safety Board, and other Government agencies.

Reporting Process Was Inefficient, Incomplete, and Untimely

We found that the JPL Occupational Safety Office had multiple reporting mechanisms for both employee and Center reporting. These multiple mechanisms made the data consolidation process cumbersome and the identification of recurring problems difficult. Employee-reported incidents of unsafe and unhealthful conditions were collected through five mechanisms: Safety Early Reporting System (online reporting), Safety Concerns in General (e-mail, telephone to JPL Occupational Safety Office staff), Immediate Mishap and Close Call (incident notification telephone line), Environmental Health and Safety Hotline (anonymous hazard reporting system), and Safety Concerns from Mishap Reporting System (JPL Occupational Safety Office internal tracking of safety concerns). Each format recorded incident data differently and with varying levels of detail.

Center reporting of mishaps and close calls was made through NASA's IRIS, the JPL Mishap Reporting System, and a subcontractor database. JPL Occupational Safety Office personnel explained that the separate mechanisms were necessary to protect the personal data of the individuals involved. For example, the JPL Mishap Reporting System did not have the capability to filter personal data before uploading information to IRIS. Similarly, a separate subcontractor database was developed to avoid disclosing JPL employee personal data to subcontractors. As a result, transfers of information from one reporting mechanism to another are made manually. This process allowed for the discretionary reporting of incident information and the potential for errors when transferring data from one system to another.

The following table contains a summary of the incidents reported by subcontractors and JPL personnel to the JPL Occupational Safety Office that were recorded on JPL standard incident reporting forms during the period of October 1, 2006, through February 28, 2009. Our review of 14 documented construction-related incidents found that only 7 were reported to NASA in IRIS. Of these 7 reports, 4 were reported late. While 5 of the 7 reported incidents did include lessons learned, these lessons learned were incomplete; that is, they did not address the root cause of the reported incident as required by NPR 8621.1B.²⁶

²⁶ "NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Recordkeeping w/Change 5 (03/15/2010)," which states that the objective is "to improve safety by identifying what happened, where it happened, when it happened, why it happened, and what should be done to prevent recurrence and reduce the number and severity of mishaps."

Summary of Documented Mishap and Close Call Incidents October 1, 2006–February 28, 2009			
Classification Summary	Number	Reported in IRIS	Recorded Lessons Learned in IRIS
Type B Mishap*	3	3	3
Close Call	6	3	2
Type C Mishap Damage between \$2,500 and \$250,000	1	1	
Type C Mishap Injury involving lost workday	1		
Minor injury	2		
No injury	1		
Total	14	7	5
* Per NPR 8621.1B, Chapter 1, a Type B Mishap is an incident that results in property damage of at least \$250,000 but less than \$1 million, or occupational injury or illness resulting in permanent partial disability or hospitalization.			

In our opinion, there would have been meaningful lessons learned from the other two incidents reported in IRIS because they involved employees being exposed to potentially dangerous situations. The JPL Occupational Safety Office made no lessons learned report to NASA concerning these incidents, thereby preventing the development and implementation of corrective actions to reduce the probability of similar mishaps at other NASA facilities.

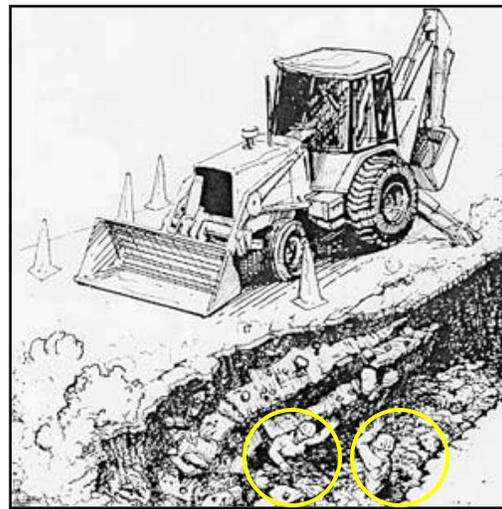
One of the reported incidents was the collapse of a trench that had not been reinforced with shoring during Flight Projects Center construction (see Figure 8). The collapse caused approximately \$329,000 in damage to fiber-optic telecommunication cables, reducing operational networking capabilities and jeopardizing communication with Earth science and space exploration missions. Although JPL facility and information technology personnel were notified of the mishap the day after it occurred, the JPL Occupational Safety Office was not notified until 3 days later. In the interim, subcontractor employees entered the unshored trench to begin repair work, thereby being placed in danger from further collapse. Had the JPL Occupational Safety Office been notified of the incident in a timely manner, safety personnel would have had the opportunity to provide guidance for safe entry into the collapsed trench.

Figure 8. Workers in Collapsed Trench and Unprotected Job Site



Source: Vanir Construction Management, Inc. (July 18, 2008)

2008 Duct Bank Collapse at JPL. Subcontractor employees were placed at risk during repair work. The trench cave-in was not reported to the JPL Occupational Safety Office for 3 days.



Source: Occupational Safety and Health Administration Web site

This OSHA illustration demonstrates the danger of laborers being buried when a portion of a trench wall collapses.

Another example of inadequate reporting was a close call involving a response by the JPL Fire Department to a report of compressed gas cylinders unearthed during excavation operations at the Flight Projects Center construction site. A photograph provided by the subcontractor (see Figure 9) shows JPL Fire Department employees working around one of the unearthed compressed gas cylinders without protective clothing or equipment.

It was later determined that two of the four cylinders, including the one pictured, contained pentaborane, a highly toxic chemical that may ignite spontaneously if exposed to air.

Figure 9. JPL First Responders Testing One of the Unearthed Cylinders



Source: Vanir Construction Management, Inc. (October 25, 2007)

The JPL Occupational Safety Office did not report this close call to NASA via IRIS until February 2009, 16 months after the incident, and then only at the prompting of NASA OIG personnel. In the absence of this and similar reporting, other NASA safety officials were not in a position to learn from the incident or to take steps to prevent exposures to similar risks in the future.

Benefits from Lessons Learned Were Not Shared

JPL's reporting systems did not meet the intended objective of NPR 8621.1B, particularly, "why it happened, and what should be done to prevent recurrence." This concern was also discussed in OSMA's March 2007 Institutional/Facilities/Operational (IFO) audit, which reported that many of JPL's lessons learned did not meet the definition provided in NPR 8621.1B, which states that lessons learned from a mishap encapsulate "knowledge or understanding that is gained by experience." We found that the JPL Occupational Safety Office did not adequately capture the knowledge gained from mishap analyses, report lessons learned from the root causes of events, or share lessons learned with the parties involved in the construction process or with other NASA Centers. For example, as previously discussed, the JPL Occupational Safety Office did not analyze or report on the close call involving pentaborane at the Flight Projects Center construction site so that other NASA Centers could learn from JPL's experience. Our review of the 14 mishaps and close calls reported by the Occupational Safety Office and subcontractors found that 7 were reported to NASA in IRIS. In order for other NASA Centers to benefit from the experiences and lessons learned by JPL staff, all incidents and lessons learned must be documented in IRIS.

During our initial fieldwork, we found that the JPL Occupational Safety Office did not have a process in place to share construction-related lessons learned from other NASA Centers with the JPL Facilities Division and subcontractors. We identified five reports containing lessons learned by other Centers that would have been useful to JPL subcontractors. However, the JPL Occupational Safety Office failed to share this information with the JPL Facilities Division or subcontractors.

As a result of our review, the JPL Occupational Safety Office implemented a process to share with subcontractors lessons learned that are reported by other Centers. However, the JPL Occupational Safety Office still has no process in place to share lessons learned as a result of employee-reported incidents that occur at JPL.

Recommendations, Management's Response, and Evaluation of Management's Response

Recommendation 5. We recommended that the JPL Occupational Safety Program Office Manager reassess the internal mishap, close call, and hazard reporting system to improve timeliness and completeness and ensure compliance with NPR 8715.1.

Management's Response. JPL management responded with comments provided by the Manager of the Finance and Contract Management Division. JPL management nonconcurred with our finding and recommendation, stating that pursuant to the JPL prime contract and the State of California privacy laws the JPL Occupational Safety Office is not permitted to share personal identifiers and medical information with NASA. In JPL's opinion, it is obligated to maintain multiple reporting processes in order to meet NASA and California OSHA reporting requirements and the terms of the prime contract. Despite its disagreement, JPL stated that the JPL Occupational Safety Office is working with the NASA Safety Center to input mishaps, including subcontractor mishaps, directly into IRIS and adding filters that are specifically designed to protect personal information and medical data. Once the privacy concerns are addressed in IRIS, the JPL Occupational Safety Office said it will be able to disseminate and implement all of the prime contract mishap reporting requirements. JPL and NASA's target completion date is the first quarter of 2011; however, JPL management stated that the date is conditional and may change due to the availability of funding.

Evaluation of Management's Response. We understand that as a contractor JPL's mishap reporting requirements are unique, especially in the area of privacy and the sharing of medical records. However, we believe that multiple reporting mechanisms make the data consolidation process cumbersome and the identification of recurring problems difficult. In addition, the manual transfer of information from one reporting system to another may allow for discretionary reporting of incident information or result in potential input errors.

Although JPL nonconcurred with our recommendation, we find that the actions management is taking in concert with NASA are responsive to the intent of our recommendation. Accordingly, the recommendation is resolved and will be closed upon completion and verification of the corrective actions.

Recommendation 6. We recommended that the JPL Occupational Safety Program Office Manager establish procedures for documenting and disseminating JPL's lessons learned and those from other NASA Centers.

Management's Response. JPL management disagreed with our findings that led to this recommendation, stating that all Mishap-Warning-Action-Responses coming from the NASA Safety Center are forwarded to JPL facilities organizations for appropriate dissemination to subcontractors, but agreed to take corrective action to address our

recommendation.²⁷ As corrective action, JPL stated that it will trend mishaps by type, level, and organization and will post the results on the JPL Occupational Safety Office Web site for all JPL personnel to view. Lessons learned from all lost time cases and cases of interest will be presented at the quarterly JPL safety committee meetings. In addition, the Mishap-Warning-Action-Response initiated by the NASA Safety Center will be forwarded to the applicable organizations for dissemination.

Evaluation of Management's Response. Although we continue to believe that the JPL Occupational Safety Office process for sharing construction-related lessons learned from other NASA Centers with the JPL Facilities Division and JPL subcontractors was deficient for the reasons stated in our report, we find JPL's proposed actions to be responsive to our recommendation. Accordingly, the recommendation is resolved and will be closed upon completion and verification of the proposed corrective actions.

Recommendation 7. We recommended that the JPL Occupational Safety Program Office Manager conduct employee training to provide guidance on proper identification of root causes and reinforce the concept of sharing lessons learned.

Management's Response. JPL management disagreed with our findings that led to this recommendation, stating that since 2007 JPL has been inputting root cause, lessons learned, and corrective actions from the internal JPL Mishap Reporting System into IRIS and that the JPL Occupational Safety Office has taken the initiative to request NASA-provided Root Cause Analysis training to better align with NASA's terminology and investigation methodology. Despite this disagreement, JPL agreed to take action to address our recommendation.

Evaluation of Management's Response. We find JPL's proposed action to be responsive to our recommendation. Accordingly, the recommendation is resolved and will be closed upon completion and verification of the proposed corrective action.

²⁷ Mishap investigation authorities issue a Mishap-Warning-Action-Response (MWAR) when their investigations uncover hazards they want to share with the Agency. MWARs allow investigators to share safety-critical information before completing the final mishap investigation report.

THE NASA MANAGEMENT OFFICE AND OSMA DID NOT ENSURE THAT OCCUPATIONAL SAFETY AND HEALTH PROGRAM REQUIREMENTS WERE EFFECTIVELY IMPLEMENTED AT JPL

We found that the NASA Management Office did not have established policies or procedures to ensure that JPL had fully implemented contractually mandated safety requirements and that OSMA did not follow its own procedures in conducting safety audits of JPL. Specifically, the NASA Management Office and OSMA did not ensure that JPL complied with NASA safety policy and, therefore, were unable to provide reasonable assurance that an effective safety oversight process had been implemented at JPL. Consequently, the NASA Management Office and OSMA did not identify that the JPL Occupational Safety Office had ineffective management systems and controls in the area of construction safety and NASA management did not have the information required to make knowledgeable risk acceptance and mitigation decisions, which placed JPL personnel and facilities at unnecessary risk.

Occupational Safety and Health Programmatic Requirements

According to NASA Policy Directive (NPD) 1000.3D,²⁸ OSMA is responsible for “policy direction, functional oversight and assessment” for all NASA safety activities; the Mission Support Directorate and its subordinate division, Agency Operations, provides “programmatic and institutional implementation oversight at the Jet Propulsion Laboratory.”²⁹ The NPD establishes a direct reporting relationship between the Mission Support Directorate’s Agency Operations and the NASA Management Office but does not specify the roles and responsibilities of the NASA Management Office.

NPD 8700.1E, “NASA Policy for Safety and Mission Assurance,” October 28, 2008, states that the Center Directors are responsible for the safety and mission success of their activities and operations. Each Center Director designates a safety and mission assurance functional manager who supports the Center Director in implementing that responsibility. At JPL, the safety and mission assurance functional manager is a Caltech employee.

The JPL prime contract includes NPR 8715.1, which implements NASA safety and health requirements at JPL. The NPR, which sets forth the requirements for NASA’s occupational safety and health programs, applies to (1) all NASA organizations, elements, entities, or individuals; (2) all NASA equipment, property, systems, and

²⁸ “The NASA Organization,” December 3, 2008, documents the NASA organization and assigns organizational responsibilities.

²⁹ The NPD actually refers to the Office of Program and Institutional Integration, whose functions have since been assumed by the Mission Support Directorate.

facilities; and (3) all phases of the life cycle of systems or facilities and establishes the programmatic requirements for safety and health administration, inspections and abatement, safety and health training, recording and reporting requirements, and the evaluation of Center Occupational Safety and Health Programs.^{30, 31, 32}

JPL's Safety Oversight Structure Is Unique among NASA Centers

JPL is a unique Center relative to the NASA organizational structure in that it is a federally funded research and development center owned by NASA but operated pursuant to contract by Caltech. Caltech operates and maintains the facility, but NASA retains the authority to approve funding for operating, maintaining, improving, and performing new construction on the facility. The contractor performs work assigned in the prime contract and in task orders issued by the NASA Management Office Procurement Officer.

The NASA Management Office is responsible for providing oversight of industrial safety, occupational health, industrial hygiene, medical services, environmental protection, fire safety, emergency preparedness, continuity of operations, and facility maintenance and construction. In addition, the NASA Management Office is responsible for ensuring adherence to appropriate Federal, state, and local standards and guidelines.

The NASA Management Office and OSMA Can Improve Oversight of JPL Institutional Safety

We found that oversight by the NASA Management Office and OSMA was insufficient to ensure safety program compliance at JPL. First, the two offices did not collaborate on their respective oversight roles and the NASA Management Office failed to coordinate its oversight activities with OSMA's strategic IFO audit for JPL.³³ Second, the NASA Management Office did not develop plans or resource requirements to oversee JPL's safety operations. Third, OSMA's scheduled biennial IFO audit issued on March 19, 2007, failed to identify the JPL Occupational Safety Office's noncompliance with

³⁰ On March 30, 2004, NASA administratively renamed NASA Procedures and Guidelines 8715.1 as NPR 8715.1, "NASA Occupational Health and Safety Programs," without substantially changing its requirements. Our report refers to the NASA Procedures and Guidelines as the NPR.

³¹ As required by Section 19 of the Occupational Safety and Health Act of 1970, as amended, and 29 C.F.R. Part 1960.

³² NPR 7123.1A, 5.1.2, "NASA Systems Engineering Processes and Requirements," January 4, 2009, paragraph 5.1.2, states that life cycle "... proceeds through a capital assets life cycle in five well defined phases, a 'Pre-Formulation and Proposal' phase, progresses into a 'Preliminary Design' and then a 'Build/Construct/Fabricate' phase, and eventually ends after 'Operations and Maintenance' with an 'Asset Disposal' phase."

³³ IFO audits provide independent verification that institutions, facilities, and operations are in compliance with applicable NASA safety requirements.

NPR 8715.1. This inadequate oversight was caused, at least in part, by the absence of clearly defined roles and responsibilities between the NASA Management Office and OSMA. For example, personnel from both offices told us during the course of our audit that they had not addressed the findings in OSMA's 2007 IFO audit because they believed that the other office was responsible for disposition and corrective action verification.

Oversight by the NASA Management Office Was Insufficient

The NASA Management Office did not have a clear definition of its on-site safety oversight role, and we found no documented procedures that defined that role. We also did not find any evidence of construction site safety reviews by the NASA Management Office's Health, Safety, and Environmental Manager.

The NASA Management Office's Health, Safety, and Environmental Manager provided the OIG with a list identifying five major areas that the manager alone was responsible to oversee: occupational safety, environmental safety, occupational health services, fire safety, and emergency preparedness. This list described 166 specific tasks, including 63 in the occupational safety area, 46 in the occupational health services area, and 27 in the environmental safety area. However, despite this long list, the manager did not prepare any strategic or other type of plan prioritizing how he intended to meet his oversight responsibilities. In our judgment, one individual cannot adequately oversee five major functional areas of safety and provide reasonable assurance that the requirements of NPR 8715.1 are being met at JPL. In addition, the NASA Management Office did not have a documented policy for safety oversight procedures that defined the office's oversight roles and responsibilities, had not assessed resource requirements to fulfill its oversight responsibilities, and had no strategic plan to oversee JPL safety activities.

OSMA Did Not Ensure that JPL Effectively Implemented Contractually Mandated Safety Requirements

The Chief of OSMA is responsible for conducting IFO audits, which provide independent verification that institutions, facilities, and operations are in compliance with the applicable IFO Baseline Requirements Set.³⁴ The last IFO audit that OSMA conducted at JPL was completed in March 2007. The 2007 IFO audit found that the JPL Occupational Safety Office failed to effectively report mishaps and close calls; did not provide adequate oversight of subcontractor job hazard analyses and safety plans; and did not

³⁴ NPR 8705.6A, "Safety and Mission Assurance Audits, Reviews, and Assessments," April 9, 2009, states that the Baseline Requirements Set represents a set of requirements jointly negotiated among the program/project, engineering community, safety and mission assurance community, and, as appropriate, institutional organizations. Typically, the Baseline Requirements Set represents a subset of Agency safety and mission assurance processes and technical and engineering performance specification requirements uniquely applicable to a given NASA program, project, facility, or operation.

have adequate staffing for all of the ongoing facilities projects. However, OSMA was unaware that the JPL Occupational Safety Office did not:

- identify and monitor budget resource requirements to assess safety program performance;
- effectively conduct oversight and safety and health inspections for on-site construction projects; or
- identify or address root causes of the deficiencies identified in the March 2007 IFO audit report.

Ineffective Use of IFO Audit Process

OSMA did not follow its oversight procedures to ensure contractor compliance with NPR 8715.1 during the performance of the 2007 IFO audit. NPR 8715.1, Chapter 8, “Evaluation of Occupational Safety and Health Programs,” requires that NASA Headquarters perform IFO audits that include qualitative assessments of the extent to which the Center safety and health programs comply with NASA policy and procedures and the OSHA provisions set forth in Part 1960 of Title 29 of the Code of Federal Regulations.³⁵ In addition, the NPR requires that the IFO audits ensure these programs have been effectively implemented by the Center and are consistent with recognized best practices. Chapter 8 also requires that Centers evaluate their safety and health programs annually using the OSHA baseline questionnaire, which lists the key safety program elements found in Part 1960 that, if not adhered to, could result in Federal OSHA inspectors issuing NASA a notice of violation.³⁶ These safety program elements are also required by NPR 8715.1.

We found that the IFO audit assessment of JPL’s reporting and abating of safety hazards and concerns did not sufficiently address NPR 8715.1, which lists 142 auditable requirements. However, the 2007 IFO audit covered only 9, excluding 38 of the 47 requirements found in Chapter 2, “Safety and Health Administration.” The IFO audit excluded all 42 auditable requirements found in Chapter 4, “Inspection and Abatement,” and 53 other key topic requirements that in our judgment are essential to verifying that Centers are compliant with NASA safety requirements.

³⁵ Basic program elements for Federal employee occupational safety and health programs are published in 29 C.F.R. Part 1960. The purpose of NPR 8715.1 is to provide details necessary to implement the occupational safety and health regulations found in 29 C.F.R. Part 1960.

³⁶ 29 C.F.R. Part 1960 program elements citable by OSHA as found in Appendix A of OSHA Instruction FAP 01-00-003, “Federal Agency Safety and Health Programs,” May 17, 1996. The instruction was developed as a reference document for identifying the responsibilities associated with Federal Agency Inspections and Evaluations conducted by OSHA.

OSMA personnel stated that they did not have the time or resources to audit all of the topics and used other methods in addition to the IFO audit to monitor safety compliance at JPL. We contend that an audit performed only once every 2 years, although 3 years elapsed between the two most recent IFO audits at JPL, should cover more than just nine auditable requirements. Moreover, had OSMA included in the audit such elements as qualifications of inspectors, conduct of inspections, employee reports of alleged unsafe or unhealthful conditions, notice of unsafe or unhealthful conditions, and abatement of unsafe or unhealthful conditions, OSMA most likely would have identified significant deficiencies in the JPL Occupational Safety Office's inspection and documentation of employee complaints of such incidents.

We also found that the resolution process for OSMA's IFO audit was ineffective because it did not review JPL's corrective action plans in a timely or sufficient manner. JPL management issued 10 "Corrective Action Plans" to address the 2007 IFO audit findings. However, during the 3-year period since the report's issuance, OSMA had not made a determination regarding the adequacy of these action plans. Consequently, the audit findings remain open. In addition, we reviewed JPL's corrective action plans and found that none of them, in our judgment, contained a full assessment of the identified deficiencies and root cause analyses, as required by the final IFO audit report.³⁷

Ineffective Use of Annual Operating Agreements

NASA did not use JPL's Annual Operating Agreement (AOA) as a means to validate the adequacy of JPL's safety resources. An AOA is a management plan that defines Center safety and health requirements and the resources required to meet those requirements. In addition, an AOA defines the metrics used to measure the efficacy of safety and mission assurance processes.

All NASA Centers are required to submit an AOA on an annual basis. Although there was no contractual requirement that JPL submit an AOA, JPL has submitted an AOA for the past 4 years. However, JPL's AOAs did not address all of the elements requested by OSMA. Specifically, the FY 2009 AOA did not identify resource allocations by safety program requirements in terms of staffing, training, sampling, program promotion, technical information, and subcontracts. In addition, both NPR 8715.1 and AOA performance specifications require the identification of resource shortfalls and documentation of mitigation plans to address any shortfalls. However, the topic of resource shortfalls was not mentioned in JPL's FY 2009 AOA.

In addition, during a review of the JPL AOA, OSMA did not request or review any supporting documentation for JPL's annual cost estimate and self-evaluation. OSMA

³⁷ Root cause analysis is a structured evaluation method that identifies the root causes of an undesired outcome and the actions required to prevent recurrence. Root cause analysis helps determine what happened, how it happened, and why it happened and the identification of appropriate corrective actions to prevent recurrence.

also failed to evaluate and ensure that the AOA included all of NASA's safety requirements, which OSMA's own internal work instruction requires.³⁸ Had OSMA performed its evaluation of the AOA in accordance with the work instruction, it most likely would have identified the same deficiencies we identified during the course of our audit, including that the JPL Occupational Safety Office had not identified resource shortfalls and was not developing resource requirements and prioritizing resources by work process.

Recommendations, Management's Response, and Evaluation of Management's Response

Although we directed recommendations 8, 9, and 10 to the Assistant Administrator for Agency Operations, we find the comments submitted by the NASA Management Office to be responsive to those recommendations.

Recommendation 8. We recommended that the Assistant Administrator for Agency Operations coordinate with the Chief of Safety and Mission Assurance to establish clear oversight roles and responsibilities concerning JPL, including responsibility for the review of audit findings.

Management's Response. The NASA Management Office concurred, stating that specific discussions will be held between the NASA Management Office and OSMA to clearly delineate the respective organizations' responsibilities for the oversight of safety implementation and audit compliance at JPL. Management expects to complete the proposed action by January 31, 2011.

Evaluation of Management's Response. The NASA Management Office's proposed action is responsive. The recommendation is resolved and will be closed upon completion and verification of the proposed corrective action.

Recommendations 9. We recommended that the Assistant Administrator for Agency Operations establish written safety oversight procedures defining the roles and responsibilities of the NASA Management Office.

Management's Response. The NASA Management Office concurred, stating that it will coordinate with OSMA to establish clear roles and responsibilities with respect to JPL safety oversight. Management expects to complete the proposed action by January 31, 2011.

Evaluation of Management's Response. The NASA Management Office's proposed action is responsive. The recommendation is resolved and will be closed upon completion and verification of the proposed corrective action.

³⁸ Headquarters Office Work Instruction 8700-GB05, Rev E, "Development and Utilization of Annual Operating Agreements," January 26, 2009.

Recommendation 10. We recommended that the Assistant Administrator for Agency Operations assess the level of resources required for the NASA Management Office to meet its responsibilities and provide those resources.

Management's Response. The NASA Management Office conditionally concurred, stating that the implementation of this recommendation is dependent upon the results of the corrective actions related to recommendations 8 and 9 and upon the availability of additional resources from the Agency. However, the NASA Management Office expects to take action to implement this recommendation by March 31, 2011.

Evaluation of Management's Response. The NASA Management Office's proposed actions are responsive. The recommendation is resolved and will be closed upon completion and verification of the proposed corrective actions.

Recommendation 11. We recommended that the Chief of Safety and Mission Assurance assess the IFO audit process and include steps to ensure JPL's compliance with NPR 8715.1 requirements.

Management's Response. OSMA disagreed with this recommendation, stating that requirements for IFO audits at JPL are contained in NPR 8705.6A, "Safety and Mission Assurance Audits, Reviews, and Assessments," April 9, 2009, and noting that OSMA is responsible for the selection of auditable areas. OSMA further stated that performance of the IFO audit at JPL is not governed by NPR 8715.1 and that NPR 8715.1 should not have been included in the JPL prime contract. However, OSMA stated that it would review NPR 8715.1, NPR 8705.6, and the JPL prime contract to determine whether additional clarifying modifications are appropriate.

Evaluation of Management's Response. OSMA's implication that NPR 8715.1 was included in the current JPL prime contract by mistake is not reasonable given the level of review the JPL contract undergoes before its execution. Moreover, in our judgment it is entirely appropriate to hold JPL accountable to NPR 8715.1 because JPL is a federally funded research and development center wholly owned by the Federal Government. Further, NPR 8715.1 clearly states that it is applicable to all "Component Facilities" where NASA employees are located. Specifically, NPR 8715.1 requirements apply to the following: (1) all NASA organizations, elements, entities, or individuals; (2) all NASA equipment, property, systems, and facilities; and (3) all phases of the life cycle of systems or facilities. OSMA's implication that the most comprehensive NASA policy on safety requirements was included in the JPL contract by mistake and that the requirements have gone unenforced for the entire term of the contract does little to bolster our confidence in NASA's oversight of the JPL safety program.

OSMA also stated that the IFO audit process at JPL is governed by NPR 8705.6A and that the 2007 IFO audit of JPL complied with that NPR. However, we found that OSMA failed to comply with the requirements of that NPR in conducting and following up on the 2007 IFO audit at JPL. Specifically, OSMA did not conduct timely follow-up activities to verify implementation of effective corrective and preventive actions for

Headquarters IFO safety and mission assurance audit findings. As previously explained, we disagree that the requirements of NPR 8715.1 do not apply to JPL and, therefore, stand behind our findings and recommendation with respect to the IFO audit process and its applicability to JPL. Accordingly, we consider OSMA's comments to be nonresponsive and this recommendation to be unresolved.

Recommendation 12. We recommended that the Chief of Safety and Mission Assurance review JPL's compliance with NPR 8715.1 programmatic requirements.

Management's Response. OSMA disagreed with this recommendation. OSMA stated that the basis for this recommendation is NPR 8715.1 and that this document does not apply to contractor employees and should not be included in the JPL contract.

Evaluation of Management's Response. As previously discussed, we maintain that NPR 8715.1 does apply to JPL because it is applicable to NASA Headquarters and NASA Centers, including Component Facilities and international operations where NASA employees are located. Therefore, we consider OSMA's comments to be nonresponsive and this recommendation to be unresolved.

Recommendation 13. We recommended that the Chief of Safety and Mission Assurance coordinate with the NASA Management Office to establish a contractual requirement for JPL to annually submit an AOA and ensure that future AOAs are reviewed in accordance with the applicable work instruction.

Management's Response. OSMA disagreed with our recommendation and stated that the AOA is intended to be a tool to gain "insight" rather than an "oversight" mechanism. In addition, OSMA stated that the purpose of the AOA is to facilitate dialogue and negotiation between the Center Director and the Center Safety and Mission Assurance Director rather than between the Center and OSMA. OSMA also concluded that delivery of the AOA on a contractual basis may have a detrimental effect on open communication between JPL and NASA. OSMA's comments did not address our conclusion that if JPL's AOA had been adequately reviewed using OSMA's own internal work instruction, the deficiencies we identified in the budget process would likely have been discovered.

Evaluation of Management's Response. As discussed in our report, the AOA defines Center safety and health requirements and the resources required to meet those requirements. The July 1, 2009, AOA call letter addressed to JPL provides:

The purpose of the AOA process is to encourage and institutionalize the Center SMA [Safety and Mission Assurance] Management's conduct of thorough planning to: 1) obtain, understand, and define the customer requirements, 2) identify the SMA processes and resources required to meet those customer requirements, and 3) define the metrics to be used to evaluate the efficacy and efficiency of the SMA process. The resulting AOA represents a contract between the Center Director and the Center Management that establishes the baseline of SMA implementation for the institutions, programs, and projects at the Center. Additionally, the completed AOA provides the

Chief, SMA, with an oversight tool to understand customer requirements at individual Centers and to establish a baseline to assess the effectiveness of the Center's functional SMA processes.

In our judgment, the AOA can be a valuable tool to provide much needed structure and rigor to the JPL safety program.

We do not consider OSMA's comments to be responsive and therefore consider the recommendation to be unresolved.

Scope and Methodology

We performed this audit from March 2009 through September 2010 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 objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

We performed work at JPL and at NASA Headquarters, Washington, D.C. We obtained, reviewed, and analyzed Federal, NASA, and JPL policies and procedures relating to safety and occupational health programs, including NASA Federal Acquisition Regulation Supplement 1852.223-7, 29 C.F.R. Part 1960, Title 8 Division of Occupational and Health California Regulations, NPR 8715.1, NPR 8715.3, NPR 8621.1, and JPL Rules and Internal Standard Operating Procedures. We also reviewed NASA contract NAS7-03001 to determine contractual requirements.

We interviewed NASA, JPL, and subcontractor employees. We reviewed the JPL processes for reporting, investigating, and documenting mishaps, close calls, and hazards to determine whether JPL ensured that hazards were properly identified and abated and that lessons learned were properly communicated to prevent reoccurrence. We selectively reviewed subcontract procurement files and associated safety plans for construction projects since October 2006 to determine whether JPL had established oversight procedures to ensure contractor and subcontractor compliance with OSHA regulations and NASA policies and procedures. We also reviewed the Caltech budgetary process to determine whether JPL employed an adequate management system of control in construction safety areas to ensure resources were effectively allocated to address safety considerations.

To determine whether NASA provided adequate oversight of the JPL safety program, we interviewed officials with the NASA Management Office and OSMA. We also followed up on the findings of the 2007 IFO audit conducted by OSMA in support of the NASA Management Office.

Use of Computer-Processed Data. We used computer-processed data to perform this audit. JPL mishaps and close calls were entered into IRIS. We separately requested documented construction-related incident reports from the JPL Occupational Safety Office and compared the information in the key data fields. We believe the data to be reliable based on our tracking and comparison.

Review of Internal Controls

We reviewed and evaluated the internal controls associated with NASA oversight of the JPL Occupational Safety Program Office and JPL staff oversight of subcontractors performing on-site construction projects. We found deficiencies in both areas, as discussed in this report. Our recommendations, if implemented, should correct the weaknesses we identified.

Prior Coverage

During the last 5 years, the NASA Office of Inspector General issued one report relevant to the subject of this report: “Glenn Research Center Needs to Better Define Roles and Responsibilities for Emergency Response” (IG-08-027, September 3, 2008), accessible over the Internet at <http://oig.nasa.gov/audits/reports/FY08>.

MANAGEMENT COMMENTS



Jet Propulsion Laboratory
California Institute of Technology

4800 Oak Grove Drive
Pasadena, California 91109-8099
(818) 354-4321

October 18, 2010

Refer to JPL ARO: 200970004

Dr. Eugene H. Trinh
Director, NMO
NASA Management Office - JPL
4800 Oak Grove Drive, Mail Stop 180-801
Pasadena, CA 91109-8099

Subject: JPL Response to the Office of Inspector General's (OIG) Draft Audit Report, "Review of the Jet Propulsion Laboratory's Occupational Safety Program" (Assignment No. A-09-010-00), received September 24, 2010

Reference: OIG's Draft Audit Report, "Review of the Jet Propulsion Laboratory's Occupational Safety Program," (Assignment No. A-09-010-00), dated September 24, 2010

Dear Dr. Trinh:

JPL is pleased to provide its comments in response to the subject draft audit report on the attached enclosure. The OIG requested in its report cover letter that, "Management comments should indicate concurrence or nonconcurrence with each applicable finding and recommendation identified in the report." JPL has therefore identified by highlighting and numbering each finding embedded in the Results section of the draft report. JPL then isolated each specific finding and reiterated it (again highlighted) followed by the corresponding Management comment. For ease of reference, JPL uses the following numbering convention:

Findings are prefixed with F and the numerical identifier. The corresponding *Management comments/responses* are prefixed with RF or RR and the corresponding number, with blue text as follows:

(F.1) = Finding One
(RF.1) = Management Comment/Response to Finding One
(RR.1) = Management Comment/Response to Recommendation One

Dr. Eugene H. Trinh

- 2 -

October 18, 2010

Please note that JPL concurs with 1 of the findings; partially concurs with 3 of the findings; and does not concur with the remaining 40 findings (91%), presented in the draft report.

JPL would like to note the following NPRs cited in the OIG Report were not in the Prime Contract during the time of the audit:

- NPR 8621.1B, "NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Recordkeeping w/change 5 (03/15/2010),
- NPR 8715.1, "NASA Occupational Health and Safety Programs," and
- NPR 8715.3C, "NASA General Safety Program Requirements (w/change 4 dated 7/20/09);

However, JPL uses the above NPRs as guidelines where applicable. JPL's internal processes are designed to meet the intent of the aforementioned NPRs as will be demonstrated our following comments.

If you have any questions, please direct them to Mr. Albert Battistelli, Manager, JPL Audit Liaison Office, at (818) 354-2425.

Cordially,



Jean C. Milbrandt, Manager
Finance and Contract Management Division

Enclosure

cc : R. Kacmar
D. B. Mahon
J. B. McKelvie

Omitted due to size (a copy can be provided on request).



October 25, 2010

TO: Jim Morrison
Assistant Inspector General for Audits

FROM: Eugene Trinh 
Director, NASA Management Office, Jet Propulsion Laboratory

VIA: Tom Luedtke
Assistant Administrator, Agency Operations

Bryan O'Connor
Chief, Safety and Mission Assurance

Charles Elachi
Director, Jet Propulsion Laboratory

SUBJECT: NASA Response to the Office of Inspector General's (OIG) Draft Audit Report,
"Review of the Jet Propulsion Laboratory's Occupational Safety Program"
(Assignment No. A-09-010-00)

REFERENCE: OIG's Draft Audit Report, "Review of the Jet Propulsion Laboratory's
Occupational Safety Program," (Assignment No. A-09-0 10-00), dated
September 24, 2010

The NASA Management Office (NMO) is pleased to provide the Agency consolidated comments, in response to the subject draft audit report.

This response is provided in two separate parts:

- 1) The response from Caltech, the JPL operating contractor (hereinafter referred to as JPL), to the findings and recommendations addressed to them (see separate enclosure); and
- 2) Agency response to findings and recommendations addressed to NASA.

The OIG requested in its report cover letter that, "Management comments should indicate concurrence or nonconcurrence with each applicable finding and recommendation identified in the report."

In the JPL enclosure, JPL has identified by highlighting and numbering each finding embedded in the Results section of the draft report. JPL then isolated each specific finding and reiterated it (again highlighted) followed by the corresponding Management comment. For ease of reference, JPL used the following numbering convention:

Findings are prefixed with F and the numerical identifier. The corresponding *Management comments/responses* are prefixed with RF or RR and the corresponding number, with text as follows:

(F.1) = Finding One

(RF.1) = Management Comment/Response to Finding One

(RR.1) = Management Comment/Response to Recommendation one

JPL would also like to note the following NPRs cited in the OIG Report were not in the Prime Contract during the time of the audit:

- NPR 8621.1 B, "NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Recordkeeping w/change 5 (03/15/2010),
- NPR 8715.1, "NASA Occupational Health and Safety Programs," and
- NPR 8715.3C, "NASA General Safety Program Requirements (w/change 4 dated 7/20/09);

However, JPL uses the above NPRs as guidelines where applicable. JPL's internal processes are designed to meet the intent of the aforementioned NPRs.

For the NASA response there was one main finding addressed to NASA:

THE NASA MANAGEMENT OFFICE AND OSMA DID NOT ENSURE THAT OCCUPATIONAL SAFETY AND HEALTH PROGRAM REQUIREMENTS WERE EFFECTIVELY IMPLEMENTED AT JPL

The NASA Management Office and OSMA Can Improve Oversight of JPL Institutional Safety

NASA partially concurs with this finding and will address it in the responses to the OIG recommendations 8, 9, and 10.

Oversight by the NASA Management Office Was Insufficient

The NASA Management Office (NMO) is not currently relied upon to provide technical assessment or auditing of JPL processes. NMO provides logistical support to NASA audit teams and administratively verifies OSMA's endorsement of audit findings, resolution, and reporting of satisfactory completion of corrective actions. On the other hand, NMO has been closely monitoring issues in construction safety and has appropriately escalated any perceived issue regarding lapses on the part of the JPL Safety organization to the JPL Award Fee Performance Evaluation Board (PEB). Such a specific instance relevant to this OIG report, took place in April 2008 regarding incidents related to the construction of the Flight Project Center: The NMO Procurement Officer notified the PEB of concerns regarding the implementation of safety measures on the construction site. The issue was discussed and resolved by OSMA. NASA agrees that any potential increase in the NMO oversight function will be determined by the results of the NASA activities related to our responses to Recommendations 8, 9, and 10.

OSMA Did Not Ensure that JPL Effectively Implemented Contractually Mandated Safety Requirements

Ineffective Use of IFO Audit Process

Ineffective Use of Annual Operating Agreements

NASA disagrees with these findings.

The following recommendations were addressed to The Assistant Administrator for Agency Operations:

8. Coordinate with the Chief of Safety and Mission Assurance to establish clear oversight roles and responsibilities concerning JPL, including responsibility for the review of audit findings;

NASA RESPONSE: NASA Concur with this recommendation. Specific discussions will be held between NMO and OSMA to clearly delineate the respective organizations' responsibilities for the oversight of safety implementation and audit compliance at JPL. Response due date - January 31, 2011.

9. Establish written safety oversight procedures defining the roles and responsibilities of the NASA Management Office;

NASA RESPONSE: NASA Concur with this recommendation. NMO will coordinate with OSMA in establishing clear role and responsibilities with respect to JPL safety oversight. Response due date - January 31, 2011.

10. Assess the level of resources required for the NASA Management Office to meet its responsibilities and provide those resources.

NASA RESPONSE: NASA Conditionally Concur with this recommendation, depending on the results of the corrective actions related to recommendations 8 and 9 and the availability of additional resources granted by the Agency. Response due date March 31, 2011.

The following recommendations were addressed to The Chief of Safety and Mission Assurance:

11. Assess the IFO audit process and include steps to ensure JPL's compliance with NPR 8715.1 requirements;

NASA RESPONSE: NASA disagrees with this recommendation.

The cited basis for this recommendation is interpretation of NASA Procedural Requirements (NPR) 8715.1, NASA Occupational Safety and Health Programs and Part 1960 of Title 29 of the Code of Federal Regulations, Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters. NPR 8715.1 is NASA's implementation of 29 CFR 1960 that is intended to apply to government employees. Neither 29 CFR 1960 nor NPR 8715.1 applies to contractor employees, including employees of JPL/Caltech. Additionally, the text that supports this recommendation refers to the March 2007 IFO Audit results along with an indication that the audit requirements cited in NPR 8715.1, Chapter 8 have been violated. As was already indicated, the requirements contained within NPR 8715.1 do not apply to contractors. The requirements for performance of IFO audits at the JPL are contained within NPR 8705.6, Safety and Mission Assurance Audits, Reviews, and Assessments, in particular

paragraph 2.2.2.5 that states: “The Chief Safety and Mission Assurance Officer shall conduct Headquarters IFO SMA Audits on a biennial basis at all NASA Centers, Component Facilities, and the *JPL NASA Management Office* and include all focus areas applicable to each organization.” (Italics added). Unfortunately, NPG 8715.1 the predecessor to NPR 8715.1 was applied to the JPL contract that creates the confusion we now see.

In the case of JPL, OSMA is providing staff assistance to NMO in the review and assessment of JPL’s SMA Program. Although NMO has the oversight of the JPL Contract, NMO has continuously requested OSMA to assist by performing a review/assessment of the JPL/Caltech SMA Program so to help provide NMO with an independent evaluation of how well JPL is implementing the Federal and Agency-wide SMA requirements per the JPL Contract. This is where the IFO audit process has been used to support the JPL-NMO in the independent evaluation of the Safety and Health Programs for JPL, as part of the Annual JPL Performance Award Fee. With this support, OSMA performs an assessment/evaluation of JPL Safety and Health Program and not an audit. Although the assessment/evaluation results are provided in the finding categories of non-compliances, observations, and commendations, the Final IFO Report is provided as an evaluation to the NMO for their usage and action.

In order to avoid future misinterpretations regarding these requirements, NASA will review NPR 8715.1, NPR 8705.6, and the JPL Contract to determine if additional clarifying modifications are appropriate.

12. Review JPL’s compliance with NPR 8715.1 programmatic requirements;

NASA RESPONSE: NASA disagrees with this recommendation.

The cited basis for this recommendation as in recommendation 11, is NPR 8715.1 and 29 CFR 1960. As previously stated neither of these documents apply to contractor employees and should not be cited in the JPL contract.

The report in discussing the scope of the IFO audits indicates that “an audit performed only once every 3 years should cover more than just nine auditable requirements” inferring that the entire 2007 IFO only covered nine requirements. In fact that 2007 IFO covered a broad range of topic areas including Pressure Vessels, Lifting devices and Equipment, Fire Protection, and Explosive’s Safety to name a few. NASA does not review every requirement statement on every review, instead we cycle through the requirements over several audits. Within a weeklong IFO, the actual audit/review is conducted during a 2 day timeframe (Tuesday-Wednesday), where the IFO Team in-briefing is provided on the first day (Monday) and out-briefing of the

Edited to differentiate between policy and the actual number of years between audits on page 28.

audit results on the last day (Friday) with the 4th day (Thursday) drafting the audit results and out-briefing. Typically for 9 audit areas, there are 12 IFO Team Members that conduct the weeklong audit. Also, for all IFO topics (or functional safety areas), the elements such as qualifications of inspectors, conduct of inspections, employee reports of alleged unsafe or unhealthful conditions, notice of unsafe or unhealthful conditions, abatement of unsafe or unhealthful conditions, etc., are being reviewed. If there are findings for any of these areas, audit findings are written for the IFO topics found and provided as part of the Final IFO Report. If there is compliance for these elements within the IFO topic, there are no written statements within the Final IFO Report that will state that the Center is complying with the elements.

For the corrective action plan (CAP) to the IFO audit, it should be noted that the Center owns and is responsible for completion of the CAP. An annual status of the Center's CAP is then provided to OSMA for status information. For JPL, the IFO audit was conducted as a staff assistance review to support JPL-NMO.

As previously stated NASA will review NPR 8715.1, NPR 8705.6, and the JPL Contract to determine if additional clarifying modifications are appropriate.

13. Coordinate with the NASA Management Office to establish a contractual requirement for JPL to annually submit an AOA and ensure that future AOAs are reviewed in accordance with the applicable work instruction.

NASA RESPONSE: NASA disagrees with this recommendation.

The "Review of the Jet Propulsion Laboratory's Occupational Safety Program" report indicates that JPL's AOA did not address all of the elements *required* by OSMA. (Italics added). In fact, and practice, the call letter that the Office of Safety and Mission Assurance issues is guidance for preparing and submitting the AOA. This is evidenced by the use of the word "should" rather than the word "shall" within the call letter's text. The AOA is used by the Office of Safety and Mission Assurance as an "insight" mechanism to obtain information and an indication that the Center Management and the Center Safety and Mission Assurance organizations have actively engaged in a planning effort and have reached agreement on the safety and mission assurance activities to be performed on the Center. The AOA was not and is not intended to be an "oversight" mechanism to effect control or decision making on the process. This is visibly evidenced by the endorsements that the Office of Safety and Mission Assurance applies to the Center AOAs. These endorsements provide feedback but don't require update or reissue of the AOA which is something that would typically be done with a required deliverable. As an insight mechanism, delivery on a rigid contractual basis may have a detrimental effect in open

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"required" to
"requested"
on page 28.

communication between JPL and NASA. One of the fundamental expectations of the AOA is that it facilitates the planning dialog and negotiation between the Center Director and the Center Safety and Mission Assurance Director concerning resources. In this primary role it is a Center document rather than a Center (JPL) to Headquarters (NASA) document. For these reasons we choose not to establish the AOA as a contractual deliverable.

We appreciate the opportunity to comment on this draft audit report. Mr. Raymond Kacmar (818 393 2920), the NMO Safety, Health and Mission Assurance Manager and Mr. Dennis Mahon, the NMO Audit Liaison Representative (818 393 6779) will be ready to answer any further question.

Sincerely,

Eugene Trinh
Director, NASA Management Office
Jet Propulsion Laboratory

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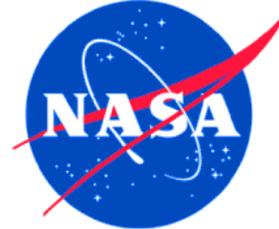
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