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NASA's Management of Hazardous Materials

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NASA Office of Inspector General
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RESULTS IN BRIEF

NASA's Management of Hazardous Materials

December 3, 2020 IG-21-006 (A-19-014-00)

WHY WE PERFORMED THIS AUDIT

A hazardous material is any substance that poses a significant risk to health, safety, or property. NASA uses hazardous materials on a daily basis, including acids, bases, and oxidizers in research laboratories; propellants and fuels in engine testing; ethanol-based solvents in engineering laboratories; ammonia, acetone, and glycols in flight equipment operations; and chemicals in simulated planetary environmental testing. These materials can be toxic, reactive, flammable, or explosive and, if poorly managed, can result in personal injury, property damage, or require costly clean-up.

The overall objective of this audit was to evaluate NASA's processes and procedures regarding the acquisition, handling, storage, and disposal of hazardous materials. Additionally, we evaluated the Agency's efforts to protect personnel, the public, and the environment from these materials. As part of this review, we visited Goddard Space Flight Center (Goddard), Johnson Space Center (Johnson), Langley Research Center (Langley), and Stennis Space Center (Stennis) to observe and assess their hazardous materials processes and operations. At each of the four Centers, we identified 100 hazardous materials to test controls over their acquisition, storage, use, and disposal. We also interviewed officials from the Office of Safety and Mission Assurance, and Logistics and Environmental Divisions at NASA Headquarters.

WHAT WE FOUND

We found that hazardous materials are not managed uniformly across the Agency, the Centers we visited did not consistently implement adequate controls, and employees and contractors at times circumvented existing controls to acquire hazardous materials. These findings suggest a likelihood of weak controls over hazardous materials Agency-wide. Specifically, we found a lack of accountability by a designated organizational manager in the acquisition of hazardous materials and a lack of review by a designated official prior to the acquisition of hazard materials by purchase card users. In addition, we found inadequate controls over the acquisition of highly hazardous chemicals. For example, although Goddard policy requires a prohibited and restricted list of highly hazardous materials, the Center does not maintain such a list, does not have a documented hazardous materials acquisition review process, and does not restrict these dangerous items. According to Center personnel, the Center culture supports the use of any material needed to conduct research and meet operational needs. As a result, NASA has accepted increased risks associated with the acquisition of hazardous materials that could result in personal injury or property and environmental damage.

Further, the Agency does not have adequate internal controls for managing its inventory of hazardous materials. Federal regulations require organizations that maintain hazardous materials to identify chemicals harmful to personnel and the environment and to develop strategies to mitigate associated risks. We randomly selected and traced 100 items from each of the four Centers' inventory and found that they did not accurately record all hazardous materials when delivered, stored, and consumed. For example, at Langley 25 of 100 (25 percent) sample items could not be located. We determined that the missing items had been either consumed, moved to another location, or had not been updated in the Center's database. Moreover, each Center uses a standalone database to track their hazardous materials,

resulting in a lack of sufficient insight by Headquarters management into the extent of the Agency's hazardous materials inventory and overall risk.

During our visits to the four Centers, we also observed inconsistent storage practices as well as conditions at Langley and Stennis that did not follow the Centers for Disease Control and Prevention (CDC) guidelines or comply with Center-specific procedures. For example, while laboratory storage facilities at Goddard and Johnson were organized, clean, and met CDC guidelines for storing chemicals, at Langley we found a storage room with chemicals on rusty and corroded metal shelving within a building that houses research laboratories. The severely corroded shelving resulted from leakage in an overhead water line. At Johnson, we found the Center's outdoor 90-day hazardous waste holding facility was not adequately protected from adverse weather and employees did not consistently monitor when waste was scheduled for disposal from the facility.

WHAT WE RECOMMENDED

In order for NASA to increase transparency, accountability, and oversight of its hazardous materials, we recommended that the Associate Administrator for Mission Support in coordination with the Chief of Safety and Mission Assurance and Office of Chief and Health Medical Officer undertake an Agency-wide initiative to:

1. Ensure that an appropriate organizational manager who is authorized to accept risks on the Center Director's behalf is included in the hazardous materials acquisition process as the concurring authority.
2. Establish a unified purchase card policy and designate an appropriate official at each Center to ensure hazardous material acquisitions made via purchase cards are appropriately approved, received, and tracked.
3. Ensure contractors and tenants at NASA Centers report their hazardous material inventory to Center management at least annually.
4. Evaluate Centers' application of Agency policy to maintain a list of restricted and prohibited materials and their associated waiver processes and make improvements as warranted.
5. Assess various options for development and implementation of an Agency-wide hazardous materials information system that tracks hazardous materials throughout the life cycle, and ensure processes are in place to consistently maintain a complete and accurate inventory.
6. Develop and implement an Agency-wide policy that establishes a standard for storage spaces and facilities used to house hazardous materials.
7. Require Center Directors to inspect and replace, as required, laboratory hazardous material storage structures and improve shelters that do not follow CDC guidelines or comply with Agency requirements.
8. Inspect and evaluate Centers' 90-day storage facilities and processes and make improvements as warranted.

We provided a draft of this report to NASA management, who concurred or partially concurred with our recommendations. We consider management's comments responsive; therefore, the recommendations are resolved and will be closed upon completion and verification of the proposed corrective actions.

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TABLE OF CONTENTS

Acronyms

CDC	Centers for Disease Control and Prevention
C.F.R.	Code of Federal Regulations
EMD	Environmental Management Division
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
GPO	Government Printing Office
LMD	Logistics Management Division
MAP	Mission Support Future Architecture Program
NFS	NASA Federal Acquisition Regulation Supplement
NPD	NASA Policy Directive
NPR	NASA Procedural Requirements
NSSC	NASA Shared Services Center
OCHMO	Office of the Chief Health and Medical Officer
OIG	Office of Inspector General
OSHA	Occupational Safety and Health Administration
OSMA	Office of Safety and Mission Assurance
SAA	satellite accumulation area

INTRODUCTION

A hazardous material is any substance that poses a significant risk to health, safety, or property. NASA uses hazardous materials on a daily basis, including acids, bases, and oxidizers in research laboratories; propellants and fuels in engine testing; ethanol-based solvents in engineering laboratories; ammonia, acetone, and glycols in flight equipment operations; and chemicals in simulated planetary environmental testing. These materials can be toxic, reactive, flammable, or explosive and, if poorly managed, can require costly clean-up to avoid personal injury or property damage.

In March 2013, we issued a report critical of NASA's storage and handling of explosives—a particular class of hazardous materials.[1] Specifically, we identified a significant number of improper storage, handling, and other procedural violations involving explosives or "energetic materials," some of which could have resulted in injury, death, or significant damage to facilities. In response, NASA reviewed the management, storage, and handling procedures for energetic materials at all Centers, identified and corrected deficiencies, and conducted an inventory of such materials at each Center.

Since that time, the Agency has experienced several instances of mishandling hazardous materials. For example:

- In November 2019, a hazardous waste bottle exploded in a laboratory acid hood due to improper collection of solvent rinse waste with nitric acid waste, which caused a chemical reaction in the closed bottle (see photo). The explosion, which sent shards of glass flying out of the hood, occurred while the laboratory was vacant, approximately 30 minutes after the user mistakenly combined the waste products in the same bottle.

Results of Hazardous Waste Bottle Explosion

Source: NASA

- In April 2019, a technician discovered three mislabeled bottles of acetone in a contractor's clean room that could have seriously damaged flight hardware; the bottles were incorrectly labeled and color-coded as isopropanol, which is typically used as an antiseptic and solvent to clean and disinfect surfaces. According to the incident report, this was the second occurrence of mislabeling of acetone and isopropanol bottles at the Center in a 2-week period.
- In April 2018, improperly labeled hazardous waste picked up from a laboratory was found to be highly acidic and exposed handlers to serious health and safety risks. The container was not accurately labelled as containing acidic materials.

Our overall objective was to evaluate NASA's processes and procedures regarding the acquisition, handling, storage, and disposal of hazardous materials. Additionally, we evaluated the Agency's efforts to protect personnel, the public, and the environment from hazardous materials. As part of this review,

[1] NASA Office of Inspector General (OIG), *Review of NASA's Explosives Safety Program* (IG-13-013, March 27, 2013).

we visited Goddard Space Flight Center (Goddard), Johnson Space Center (Johnson), Langley Research Center (Langley), and Stennis Space Center (Stennis) to observe and assess their hazardous materials processes and operations. We identified 100 hazardous materials at each Center to test the controls over acquisition, storage, and use, and observed hazardous waste storage and disposal operations. We also met with officials from the Office of Safety and Mission Assurance, and Logistics and Environmental Divisions at NASA Headquarters. See Appendix A for details of the audit's scope and methodology.

Background

A hazardous material is any product or substance (biological, chemical, radiological, or physical) that has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors such as exposure to extreme heat or mishandling by users. Highly hazardous materials are substances possessing toxic, reactive, flammable, or explosive properties that have the potential for a catastrophic occurrence at or above certain quantity thresholds. The management, storage, and disposal of all hazardous materials is regulated, primarily via laws and regulations administered by the U.S. Environmental Protection Agency (EPA), the U.S. Occupational Safety and Health Administration (OSHA), and the U.S. Department of Transportation.[2]

Federal regulations require that agencies including NASA maintain inventories of hazardous materials to protect the workplace and the environment. The Emergency Planning and Community Right-to-Know Act (EPCRA) requires facilities to submit annual hazardous material inventory reports to state and local officials and local fire departments.[3] To be subject to this requirement, NASA facilities must have certain chemical substances on site during the previous calendar year, and the substances must be used or stored at the site above specified threshold amounts. For each reportable chemical, NASA must report the name of the substance, the associated physical and/or health hazards, the maximum and average daily amounts present, the type of storage container, and the specific storage location at the site. In addition to the EPCRA requirements, OSHA requires organizations maintain a list of hazardous chemicals known to be present in the workplace, along with a written hazard communication program that includes provisions for container labeling, collection and availability of Safety Data Sheets, and employee training.[4] Chemical hazards must be identified and communicated to all employees who may come in contact with such material.[5]

NASA Administrative Organization, Leadership, and Responsibilities for Hazardous Materials Management

At NASA, responsibility for the management of hazardous materials falls under several offices, including those focused on the environment, logistics and transportation, occupational health and safety, and protective services. At NASA Headquarters, the Environmental Management Division (EMD) is responsible for policy formulation, oversight, and executive leadership to ensure statutory and regulatory environmental compliance. The Logistics Management Division (LMD) develops Agency-wide

[2] Additionally, the U.S. Nuclear Regulatory Commission licenses and regulates the civilian use of radioactive materials.

[3] 42 U.S.C. § 11001.

[4] OSHA requires chemical manufacturers, distributors, and importers to provide Safety Data Sheets to users. Safety Data Sheets list the properties of each chemical; the relevant physical, health, and environmental health hazards; protective measures; and safety precautions for handling, storing, and transporting the chemical. Safety Data Sheets are electronically available to personnel at each Center. During our site visits we also observed Safety Data Sheets maintained in binders.

[5] 29 Code of Federal Regulations (C.F.R.) § 1910.1200, *Hazard Communication*.

policies and conducts oversight of Agency-wide logistics, supply chain, and personal property held by NASA and its contractors. The Office of Safety and Mission Assurance (OSMA) is responsible for the safety of all NASA activities and oversees Agency-wide safety, reliability, maintainability, and quality assurance policies and procedures. The Office of the Chief Health and Medical Officer (OCHMO) is responsible for policy and oversight of all health and medical activities at NASA including activities involving handling of hazardous materials. Office of Protective Services staff, comprised of both contractors and civil service personnel, includes firefighters and security officers who are often the first responders to incidents involving hazardous material across NASA. Headquarters personnel from each of these divisions evaluate compliance with relevant statutes and regulations on a rotational basis, so that each NASA Center is audited every 3 years. Instances of non-compliances identified in these audits are presented to the Center Director for corrective action.

In addition to federal requirements, Agency-level policies govern the procurement, use, storage, and disposal of hazardous materials at NASA. Each Center is responsible for compliance with federal, state, and local regulations, and implements policies and procedures specific to its location. In addition to Center procedures, NASA contractors that manage laboratories and storage facilities are required to develop procedures that meet or exceed NASA policies.

Acquisition

NASA Centers may acquire hazardous materials through task orders on service support contracts. Agency civil servants can purchase hazardous materials through Center procurement offices using purchase orders or blanket purchase orders and, for certain smaller orders in some instances, through government-issued purchase cards administered by NASA's Shared Services Center (NSSC).[6]

Under NASA's acquisition policy, managers are responsible for ensuring that the acquisition process contributes to a safe, healthy, and reliable environment. As such, NASA policy requires each prospective buyer to affirm whether their purchase will result in the acquisition, production, or use of any hazardous material or potentially hazardous material.[7] The buyer must also affirm that any purchase of hazardous material has been reviewed to identify risks, controls, alternatives, and safety requirements.[8]

Additional purchase restrictions are in place for highly hazardous materials because of their potential for a catastrophic occurrence at or above certain quantity thresholds. NASA Centers are required to maintain a list of restricted and prohibited materials for purchase and use onsite that generally encompasses those substances that have been designated as highly hazardous. If individuals require materials on these lists for mission operations, they must follow the Agency waiver process that documents not only the approval of the purchase, but also the justification for why the item is needed.[9] Agency policy also states that hazardous materials shall not be acquired until hazards have been

[6] Located at Stennis, the NSSC performs a range of business activities for all NASA Centers, including financial management, human resources, information technology, procurement, and business support services. A task order is an order for services placed against an established contract or with government sources. A purchase order is an offer by the government to buy supplies or services, including construction and research and development, upon specified terms and conditions, using simplified acquisition procedures. A blanket purchase agreement is a simplified method of filling anticipated repetitive needs for supplies or services by establishing charge accounts with qualified sources of supply.

[7] NASA Procedural Requirements (NPR) 1800.1D, *NASA Occupational Health Program Procedures* (September 11, 2019).

[8] NASA Federal Acquisition Regulation Supplement (NFS), Section 1804, Part 7301.

[9] NPR 8715.3D, *NASA General Safety Program Requirements* (August 1, 2017). A waiver is a variance that authorizes departure from a specific safety requirement where a certain level of risk has been documented and accepted.

analyzed and adequate controls identified. Moreover, NASA's occupational health policy states that, prior to acquisition and use of any hazardous material, Centers must evaluate exposure issues and analyze hazards to ensure adequate controls are implemented. Centers must also ensure that:

- hazardous material acquisition programs and all mechanisms for acquiring hazardous materials are periodically assessed;
- all hazardous materials acquisitions are identified and reviewed at least annually by a competent person;
- health and safety requirements are identified and properly implemented prior to acquisition;
- violations of acquisition requirements are monitored and reported to Center managers, and;
- that these requirements are included as appropriate in contract and subcontract procurements.[10]

Furthermore, NASA policy requires that Centers hold purchasers, including the user of the hazardous material and their supervisor, accountable for the proper and safe use of hazardous materials to include disapproval of items that cannot be used safely; use of a less hazardous material if one can be reasonably substituted; acquisition of the smallest reasonable amount, size, activity, and/or hazard potential of a specific hazardous material; and completion of hazard training and other relevant control preparations adequate to ensure safe use.[11]

Storage and Handling

Requirements for chemical storage and usage/handling are defined in federal regulations and guidelines; NASA and Center policies, procedures, and work instructions; and chemical hygiene plans. NASA Headquarters EMD, LMD, OCHMO, and OSMA maintain policies and procedures for managing hazardous material storage, handling, and waste. In addition, Centers develop local procedures and work instructions for managing chemical storage facilities. Center-based Industrial Hygiene and Occupational Safety program officials provide oversight of the Agency's chemical laboratories and chemical storage facilities and chemical hygiene plans outline specific workplace practices and procedures to ensure employees are protected from health hazards.[12] NASA contractors must also follow these plans or develop their own that meet Center policy requirements.

Hazardous Waste Management and Disposal

Hazardous waste—including generation, transportation, treatment, storage, and disposal—is regulated under the Resource Conservation and Recovery Act.[13] "Hazardous waste" is defined as a solid or liquid waste, or combination of solid and liquid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (1) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness, or (2) pose a substantial present or potential hazard to human health or the environment when improperly treated,

[10] NPR 1800.1D.

[11] NPR 1800.1D.

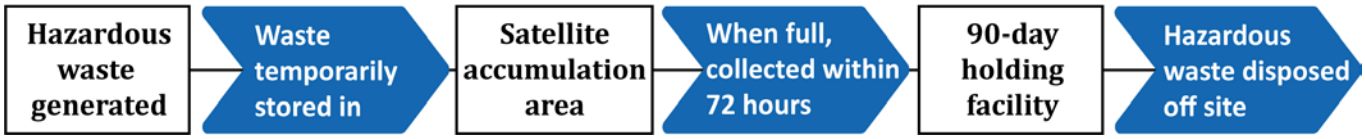
[12] 29 C.F.R. § 1910.1450.

[13] 42 U.S.C. § 6901.

stored, transported, disposed of, or otherwise managed.[14] Federal facilities that fail to comply with federal, state, interstate, and local solid and hazardous waste requirements are subject to civil penalties with federal employees personally liable for criminal violations in some cases.[15]

NASA Centers are large quantity hazardous waste generators—defined as facilities that produce more than 1,000 kilograms of hazardous waste or more than one kilogram of acutely hazardous waste monthly.[16] Centers manage hazardous waste disposal through collection, storage, and ultimate transport of hazardous materials offsite. Each Center has a designated 90-day hazardous waste storage facility for storing site-generated wastes before they are shipped for disposal offsite. Center hazardous waste program personnel transport these materials from collection points referred to as satellite accumulation areas (see Figure 1). All Centers use a contractor for the ultimate removal and disposal of hazardous waste. However, the Agency is responsible for the proper management of waste, even after it leaves a NASA Center. See Appendix B for a more detailed description of waste disposal processes at the four NASA Centers we reviewed.

Figure 1: Waste Disposal Process at NASA



Source: NASA Office of Inspector General (OIG) presentation of Agency information.

[14] 42 U.S.C. § 6903.

[15] Resource Conservation and Recovery Act Section 6001.

[16] Acute waste contains such dangerous chemicals that it could pose a threat to human health and the environment even when properly managed.

NASA Needs to Improve its Acquisition, Storage, and Disposal of Hazardous Materials

Weak management of hazardous materials across the Agency increases risks to employee health, safety, and the environment. We found that hazardous materials are not managed uniformly across NASA, and the Centers we visited did not consistently exercise adequate care when procuring, storing, and disposing of hazardous materials. For example, we identified instances of Centers circumventing internal controls to acquire hazardous materials and found that Centers need to improve hazardous materials tracking given that we could not locate a significant number of items reportedly on site at the Centers we visited. Moreover, each Center uses a standalone database to track hazardous materials leaving Headquarters management without sufficient insight into the extent of the Agency's hazardous materials inventory and overall risk exposure. During our site visits to four Centers, we also found several storage facilities in poor condition that raised serious safety concerns.

Inadequate Controls over Acquisition of Hazardous Materials

We found that NASA policies governing the acquisition of hazardous materials varied from Center to Center, and that employees and contractors were sometimes circumventing controls to acquire hazardous materials inappropriately. Specifically, we found a lack of concurrence and accountability by a designated organizational manager in the acquisition of hazardous materials under Center core services support contracts; a lack of assurance of review by a designated competent person prior to the acquisition of hazard materials by purchase card; and a lack of adequate control over the acquisition of highly hazardous chemicals.[17] As a result, NASA has accepted increased risks associated with the acquisition of hazardous materials that could result in severe adverse impacts on employee and contractor health, safety, and the environment.

Lack of Concurrence and Accountability in the Acquisition and Use of Hazardous Materials

NASA has not followed its risk acceptance policy when acquiring hazardous materials. Specifically, Centers have often acquired hazardous materials without concurrence by an appropriate organizational manager. NASA's risk management framework defines institutional risk as risk to infrastructure, information technology, resources, personnel, assets, processes, operations, occupational safety and health, environmental management, security, or programmatic constraints that affect capabilities and

[17] NASA incorporates OSHA's definition of a "competent person" (29 C.F.R. § 1926.32(f)) as someone capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

resources necessary for mission success, including compliance with internal and external requirements (for example, EPA or OSHA regulations).[18] In our judgement, the Agency's management of hazardous materials is an institutional risk due to the health and safety risk to personnel, potential environmental contamination, regulatory requirements, and the Agency's responsibility for hazardous materials from acquisition through disposal.

In 2014, NASA's Aerospace Safety Advisory Panel recommended the Agency demonstrate clear accountability through consistent, formal processes for managing risk.[19] In response, NASA revised its risk management framework in 2017 to require concurrence and accountability in risk acceptance.[20] Specifically, Center Directors are required to develop and implement a process for institutional risk acceptance and, within that process, document the Center's institutional risk management plan. Depending on the nature of the risk, the formal risk acceptance process must include designation of the individual risk acceptor as well as the concurring authority, with the understanding that the Center Director ultimately remains accountable for institutional risks at the Center.[21] The formal process assigns accountability for risk acceptance to a single responsible, authoritative individual (e.g., organizational unit manager), rather than to a committee or group of individuals.[22]

To determine whether the appropriate NASA manager accepted the risks of procuring and using hazardous materials, we judgmentally selected 14 core service support contracts for review. All of the contracts we reviewed included the procurement clauses that require the contractor to take all reasonable safety and health measures and to properly identify any hazardous material to be delivered under the contract.[23] In addition, the contract documentation we reviewed included NASA Form 1707, "Special Approvals and Affirmations of Requisitions," in which the buyer of hazardous materials must affirm their coordination of the purchase with the appropriate Center authorities. The procurement office is not supposed to accept the acquisition request without this documentation.[24] We found that all 14 contracts were supported by affirmation of coordination as required; however, 7 of the 14 contracts identified environmental risks to the Agency, but only 2 of those 7 had management concurrence. Similarly, of the 14 contracts, 8 identified safety and health risk to the Agency but only 3 of those 8 had management concurrence.

We determined that among the four Centers we visited, only Stennis required concurrence from a designated organizational manager for hazardous material acquisitions. At the other Centers we visited, coordination was only required between the purchaser and a designated Center management authority. In our view, affirmation of "coordination" by the buyer is not sufficient to show concurrence and risk acceptance by the appropriate Center organizational manager. This inadequate control over the

[18] NPR 8000.4B, *Agency Risk Management Procedural Requirements* (December 6, 2017).

[19] NASA Aerospace Safety Advisory Panel, *2014 Second Quarterly Meeting Report*, Recommendation 2014-AR-05 (May 5, 2014).

[20] NPR 8000.4B. A decision to "accept" a risk is a decision to proceed without further mitigation of that risk (i.e., despite exposure to that risk).

[21] NPR 8000.4B.

[22] NPR 8000.4B, paragraph 1.1.1.

[23] All of the contracts reviewed incorporated both the NASA Federal Acquisition Regulation Supplement (NFS) 1852.223-70 "Safety and Health" clause, which requires the contractor to take all reasonable safety and health measures in performing the contract, and the Federal Acquisition Regulation 52.223-3, "Hazardous Materials Identification and Material Safety Data Sheets" clause, which requires the contractor to list and properly identify any hazardous material to be delivered under the contract and to also include a Safety Data Sheet for each hazardous material listed.

[24] NFS, paragraph 1804.7301.

acquisition of hazardous materials is likely due to Center cultures that historically have allowed the purchase of any chemicals deemed necessary to support researchers and ensure mission success. Moreover, although NASA Headquarters provides oversight and conducts procurement audits every 3 years, we found that for three of the Centers we visited, the most recent procurement review did not address whether the appropriate management authority had concurred with hazardous material contract acquisition decisions.

Acquisition of Hazardous Materials via a Purchase Card Carries Additional Risks

NASA does not have a consistent, Agency-wide policy on the acquisition of hazardous materials using purchase cards. As such, each Center we visited had its own policy and procured hazardous materials using purchase cards.[25] In our review of hazardous materials purchase card transactions over the past 5 years for each of the four Centers, we found that controls were inconsistent and in most cases inadequate. Goddard forbids the purchase of hazardous materials by purchase card, while Johnson, Stennis, and Langley do not. Even with a no-purchase card policy in place at Goddard, we found 20 hazardous material purchases made by purchase card in 2019. Of those 20 purchases, 3 are considered to be probable human carcinogens, 8 did not appear in the Center's hazardous materials database, and 8 had the product description deleted from the purchase card bank statement by the cardholder.[26]

NASA's Office of Procurement establishes the policy for the use of purchases cards, and NASA's Shared Services Center (NSSC) is responsible for the administration of the Agency's purchase card program. NSSC personnel conduct monthly audits of 5 percent of all purchases, and if a purchase requires special approval and is not included, NSSC contacts the cardholder. However, NSSC told us they do not specifically flag hazardous materials purchases or provide Centers with this information. In fact, NSSC officials further stated they did not know who the hazardous materials subject matter expert is at each Center. NASA policy requires Centers to identify and review hazardous material purchases at least annually to ensure each purchase was approved and that occupational, health, and safety requirements were implemented prior to purchase.[27] By not identifying or reviewing hazardous materials acquisitions by purchase card, Center personnel and facilities are potentially exposed to unknown health and safety risks.

NSSC personnel provided us with a list of planned changes to their policy guidance and procedures scheduled to take effect in April 2020, including a list of disciplinary actions applicable to policy violators, required product description and category input fields in the purchase card order log, electronic controls for items that require special authorizations, such as hazardous material purchases, and maintaining a list of approvers for hazardous material purchases. We were informed by NSSC in September 2020 that all of the above planned changes have been implemented. However, NSSC personnel also told us that

[25] *Government-wide commercial purchase card* means a purchase card, similar in nature to a commercial credit card, issued to authorized agency personnel to use to acquire and to pay for supplies and services. According to NASA procurement policy, Agency purchase cards shall be used for micro-purchase threshold transactions, and for other eligible purchases, to the maximum extent practicable (NFS 1813.301). *Micro-purchases* are those acquisition of supplies or services using simplified acquisition procedures, the aggregate amount of which does not exceed the typical micro-purchase threshold of $3,500.

[26] One of the eight deleted from the purchase card bank statement were part of the group that did not appear in the Center's hazardous materials database.

[27] NPR 1800.1D paragraph 4.7.2.3.

even with their planned improvements in controls over the procurement of hazardous material purchases by purchase card, it will continue to be possible for a buyer to inadvertently or intentionally classify the purchase as something other than a hazardous material due to the functionality of the purchase card application. Furthermore, we determined through our discussion with Center-based logistics personnel that employees could order hazardous materials by purchase card and accept delivery directly to their individual work or other locations, thereby bypassing all Center acquisition controls (see Appendix B for controls detailed by Center). When hazardous materials are acquired via purchase card, the Agency does not have reasonable assurance that occupational health, safety, and environmental requirements are being met and that the appropriate manager evaluated and approved the purchase.

Inconsistent Controls over the Acquisition of Highly Hazardous Chemicals

NASA policy requires that each Center implement a means to control and regulate acquisitions of hazardous materials and that Center Directors maintain a list of restricted and prohibited hazardous materials; typically, such chemicals are highly hazardous.[28] Specifically, the policy states that Center Directors are to ensure that local procedures include a listing of restricted/prohibited materials for purchase and use at Centers. This is intended to control the amount of highly hazardous materials kept onsite. However, there is no Agency-wide policy or guidance for how to maintain the restricted and prohibited materials list and as a result we found varied implementation among the Centers we visited.

Of the four Centers we visited, Goddard was the only one that did not maintain a restricted and prohibited materials list and also did not have a documented hazardous materials review process in place. Although Goddard policy mandates such a list, Goddard managers told us they do not restrict hazardous materials because the Center culture supports the use of any material needed to conduct research and meet operational needs. One example of a material that should be on the Center's restricted and prohibited list is acrylonitrile (a petroleum-derived compound used in resins, polymers, acrylics, plastics for 3D printing, and carbon fiber). Acrylonitrile is stored and used at Goddard and is extremely shock- and heat-sensitive; highly flammable and reactive leading to a potential for fire and explosion; harmful to the eyes, skin, lungs, and nervous system; and potentially carcinogenic. Allowing such a material on Center without sufficient implementation of controls to regulate its presence increases safety risks to personnel and property.

Although Langley does not have a prohibited and restricted materials list, it restricts chemicals by class including carcinogens and highly toxic gases. If a user needs an item in one of these classes, the acquisition undergoes a more intensive review in which the user obtains a safety permit approved by environmental, safety, and industrial hygienist subject matter experts. This permit outlines the conditions under which the chemical may be used, such as the personnel approved to work with the chemical, storage, training requirements, and waste disposal. Similarly, Stennis maintains a "chemicals not permitted" list, and Center personnel are required to coordinate with Stennis environmental, occupational health, and industrial hygiene personnel to request approval to use these materials if needed. Approval to acquire and use these chemicals is contingent upon implementation of approved environmental and industrial hygiene controls.[29]

[28] NPR 1800.1D, paragraph 4.7.3.1 and NPR 8715.3D, paragraph 3.7.6.

[29] Stennis Common Work Instruction 1800-0005, Rev H. January 2017, paragraph 5.2.

We found that Johnson maintains a restricted and prohibited materials list and also uses a detailed waiver form that includes approval and expiration dates for any restricted or prohibited material that receives a waiver to be on Center.

NASA Does Not Effectively Manage Hazardous Material Inventory

NASA does not have adequate internal controls for managing its inventory of hazardous materials. Federal regulations require organizations that maintain hazardous materials to identify chemicals that are harmful to personnel and the environment and to develop strategies to mitigate the associated risks. We found that the four NASA Centers we visited did not accurately record all hazardous materials when delivered, stored, and consumed. Centers have procedural requirements for hazardous material inventories, which generally require personnel to input data into an electronic, Center-specific information system when the items are delivered and used. However, we identified weaknesses both with recording hazardous materials upon delivery and when the materials were used. To test inventory procedures, we randomly selected a sample of 100 hazardous material items from each of the four Center's hazardous material inventory databases and attempted to track each sample item to the physical location indicated in the database.

Chemicals missing yellow database labels at Goddard

Source: OIG photo from site visit, November 2019

At Goddard, we could not locate 10 of 100 (10 percent) sample items. We determined that the missing items had been either consumed, disposed of, moved to another location or, in one instance, we were told by a shop manager the item was assumed stolen yet had not been updated in the hazardous materials database. We also found that users did not consistently notify the database administrators once the material was consumed, which contributed to inaccuracies in the database. In addition, we observed four chemical containers with missing labels. To confirm the status of these four sample items, we matched the container description, location, and estimated quantity found in the database, and discussed the location of these sample items with the Goddard laboratory manager. The laboratory manager confirmed that three of the four sample items were old and explained that the yellow Center tracking labels had fallen off over time and the items would be disposed of in the near future. According to NASA policy, the conditions of materials in storage are required to be assessed at least quarterly, and those determined to be unsuitable for use are to be removed from active inventory.

We were unable to locate a larger percentage of our sample inventory at the other three Centers. At Johnson, we were unable to locate 11 of the 100 (11 percent) sample items; at Langley, we could not locate 25 of 100 (25 percent) sample items; and at Stennis, we could not locate 13 of 46 (28 percent)

sample items.[30] Similar to Goddard, sample items were missing for a variety of reasons, including that the items had been consumed, moved to another location, or had not been updated in the Center's database. Missing items ranged from isobutyl alcohol and chloroform, to a 1-liter bottle of ethylenediamine—a flammable liquid that can react violently with some acids and other oxidizing material. Having an inaccurate hazardous materials inventory could put lab personnel and emergency response personnel at risk. In the event of a spill, fire, or other emergency, first responders need an accurate inventory to know what hazardous materials may be present on Center as well as the locations of those materials.

Weak Controls over Hazardous Material Inventory

Several Centers we visited had weak internal controls and procedures to record hazardous materials after delivery to user's locations. At Goddard, items are typically entered into the hazardous materials database by logistics personnel at the time they are received. At the three other Centers we visited, this responsibility fell to a building representative or the end user once they took possession of the hazardous material. Moreover, end users did not consistently notify authorized personnel—who can make entries into Center inventory databases—when they received, stored, or consumed hazardous materials.

At Goddard, where hazardous materials are tracked at the point of entry onto the Center, we found that the central receiving and database inventory controls process can be bypassed. We selected a random sample of 55 items from the Center's hazardous materials database that were procured within the last 6 years (the time period paper documentation is required to be retained). Five items in our sample (9 percent) were designated in the database as "Found on Station," meaning that each was discovered on Center during a safety inspection and had not been entered into the database when first received at the Center. Each item was subsequently researched by logistics personnel, who obtained the required Safety Data Sheet and added the items into the hazardous material database. Goddard policy gives users the option of either requesting delivery of hazardous materials to central receiving or notifying the logistics division within one business day when ordering hazardous materials. We spoke to Goddard environmental and logistics personnel who said that at least two contractors transport hazardous materials directly onto the Center in company vehicles. We were informed by Goddard logistics that these "Found on Station" items had bypassed the Center's receiving facility and were not reported as required.

At Stennis, we found that the Government Printing Office (GPO), a tenant on the Center, does not report its hazardous materials inventory to the Center. This practice does not align with the 2016 written tenant-host agreement in which GPO agreed to provide a courtesy copy of the hazardous materials inventory to Stennis.[31] In addition, the Stennis hazardous materials inventory database is locked down and offline for approximately 4 to 6 weeks every February and March in preparation for annual

[30] The statistical sample size at Stennis was reduced from 100 to 46 because of the unique organizational structure for the Stennis hazardous material database. Stennis environmental officials do not manage nor are they responsible for Center tenants; however, most Stennis tenants utilize Stennis' database at no cost to track their hazardous materials. Therefore, we adjusted the sample size to reflect only those hazardous materials that were directly NASA's responsibility. In addition, Stennis personnel stated that their inventory is not intended to be a real-time reflection of the materials on-hand.

[31] NASA is not responsible for GPO's external environmental reporting.

compliance reporting. This lockdown period could lead to inventory inaccuracies until authorized personnel are able to update the database once it is back online.[32]

NASA Lacks an Agency-wide Hazardous Materials Database

NASA does not track hazardous materials Agency-wide, resulting in limited Headquarters oversight and insight into the Agency's overall hazardous material inventory and the associated risks. While NASA Centers generally meet federal and Agency compliance standards, there are opportunities to improve hazardous material management.[33] EPCRA requires facilities to submit annual hazardous chemical inventory reports, and OSHA requires all employers to maintain a list of hazardous chemicals known to be present in the workplace. Any hazard that exists for a chemical must be identified and communicated through a hazard communication program. The quality of information used to satisfy these regulations—designed to protect employees and the environment—depends on the accuracy of the hazardous materials inventory and the assessment of hazards in the workplace.

NASA delegates the responsibility for evaluating the potential exposure risks involved with the use of hazardous materials to each Center. Center Directors are responsible for ensuring their Centers implement NASA environmental policy and requirements while also meeting state and federal reporting requirements. Each Center uses a different mechanism to track acquisition, storage, use, and disposal of hazardous materials with the nature and sophistication of these databases varying widely. For example, several Centers rely on commercial databases while others use simple Excel spreadsheets. The cost and functionality of these databases also vary. For example, Goddard uses a database managed by the Defense Logistics Agency that cost approximately $180,000 in fiscal year 2020 to operate and track each item individually using a bar code attached when the material arrives at the Center. In contrast, Johnson uses a database developed by Center personnel, Langley uses a database developed by a contractor many years ago, and the database at Stennis is funded as part of the Center's overall information technology system contract. When hazardous materials arrive at Johnson, Langley, or Stennis, they are entered into the Center database at the user location by a designated facility official. At Langley, a label is created from the database by the receiving user and affixed to the hazardous material container. However, at Johnson and Stennis, no identifying label, such as a bar code, is applied to track the item throughout its life cycle. See Appendix B for details of the four visited Centers' inventory processes.

An Agency-wide, enterprise hazardous materials database could increase oversight and improve NASA's management of hazardous materials. To assess the feasibility of NASA moving to an enterprise hazardous materials database, we contacted the U.S. Air Force Functional Management Office, which operates a hazardous materials information system that covers approximately 180 installations around the world (the Army and Coast Guard also use the system at their installations). The system is web-based and scalable with the cost based on the number of users. The enterprise nature of the system allows data from across the Air Force to be accessible to anyone granted access (for instance, Headquarters personnel), without having to gather information separately from each installation through a data call. Moreover, the system allows managers to approve and track hazardous materials

[32] Although personnel are instructed to submit paperwork to hazardous materials database managers once it is open for inputs, the lag time could be problematic because of the potential for changing inventory amounts during the lockdown period.

[33] For example, EPA requires annual reporting of hazardous material inventories and OSHA requires employers to maintain list of hazardous materials. NASA meets these requirements using their various spreadsheets and databases; however, these processes could be improved.

from procurement to disposal, thus increasing oversight and management of the process while also improving efficiency.

Hazardous materials management will likely be affected in coming years by NASA's Mission Support Future Architecture Program (MAP). Through the MAP initiative, the Agency plans to transform all mission support organizations—including EMD and LMD—to an enterprise-level operating model by March 2022. In addition, MAP directs EMD to identify a 5-percent budget savings by standardizing requirements and consolidating the information technology systems into an enterprise solution. By implementing an Agency-wide hazardous materials database, NASA could potentially increase oversight, minimize hazardous materials on hand, decrease waste from expired materials, enhance the Agency's ability to share materials across Centers, and reduce storage liabilities.

Storage Facilities in Need of Improvements and Repair

We identified storage and safety issues related to the storage of hazardous materials at the Centers we visited. OSHA requires employers to provide a safe storage facility for hazardous materials, and the Centers for Disease Control and Prevention (CDC) guidelines expand on these rules by providing specific instructions and a framework for compliance.[34] The CDC guidelines state: "Safe chemical handling requires routine inspections of chemical storage areas and maintenance of stringent inventory control. When chemicals must be used, proper storage and handling can reduce or eliminate associated risks." We relied on the CDC guidelines as a best practice during our review because NASA's policies governing hazardous materials storage and handling facilities are very general and each Center and/or contractor develops procedures for the storage and use of hazardous materials.[35]

During our visits to the four Centers, we observed inconsistent storage practices as well as conditions at Langley and Stennis that did not follow the CDC guidelines or comply with Center-specific procedures. In contrast, hazardous material laboratory storage facilities at Goddard and Johnson were organized, clean, and met CDC guidelines for storing chemicals. For example, at Goddard we found most laboratories stored chemicals in metal storage cabinets and gas cylinders were labeled and stored in a secure location. We found research laboratories with labels on the outside of metal storage cabinets that identified all the chemicals stored in the cabinet. At Johnson we found chemical storage locations in good condition and chemical containers labeled and stored in accordance with CDC guidelines.

[34] CDC Chemical Storage Guidelines call for inspections of chemical storage areas, stringent inventory storage controls, annual inspections, and minimizing the quantity of chemicals on hand by removing any unwanted or expired chemicals.

[35] NPR 4100.1F, *NASA Supply Support and Material Management* (March 7, 2017), and NPR 8715.3D.

Poor Materials Storage Conditions at Langley

At Langley, we found a chemical storage room with chemicals stored on rusty and corroded metal shelving within a building that houses numerous research laboratories. The severely corroded shelving was the result of leakage in an overhead water line. CDC guidelines recommend users look for unusual conditions in chemical storage areas; if these guidelines had been followed, the rusty shelving issue should have been identified and resolved. Rows of bookcase-style metal shelves in this chemical storage room contained hazardous materials stored as high as 7 feet, exceeding CDC guidelines that state, "chemicals should not be stored above eye level." Additionally, these shelving units were not tethered to a wall or secured to the floor, creating an inappropriate environment and increased potential for tipping and knocking over rows of shelving containing various types of chemicals—potentially causing a spill that could harm employees and the environment.

Rusted Shelving with Cafeteria-Style Trays at Langley

Source: OIG photo from site visit, January 2020

Langley chemical storage shelves also did not have anti-roll lips to contain spills, and many of the chemicals were stored on cafeteria-style plastic trays that would not be sufficient to fully contain the chemicals should a leak or spill occur. These conditions do not adhere to CDC guidelines that chemicals should be stored on shelves with an anti-roll lip, and the storage cabinet should have the capacity to hold its contents if chemical containers inside it leak. In addition, we observed a general lack of cleanliness, as spill-absorbing material was scattered across the metal racks containing chemicals and in piles on the floor.

We reviewed Langley's last three annual building safety inspections (the most recent in November 2019) and did not find any mention of rusty shelving or inappropriately stored hazardous chemicals. A Langley Occupational Safety & Industrial Hygiene official told us that they were aware of the rusty shelving condition and chose to mitigate the safety risks of storing chemicals on the rusted shelving by substantially reducing the number of chemicals and discontinue use of the shelves in the compromised storage area. Following our visit, the building facility safety official said it would take about a month to consolidate and dispose of the chemicals to free up the rusted shelving and order replacements.

During our site visit, we also found that Langley did not provide waterproof coverings or an overhead shelter to prevent the degradation of metal 55-gallon drums of JP-10 jet fuel. Langley uses JP-10 jet fuel to run tests in its High Temperature Tunnel testing facility. The facility stores the drums of jet fuel on pallets in an uncovered, fenced-in outdoor storage location. During our initial on-site review, we observed a pallet of uncovered JP-10 drums that had standing water and heavy rust on top of the drums. We also noted that some drums had a manufacture date of 2017/2018, yet a pallet of JP-10 with a 2019 manufacture date appeared to be the most recently used, indicating that the older drums may have been used years ago. During a follow-up visit in January 2020, we found that facility personnel had covered the drums with yellow weatherproof tarps; however, standing water was still on the top of corroding drums. The degraded JP-10 jet fuel drums are susceptible to contamination, leakage, or spills. A JP-10 jet fuel spill would create a fire hazard and could drain into the water supply, causing environmental damage.

Rusted Barrel of Jet Fuel with Standing Water on Lid at Langley

Source: OIG photo from site visit, January 2020

Hazardous Chemical Storage Issue Corrected at Stennis

Hazardous materials at Stennis were generally stored in cabinets and shelves that were in good condition. We noted the use of hard yellow plastic reservoirs with anti-roll lips to capture the entire contents in the event of a spill. However, we observed several 4-liter bottles of chemicals stored at eye level rather than as close to the ground as possible as required by the Center and contractor's Chemical Hygiene Plan. One of the chemicals we observed being stored at eye level was tetrahydrofuran, a flammable and explosive solvent commonly used in small-scale laboratory experiments. Exposure to tetrahydrofuran can cause headache, nausea, and dizziness, and very high exposure can cause unconsciousness and death. When we alerted Stennis officials to this, they immediately corrected the issue.

Hazardous Waste Facility Needs Increased Oversight and Physical Improvements

Although all Centers we visited followed requirements for managing hazardous waste at 90-day holding facilities (e.g., waste is removed within 90 days), we found oversight and maintenance issues at Johnson that need to be addressed.

Timely Awareness of Hazardous Waste Removal from Johnson Needs Improvement

We found that civil servants at three Centers provided appropriate oversight of the waste management contractor, while at Johnson we found no direct civil servant involvement. At Johnson, the responsible civil servant did not review the manifest documents prior to waste being shipped from the Center or

directly oversee operations related to waste management.[36] This process is in contrast with the three other Centers we visited, which coordinate real time with the disposal contractor and review the manifest prior to the shipment leaving the 90-day holding facility.

In our view, Johnson civil service personnel overseeing the waste program should have better awareness of what disposals are scheduled and perform an appropriate level of direct field oversight since NASA is responsible and liable for the proper management of waste, even after waste leaves a Center. Given the hazardous nature of the contents and the potential public safety and environmental impact, public perception of the Agency would certainly be negative should an incident occur.

Hazardous Waste at Johnson Insufficiently Protected from Weather Impacts

Source: OIG photo from site visit, December 2019

We found that the outdoor 90-day holding facility at Johnson could better protect hazardous waste from the weather. We noted some waste containers were in poor condition, and we found rusted and partially rusted containers that did not comply with container condition requirements. According to federal requirements, if a container holding hazardous waste is not in good condition, or if it begins to leak, the owner or operator must transfer the hazardous waste to a container in good condition or manage the waste in some other way that complies with requirements.[37] Further, at least weekly the owner or operator of a storage facility must look for leaking containers and for deterioration of containers caused by corrosion or other factors.[38] Hazardous material containers in bad condition have the potential to leak or cause a catastrophic explosion or fire.

We also found at Johnson that weather can easily affect the safety and ability to work in the 90-day waste facility. Johnson environmental personnel told us that rain shuts down operations there due to ponding and flooding throughout the site, which makes it dangerous for employees working in and around those areas. Also, the Johnson Cylinder Farm's sorbent pads, which are required to catch any hazardous waste materials that may leak from containers, were in poor condition and did not appear to be properly sloped per EPA standards for accumulation of rain.

[36] The contractor responsible for removing hazardous waste from Johnson operates under a fixed-price, performance-based contract with limited input from NASA civil servants. Nevertheless, oversight is still permitted and the contractor has an obligation to provide real-time information upon request.

[37] EPA 40 C.F.R. § 262.17 a ii., *Condition of containers*.

[38] EPA 40 C.F.R. § 262.17 v, *Inspections*.

CONCLUSION

NASA does not consistently and adequately manage hazardous materials across the Agency. Specifically, we found weak controls over acquisition, inventory, and storage of hazardous materials at the four Centers we reviewed, suggesting a likelihood of weak controls over hazardous materials Agency-wide. The lack of accountability by a designated organization manager in hazardous material risk management decision-making has resulted in the Agency assuming increased institutional risks at these Centers. Moreover, the lack of an Agency-wide database limits NASA's oversight of hazardous materials from an enterprise perspective. Finally, NASA could improve the conditions at facilities where hazardous materials and hazardous wastes are stored. Improvements in controls over the entire life cycle of hazardous materials would allow NASA to mitigate safety risks and reduce the potential for future environmental liabilities. Improperly storing, handling, or disposing of hazardous materials can have potentially catastrophic consequences, including loss of life, serious injury, damage to facilities and equipment, damage to the environment, loss of mission capabilities, and accrual of future liabilities.

RECOMMENDATIONS, MANAGEMENT'S RESPONSE, AND OUR EVALUATION

In order for NASA to increase transparency, accountability, and oversight of its hazardous materials, we recommended that the Associate Administrator for Mission Support in coordination with the Chief of Safety and Mission Assurance and Office of Chief and Health Medical Officer undertake an Agency-wide initiative to:

1. Ensure that an appropriate organizational manager who is authorized to accept risks on the Center Director's behalf is included in the hazardous materials acquisition process as the concurring authority.
2. Establish a unified purchase card policy and designate an appropriate official at each Center to ensure hazardous material acquisitions made via purchase cards are appropriately approved, received, and tracked.
3. Ensure contractors and tenants at NASA Centers report their hazardous material inventory to Center management at least annually.
4. Evaluate Centers' application of Agency policy to maintain a list of restricted and prohibited materials and their associated waiver processes and make improvements as warranted.
5. Assess various options for development and implementation of an Agency-wide hazardous materials information system that tracks hazardous materials throughout the life cycle, and ensure processes are in place to consistently maintain a complete and accurate inventory.
6. Develop and implement an Agency-wide policy that establishes a standard for storage spaces and facilities used to house hazardous materials.
7. Require Center Directors to inspect and replace, as required, laboratory hazardous material storage structures and improve shelters that do not follow CDC guidelines or comply with Agency requirements.
8. Inspect and evaluate Centers' 90-day storage facilities and processes and make improvements as warranted.

We provided a draft of this report to NASA management, who concurred or partially concurred with our recommendations. We consider management's comments responsive; therefore, the recommendations are resolved and will be closed upon completion and verification of the proposed corrective actions.

Management's comments are reproduced in Appendix C. Technical comments provided by management and revisions to address them have been incorporated as appropriate.

Major contributors to this report include Ray Tolomeo, Science and Aeronautics Director; Julia Eggert, Project Manager; Shari Bergstein; Scott Collins; Noreen Khan-Mayberry, PhD; Robert Todd Rose; and Matt Ward.

If you have questions about this report or wish to comment on the quality or usefulness of this report, contact Laurence Hawkins, Audit Operations and Quality Assurance Director, at 202-358-1543 or laurence.b.hawkins@nasa.gov.

Paul K. Martin
Inspector General

APPENDIX A: SCOPE AND METHODOLOGY

We performed this audit from September 2019 through October 2020 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.

The scope of this audit was NASA's management of hazardous materials. Our overall objective was to evaluate the effectiveness of the Agency's processes, procedures, and controls over the acquisition, handling, storage, disposal, and transportation of hazardous materials, including specific material management processes. Additionally, we evaluated NASA's efforts to protect personnel, the environment, and the public from the effects of exposure to hazardous materials. To gain an overall understanding of the Agency's policy over the management of hazardous materials, we met with officials from the Offices of Safety and Mission Assurance, Logistics, and Environmental Directorates at Headquarters. We visited four Centers—Goddard, Johnson, Langley, and Stennis—to observe and assess their hazardous materials processes, procedures, and controls. At each Center, we met with Environmental, Occupational Safety and Health, Safety and Mission Assurance, Logistics, and Procurement personnel. We also interviewed NASA Shared Services Center personnel located at Stennis to discuss the administration of the Agency's purchase card program and to assess controls over acquisition of hazardous materials by purchase card.

We reviewed relevant criteria, including Federal, Agency, and Center policies and procedures related to hazardous material management. We also collaborated with our Advanced Data Analytics Program personnel to develop a statistical sample of hazardous materials from each of the Centers selected for review. We utilized this capability to obtain a sample of 100 hazardous material items for each of the selected Centers and then used this sample to test hazardous materials processes, procedures, and controls over acquisition, storage, and use at each location. To assess the processes and controls over the transportation and disposal of hazardous waste, we met with Environmental, Occupational Safety and Health, Safety and Mission Assurance, and Logistics personnel, both civil service and contractors at each Center. We observed hazardous waste pickup, reviewed waste disposal travel manifests, and visited 90-day waste accumulation facilities and satellite accumulation areas. We also observed waste disposal pickup at two of the four Centers we visited.

Use of Computer-Processed Data

We used computer-processed data to perform this audit. At each Center visited, we obtained access to that Center's dedicated hazardous materials database and tracked the chemicals included in our sample through the hazardous material management life cycle. Our sample methodology and sample size were determined based on our audit team's professional judgment and with Advanced Data Analytics Program personnel support.

To assess the reliability of the computerized hazardous material data obtained, we (1) performed testing to determine obvious errors in accuracy, completeness, consistency, timeliness, and validity of the data; (2) reviewed logistics receiving documents, purchase card bank statements, contractor annual inventory reports, Safety Data Sheets, laboratory safety reports, Center industrial hygiene and safety reports, environmental incident reports, Safety and Mission Assurance inspection reports, Center housekeeping

reports, Center core services support contracts, data verification reports, approved hazardous material waivers, waste-holding facility reports, and Center hazardous material management cost data; and (3) worked closely with Agency and Center officials to identify discrepancies in data between sources. We therefore believe that the data we used from each Center's dedicated hazardous material systems to complete our audit assignment was appropriate and sufficiently reliable to address our audit objectives and to support our conclusions.

Review of Internal Controls

We performed an assessment of the internal controls associated with NASA's management of hazardous materials through their life cycle. Specifically, throughout the audit, we reviewed controls associated with the audit objectives and determined that NASA does not have adequate control over the acquisition, storage and use, or disposal of hazardous materials. The control weaknesses we identified are discussed in the report. Our recommendations, if implemented, should correct the identified control weaknesses. We reviewed the following documents:

NPD 1000.5C, *Policy for NASA Acquisition* (July 13, 2020)

NPD 5104.1, *Government Charge Cards* (August 19, 2016)

NPD 8500.1C, *NASA Environmental Management* (October 29, 2018)

NPR 1800.1D, *NASA Occupational Health Program Procedures* (September 11, 2019)

NPR 4100.1F, *NASA Supply Support and Material Management* (March 7, 2017)

NPR 8000.4B, *Agency Risk Management Procedural Requirements* (December 6, 2017)

NPR 8553.1B, *NASA Environmental Management System* (August 28, 2014)

NPR 8715.3D, *NASA General Safety Program Requirements* (August 1, 2017)

Aerospace Safety Advisory Panel Annual Report for 2018 (January 1, 2019)

Prior Coverage

During the last 5 years, the NASA Office of Inspector General (OIG) and the Government Accountability Office (GAO) have issued three reports relevant to the subject of this report, which can be accessed at https://oig.nasa.gov/audits/auditReports.html and http://www.gao.gov.

NASA Office of Inspector General

NASA'S Progress with Environmental Remediation Activities at the Santa Susana Field Laboratory (IG-19-013, March 19, 2019)

Government Accountability Office

Defense Transportation: DOD Has Taken Actions to Address Hazardous Material Transportation Issues but It is Too Soon to Evaluate the Effectiveness of These Efforts (GAO-17-498, July 21, 2017)

Hazardous Material Transportation: Guidance and Planning Could Enhance DOT's Explosives Classification Oversight (GAO-16-715, July 28, 2016)

APPENDIX B: SELECTED NASA CENTER HAZARDOUS MATERIAL MANAGEMENT PROCESSES

Table 1: Selected Center Hazardous Material Management Processes as of August 2020

Life-cycle Phase	Goddard	Johnson	Langley	Stennis
Acquisition	Hazardous Material Acquisition at Goddard starts with an end-user account that establishes authorization to use the Advanced Materials Management System (AMMS) to procure hazardous materials. Hazardous Material purchases approved through AMMS require submittal of GSFC 23-59 with a purchase requisition and Statement of Work or specifications/Material Safety Data Sheet (SDS) with Safety authorization (signature) if the hazardous material has not been previously catalogued in AMMS. If the hazardous material has been previously catalogued Safety notification of the purchase is required and no additional Safety Authorizations (signature) is required. The Goddard Center procurement office uses the Agency's Core Financial System to create hazardous material purchase requests. NASA Form 1707 "Special Approvals & Affirmations of Requisitions" with affirmation of coordination with Health & Safety is required by Center procurement for acceptance. Goddard policy does not allow purchase of hazardous materials via purchase card.	Hazardous Material Acquisition at Johnson starts with submittal of SDS and JSC Form 277 "Request For Safety Data Sheet (SDS) Processing" to Occupational Health to obtain a required SDS control number. Submittal of Johnson Form 594 "Request for Waiver to Use a Prohibited or Restricted Chemical" is required to be approved by Johnson Environmental and Occupational Safety and Health. Johnson government procurement office uses the Agency's Core Financial System to create hazardous material purchase requests. NASA Form 1707 "Special Approvals & Affirmations of Requisitions" with affirmation of coordination with Health & Safety is required by Center procurement for acceptance. Johnson does not have a purchase card policy with respect to hazardous materials purchases and therefore defaults to NSSC policy which requires approval by Safety and Mission Assurance.	Hazardous Material Acquisition at Langley starts with submittal of SDS and LF44 Form "Hazardous Materials – Procurement, Inventory, & Storage Record," to obtain Facility Safety Head, Langley Industrial Hygienist, and Langley Safety Manager approval. All Purchase Requests are created using NASA's core financial system. Civil servants and contractor employees (in support of civil servants) may create Purchase Requests. NASA Langley Form 1707 "Special Approvals & Affirmations of Requisitions" with affirmation of coordination with Health & Safety is required by Center procurement for acceptance. A NASA Purchase Card Holder or delegate may create an order log (commitment) in NASA's P-Card system which interfaces information to the core financial system to create a purchase request. Civil servants and contractor employees (in support of civil servants) may create P-Card order logs. LMS-CP-5108 is Langley's P-Card procedure specifically related to the purchase of hazardous materials and states that quality sensitive items must not be acquired by purchase card without LF 344 Form submittal and special approval by Safety & Mission Assurance Branch.	Hazardous Material Acquisition at Stennis for reoccurring purchases starts with Form SSC-862 and the submittal of a Safety Data Sheet and to NASA Industrial Hygiene and Environmental officials for approval. For new purchases, the Requesting Organization submits the Purchase Request package, including NASA Form 1707, Special Approvals and Affirmations of Requisitions, to NASA Environmental and Safety and Mission Assurance for review per the requirements of Stennis Common Work Instruction 5100-0001, Procedures for Initiating the Purchase of Supplies and Services. Civil Servants conduct direct procurements through NASA's core financial system. Contractors and Civil Servants can purchase hazardous materials through Service Request System or SACOM S3 Vision Service/Purchase Request System. NASA Form 1707 "Special Approvals & Affirmations of Requisitions" and signed/dated by Environmental & Hygiene Officer is required by Center procurement for acceptance. Stennis purchase card policy requires purchasers to coordinate purchases of items meeting criteria under Stennis Common Work Instruction 8730.0003 with NASA or Stennis Safety and Mission Assurance.

Life-cycle Phase	Goddard	Johnson	Langley	Stennis
Inventory & Database	Hazardous material is entered into the Goddard Hazardous Material Management System (HMMS) database when received on Center by the Receiving department personnel. The HMMS creates a yellow label to be placed on the container. Additionally, inventory entries are made for consumed hazardous materials when yellow labels are submitted to Goddard environmental personnel authorized to input data into the HMMS.	Hazardous materials are entered into the Johnson on-line inventory by the user's point of contact (POC). Each POC has a group ID number and password for access to the inventory. Additionally, laboratory mangers or end user POC's typically update their inventories into the database when hazardous materials are consumed or relocated.	Hazardous material is entered into the Langley Chemical Management Tracking System (CMTS) database by Facility Environmental Coordinators (FEC) after delivery to the user location. A hazardous material inventory "white" label is generated by the CMTS to track the container. In addition, the FEC's update the CMTS database when notified by users when hazardous materials are consumed.	Hazardous material is entered into the Stennis Hazardous Material Information System (HMIS) database after delivery to the user location. Database inventory amounts are updated and finalized prior to the annual EPCRA report on March 1st.
Storage & Handling	Hazardous material is stored and handled in various locations identified in the Center hazardous material management database. The Center and/or contractor Chemical Hygiene plans provide additional guidance for storing, using, and handling chemicals in laboratories. Storage locations include; secured laboratories, chemical storage rooms, gas cylinder storage areas, transportation garages, and within flammable cabinets in multiple buildings.	Hazardous material is stored and handled in various locations identified in the Center hazardous material management database. The Center and/or contractor Chemical Hygiene plans provide additional guidance for storing, using, and handling chemicals in laboratories. Storage locations include; secured laboratories, chemical storage rooms, gas cylinder storage areas, transportation garages, and within flammable cabinets in multiple buildings.	Hazardous material is stored and handled in various locations identified in the Center hazardous material management database. The Center and/or contractor Chemical Hygiene plans provide additional guidance for storing, using, and handling chemicals in laboratories. Storage locations include; secured laboratories, chemical storage rooms, gas cylinder storage areas, transportation garages, and within flammable cabinets in multiple buildings.	Hazardous material is stored and handled in various locations identified in the Center hazardous material management database. The Center and/or contractor Chemical Hygiene plans provide additional guidance for storing, using, and handling chemicals in laboratories. Storage locations include; secured laboratories, chemical storage rooms, gas cylinder storage areas, and within flammable cabinets in multiple buildings.
Disposal & Waste	When hazardous waste is generated, the Center hazardous waste program personnel transport hazardous materials from collection points, referred to as a satellite accumulation area (SAA). SAAs are placed, in operational areas where hazardous materials are used and waste is ultimately generated. Once the SAA is full, the waste generator will notify the hazardous waste group who will then collect wastes from SAAs within 72 hours and transfer that waste into a 90-day hazardous wastes storage facility. Waste is then removed from the Center and transported offsite by a contractor	When hazardous waste is generated, the Center hazardous waste program personnel transport hazardous materials from collection points, referred to as a satellite accumulation area. SAAs are placed, in operational areas where hazardous materials are used and waste is ultimately generated. Once the SAA is full, the waste generator will notify the hazardous waste group who will then collect wastes from SAAs within 72 hours and transfer that waste into a 90-day hazardous wastes storage facility. Waste is then removed from the Center and transported offsite by a contractor.	When hazardous waste is generated, the Center hazardous waste program personnel transport hazardous materials from collection points, referred to as a satellite accumulation area. SAAs are placed, in operational areas where hazardous materials are used and waste is ultimately generated. Once the SAA is full, the waste generator will notify the hazardous waste group who will then collect wastes from SAAs within 72 hours and transfer that waste into a 90-day hazardous wastes storage facility. Waste is then removed from the Center and transported offsite by a contractor.	When hazardous waste is generated, the Center hazardous waste program personnel transport hazardous materials from collection points, referred to as a satellite accumulation area. SAAs are placed, in operational areas where hazardous materials are used and waste is ultimately generated. Once the SAA is full, the waste generator will notify the hazardous waste group who will then collect wastes from SAAs within 72 hours and transfer that waste into a 90-day hazardous wastes storage facility. Waste is then removed from the Center and transported offsite by a contractor.

Source: OIG evaluation of NASA Center processes

APPENDIX C: MANAGEMENT'S COMMENTS

National Aeronautics and
Space Administration

Headquarters
Washington, DC 20546-0001

November 25, 2020

Office of Strategic Infrastructure

TO: Assistant Inspector General for Audits

FROM: Assistant Administrator for Office of Strategic Infrastructure

SUBJECT: Agency Response to OIG Draft Report, "NASA's Management of Hazardous Materials" (A-19-014-00)

The National Aeronautics and Space Administration (NASA) appreciates the opportunity to review and comment on the Office of Inspector General (OIG) draft report entitled, "NASA's Management of Hazardous Materials" (A-19-014-00), dated October 28, 2020.

In the draft report, the OIG makes eight recommendations to NASA intended to increase transparency, accountability, and oversight of its hazardous materials. Specifically, the OIG recommends the following:

Recommendation 1: Ensure that an appropriate organizational manager that is authorized to accept risks on the Center Director's behalf is included in the hazardous materials acquisition process as the concurring authority.

Management's Response: NASA partially concurs with this recommendation. NASA Procedural Requirements (NPR) 1800.1, Section 4.7, *Control of Hazardous Materials and Articles Acquisitions* outlines the requirements Centers must follow during the acquisition of hazardous material to ensure personnel health and safety. NPR 1800.1 requires a competent person to review procurements and other acquisitions of hazardous materials and coordinate with Center occupational safety and health organizations to: (1) identify hazards associated with the materials; (2) identify alternatives, where available, to reduce risk; and (3) determine safety and health requirements for the safe use of hazardous materials and/or articles. Note, NPR 1800.1 defines the requirements that must be met for an individual to be considered a competent person. The Office of the Chief Health and Medical Officer (OCHMO) works to ensure Centers are implementing these requirements through a variety of methods, including their tri-annual audits of each Center.

If this review process is followed and accepted requirements for the safe use of the materials and articles are put in place, the risk associated with acquisitions is considered acceptable, and no separate risk acceptance is considered necessary. If requirements for the safe use of hazardous materials and/or articles cannot be met, further approvals, including associated risk acceptances by Agency senior executives, would be required.

NASA is in the process of updating NPR 8715.1, *NASA Safety and Health Programs,* which will clearly define the process for request for relief from safety requirements owned by the Office of Safety and Mission Assurance (OSMA). NPR 8715.1 will only allow the delegation of the authority to accept risk on the Center Director's behalf to the Deputy Center Director, Associate Center Director, or Center Safety and Mission Assurance (SMA) Director. NPR 8715.1 requires contacting OCHMO to request a waiver to a health requirement. The Agency's Chief Health and Medical Officer (CHMO) reviews and approves waivers to OCHMO requirements.

In conclusion, NASA's requirements appropriately include competent personnel in the review of the acquisition of hazardous materials to protect personnel and the environment. Also, NASA requires senior executives who can accept risks on the Center Director's behalf to be the approving authority when safety requirements cannot be met. When health requirements cannot be met, the CHMO would determine whether to approve a waiver. OSMA and OCHMO believe that with the upcoming publication of NPR 8715.1, which is pending legal review and approval by the Office of the Administrator and anticipated in the coming two months, the intent of the recommendation will be met. After the updated publication of NPR 8715.1, OSMA will conduct awareness activities and training to ensure Agency employees are aware of the requirement for the risk acceptance by the appropriate senior executives when an Agency safety or health requirement cannot be met.

Estimated Completion Date: August 1, 2021.

Recommendation 2: Establish a unified purchase card policy and designate an appropriate official at each Center to ensure hazardous material acquisitions made via purchase cards are appropriately approved.

Management's Response: NASA concurs. The NASA Office of Procurement (OP) manages the Agency purchase card program and the NASA Purchase Card Procedures and Instructions (PCPI). The NSSC P-Card Team maintains a list of special approvers for hazardous material purchases at each NASA Center and at NASA Headquarters (HQ).

Additionally, the NASA P-Card Team recently implemented an online Special Approval process that facilitates the vetting and approval of proposed P-Card transactions involving hazardous substances and articles such as chemicals, toxic

substances, explosives, biological substances, and radioactive materials, as set forth in NPR 1800.1.

When the Purchase Cardholder selects "Hazardous Item," the appropriate Hazardous Material special approver is notified that a potential purchase requires review. The special approver reviews the potential purchase to ensure that it is acceptable. The cardholder is only allowed to continue if the special approver concurs within the system that it is acceptable. If the special approver does not approve, the order log is deleted, and the purchase cannot be made using the P-card.

Hazardous Materials Special Approvers were trained by the Purchase Card Agency Program Coordinator (APC) and Agency Applications Office (AAO) to assist them in understanding their responsibilities within the system and to ensure compliance with the PCPI. The training sessions successfully demonstrated the functionality of the new P-Card hazardous material purchase approval process. OP will provide the list of special approvers to the Inspector General as well as a system demonstration.

Estimated Completion Date: December 15, 2020.

Recommendation 3: Ensure contractors and tenants at NASA Centers report their hazardous material inventory to Center management at least annually.

Management's Response: NASA concurs with this recommendation. NASA HQ Environmental Management Division (EMD) will direct Center Environmental Offices to provide a copy of annual Emergency Planning and Community Right-to-Know Act (EPCRA) reporting to Center Protective Services. Center EPCRA reporting includes hazardous material inventory for NASA and resident contractors.

EMD will provide direction – December 1, 2020.

NASA is in the process of updating NPR 8715.1, *NASA Safety and Health Programs*. Through this process, NASA plans to add several new requirements to this NPR associated with tenants to ensure the Agency meets Occupational Safety and Health Administration (OSHA) requirements as a multiemployer worksite. Paragraph 4.3.9.3 will state "Each Center shall ensure contracts and agreements include any necessary provisions to ensure hazards in a non-NASA controlled worksite that can impact NASA controlled worksites are properly identified, controlled, and communicated to the workforce." Paragraph 4.3.10.4 will state "Each Center Director shall ensure contracts and agreements facilitate and do not constrain the Center Director's ability to fulfill their responsibility for safety and health. Contracts and agreements should include any necessary provisions to ensure protection of the workforce. Common provisions include sharing of safety and health information, safety and health plans, audits and inspections, and mishap investigations." These new requirements, in concert with the existing Office of Safety and Mission Assurance's Institutional, Facility, Operational Safety Audit (IFOSA) process, will ensure tenants at NASA Centers report their hazardous

material inventory to Center management at least annually. Accordingly, no additional action is planned.

Estimated Completion Date: August 1, 2021 (Publication of updated NPR 8715.1).

Recommendation 4: Evaluate Centers' application of Agency policy to maintain a list of restricted and prohibited materials and their associated waiver processes and make improvements as warranted.

Management's Response: NASA partially concurs with this recommendation. The Agency's policy that Centers maintain a list of restricted and prohibited materials is defined in NPR 8715.3, *NASA General Safety Program Requirements*. Paragraph 3.7.6.1.c requires Centers to have local procedures that "include a listing of restricted/prohibited materials for purchasing and use at Centers." The Agency has greatly reduced prescriptive requirements like this during the consolidation of institutional safety requirements in NPR 8715.3D into NPR 8715.1A, *NASA Safety and Health Programs*, which is currently pending final review and approval by the Office of the Administrator.

This reduction of very prescriptive requirements provides Centers flexibility to meet regulatory requirements (e.g., OSHA) in a cost effective and efficient manner. For example, NASA's Langley Research Center (LaRC) does not have a prohibited and restricted materials list; they restrict chemicals by class. LaRC's process requires acquisitions of carcinogens and highly toxic gases to undergo a more intensive review in which the user obtains a safety permit approved by environmental, safety, and industrial hygienist subject-matter experts.

Upon publication of NPR 8715.1A and NPR 8715.3D in the coming months, OSMA will no longer require Centers to maintain a list of restricted and prohibited materials. OCHMO does not plan to require a restricted or prohibited materials list once the requirement is removed from OSMA's NPR.

Centers may still choose to maintain a list of restricted and prohibited materials as part of their process to manage the acquisition and use of hazardous material. More importantly, Centers are expected to anticipate and recognize a chemical (material) hazard prior to purchase and arrival on Center to ensure there are no hazardous exposures that violate an Occupational Exposure Limit (OEL) or other OSHA substance-specific standard requirement. The key requirement for this is in NPR 1800.1, Section 4.7, *Control of Hazardous Materials and Articles Acquisitions*. This section requires a competent person to review procurements and other acquisitions of hazardous materials and coordinate with Center occupational safety and health organizations to: (1) identify hazards associated with the materials; (2) identify alternatives, where available, to reduce risk; and (3) determine safety and health requirements for the safe use of hazardous materials and/or articles. OCHMO

will continue to evaluate the implementation of these requirements through their tri-annual audits of each Center.

In conclusion, OSMA and OCHMO believe that removing the requirement for a restricted and prohibited material list, while maintaining the requirement of an adequate review of material purchases, balances the highly variable operational needs of NASA Centers with the need to protect the NASA workforce. OCHMO and OSMA will conduct a data call that will enable OCHMO to evaluate whether Centers are compliant with NPR 1800.1, Section 4.7, with or without a restricted and prohibited materials list.

Estimated Completion Date: October 1, 2021.

Recommendation 5: Assess various options for development and implementation of an Agency-wide hazardous materials information system that tracks hazardous materials throughout the life cycle, and ensure processes are in place to consistently maintain a complete and accurate inventory.

Management's Response: NASA concurs with this recommendation. NASA's Office of Strategic Infrastructure (OSI) will collaborate with Hazardous Materials personnel at each Center/Facility and develop an Agency-wide snapshot of current Hazardous Materials information systems being utilized at NASA. OSI will assess processes in place and identify opportunities to improve Hazardous Materials inventory management. OSI, in collaboration with the Office of the Chief Information Officer, will explore the potential of and options for an Agency-wide Hazardous Materials system. This includes defining the scope of each option and how they compare to existing Center practices, identifying and evaluating the strengths and weaknesses of each option, and the risks of adopting an Agency-wide solution.

Estimated Completion Date: December 31, 2022.

Recommendation 6: Develop and implement an Agency-wide policy that establishes a standard for storage spaces and facilities used to house hazardous materials.

Management's Response: NASA concurs with this recommendation. NASA's policies for the storage of hazardous material are in NPR 8715.3, Section 3.7, *Hazardous Material Transportation, Storage, and Use*. Additional storage requirements can be found in NASA-Standard-8719.11, *Standard for Fire Protection and Life Safety* and NPR 4100.1, *NASA Supply Support and Material Management*. Requirements for the safe use of hazardous material can be found in NPR 1800.1, *NASA Occupational Health Program Procedures*. In addition, Centers use their own or industry guidelines to assess the safe storage of material.

NASA concurs that this decentralized set of requirements and lack of overarching Agency-level guidelines for the safe storage of hazardous material at the Agency

level has led to inconsistent levels of safe storage of hazardous material. NASA will make additional updates, updates subsequent to those described above, to NPR 8715.1, *NASA Safety and Health Programs* to address this recommendation. Note, the requirements in NPR 8715.3 are being moved to NPR 8715.1.

To update NPR 8715.1, NASA will form a team from OSMA, OCHMO, and OSI. NPR 8715.1 will be updated in a manner that ensures readers can identify all legally binding requirements (e.g., 29 CFR 1910 Subpart H, *Hazardous Material*) for the storage of hazardous material. The team will also review existing guidelines for the safe storage of hazardous material (e.g., CDC Chemical Storage Guidelines) and document the guidelines all Centers should follow.

To implement these changes, NASA will develop and conduct training of the safety, occupational health, environmental management, logistics, and fire protection professionals across the Agency who conduct facility inspections. The training will focus on responsibilities for the inspection of all types of hazardous storage areas. It will also educate attendees on the new requirements and guidelines developed. Following the implementation of these changes, the Agency Center audits by OSMA and OCHMO will include chemical storage as a focus area as described in the response to recommendation 7.

Estimated Completion Date: May 1, 2022.

Recommendation 7: Require Center Directors to inspect and replace, as required, laboratory hazardous material storage structures and improve shelters that do not meet CDC or Agency requirements.

Management's Response: NASA concurs with this recommendation. NASA Centers are required to conduct safety and health inspections of all buildings and facilities annually and appropriately address issues (ref, 29-CFR-1960, *Basic Program Elements for Federal Employees OSHA*). OSMA and OCHMO evaluate the implementation of this requirement through their respective Center auditing processes. Both OSMA and OCHMO have found that annual safety and health inspections are being conducted. Since the issues identified by the OIG should have been addressed as part of a Center's safety and health inspection process, OIG Recommendations 6 and 7 are indicators that the annual inspections by Centers of hazardous material storage spaces, facilities, and shelters need improvement.

Implementation of the corrective actions for Recommendation 6 will ensure Center inspectors are educated in the Agency requirements for the storage of hazardous material. After Centers are given an appropriate amount of time to incorporate the new requirements into their processes, OCHMO and OSMA will conduct Center audits focused on hazardous material storage. This will confirm the effectiveness of the Center safety and health inspection process to identify and address safety and health issues related to hazardous material storage spaces, facilities, and shelters.

The cycle of the OCHMO and OSMA audits will be such that all Centers should be audited in a two-year period. However, to properly conduct these audits, the first part of recommendation 6 needs to be complete. Also, travel and Center access restrictions due to COVID-19 may hamper implementation. For these reasons, completion of this recommendation will take several years.

Estimated Completion Date: October 1, 2023.

Recommendation 8: Inspect and evaluate Centers' 90-day storage facilities and processes and make improvements as warranted.

Management's Response: NASA concurs with this recommendation. There is currently a process in place for large quantity waste generators. 40 CFR 262.17(a)(1)(v) requires the weekly inspections of areas where containers are stored to look for leaks and deterioration caused by corrosion or other factors. Additionally, 40 CFR 262.17(a)(1)(ii) states that if a container holding hazardous waste is not in good condition, the hazardous waste must be transferred to a new container that is in good condition. Any hazards identified during the weekly inspections are documented and routed through the Center's process for mitigation by the Environmental, Facilities Engineering, Safety or Occupational Health Organization, as appropriate.

HQ EMD conducts Environmental, Energy and Functional Reviews (EEFR) of all NASA Center's Environmental Programs on a three-year cycle. Hazardous Waste programs, including management of 90-day storage facilities, are included in the review. Any findings identified are briefed to Center Management and require submittal of correction action plans for HQ EMD review.

Estimated Completion Date: Complete.

We have reviewed the draft report for information that should not be publicly released. As a result of this review, we have not identified any information that should not be publicly released.

Once again, thank you for the opportunity to review and comment on the subject draft report. If you have any questions or require additional information regarding this response, please contact Xaivian Raymond on (202) 358-1352.

CALVIN WILLIAMS Digitally signed by CALVIN WILLIAMS
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Calvin F. Williams
Assistant Administrator
Office of Strategic Infrastructure

APPENDIX D: REPORT DISTRIBUTION

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