



February 2016

# RARE EARTH MATERIALS

## Developing a Comprehensive Approach Could Help DOD Better Manage National Security Risks in the Supply Chain

Accessible Version

# GAO Highlights

Highlights of [GAO/a16n/a161](#), a report to congressional committees

## Why GAO Did This Study

DOD depends on rare earths that contain one or more of 17 similar metals which have unique properties, such as magnetism at high temperatures, to provide functionality in weapon system components. Many steps in the rare earths supply chain, such as mining, are conducted in China, a situation that may pose risks to the continued availability of these materials. The Joint Explanatory Statement accompanying the Carl Levin and Howard P. “Buck” McKeon National Defense Authorization Act for 2015 included a provision for GAO to review DOD efforts to identify and mitigate risks in its rare earths supply chain.

This report assesses the extent that DOD (1) determined which rare earths, if any, are critical to national security; and (2) has identified and mitigated risks associated with rare earths, including the effects of a potential supply disruption. GAO reviewed DOD reports from 2011n/a2015 and relevant legislation; and collected information from DOD, the military departments, and industry organizations.

## What GAO Recommends

GAO recommends that DOD designate which rare earths are critical to national security, and develop a comprehensive approach to help ensure a secure supply by identifying risk metrics, among other activities. DOD concurred with all the recommendations in this report and provided timeframes for action.

View [GAO/a16n/a161](#). For more information, contact Marie A. Mak at (202) 512n/a4841 or [makm@gao.gov](mailto:makm@gao.gov).

February 2016

## RARE EARTH MATERIALS

### Developing a Comprehensive Approach Could Help DOD Better Manage National Security Risks in the Supply Chain

## What GAO Found

Three Department of Defense (DOD) offices have identified certain rare earth materials (rare earths) as critical for some defense applications, such as lasers, but DOD has not taken a comprehensive, departmentn/awide approach to identifying which rare earths, if any, are critical to national security. Specifically, DOD offices have not yet agreed on what constitutes “critical” rare earths. Using different statutoryln/abased definitions, these offices have identified 15 of the 17 rare earths as critical over the last 5 years (see table).

Rare Earth Materials (Rare Earths) Meeting Various Definitions of Critical by Office			
Rare earths	Acquisition, Technology and Logistics	Manufacturing and Industrial Base Policy (MIBP) <sup>a</sup>	Defense Logistics AgencyNoStrategic Materials
	2012	2013	2011, 2013, 2015
Scandium	No	No	Yes
Yttrium	Yes	Yes	Yes
Lanthanum	No	No	Yes
Praseodymium	Yes	No	Yes
Neodymium	Yes	No	Yes
Samarium	No	No	Yes
Europium	Yes	No	Yes
Gadolinium	Yes	No	No
Terbium	No	Yes	Yes
Dysprosium	Yes	Yes	Yes
Holmium	No	Yes	No
Erbium	Yes	Yes	Yes
Thulium	No	Yes	Yes
Ytterbium	No	Yes	No
Lutetium	No	Yes	No

Source: GAO presentation of Department of Defense reports. | [GAO/a16n/a161](#)

Notes: Two rare earths, cerium and promethium, were not identified as critical. The rare earths are an International Union of Pure and Applied Chemistry named group.

<sup>a</sup>MIBP identified these rare earths as higher risk.

DOD’s current approach to identifying and mitigating risks associated with rare earths is fragmented. With different interpretations of which rare earths are critical, establishing priorities to analyze supply risk becomes difficult. For example, the Defense Logistics Agency/aStrategic Materials office methodically analyzes risks for all materials, but its focus is a founn/ayear timeframe with stockpiling as its mitigation tool. The Manufacturing and Industrial Base Policy office relies on other DOD organizations to identify and elevate risks, relies primarily on the market to resolve supply disruptions, and has not put in place measures to evaluate the success of its mitigating actions. According to DOD, supply disruptions in rare earths have not occurred over the last several years. Regardless, the Strategic Materials Protection Board has not developed a comprehensive approach for ensuring a sufficient supply of rare earths for national security needs—one that can establish criticality, assess supply risks, and identify mitigating actions. Such an approach would better position DOD to help ensure continued functionality in weapon system components should a disruption occur.

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**Abbreviations**

DLA/aStrategic Materials	Defense Logistics Agency/aStrategic Materials
DOD	Department of Defense
MIBP	Office of the Deputy Assistant Secretary of Defense for Manufacturing and Industrial Base Policy
NDA	National Defense Authorization Act
OUSD(AT&L)	Office of the Undersecretary of Defense for Acquisition, Technology and Logistics
Rare earths	Rare earth materials
SMPB	Strategic Materials Protection Board

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February 11, 2016

### Congressional Committees

The Department of Defense (DOD) depends on rare earth materials (rare earths) to provide functionality in weapon systems components.<sup>1</sup> Many steps in the rare earths supply chain, such as mining and refining the ore, are primarily conducted outside the United States, which may pose risks to continued availability of these materials to DOD. For example, in our prior work conducted in 2010, we found that much of the rare earths processing is performed in China, giving it a dominant position that could affect worldwide supply and prices.<sup>2</sup> U.S. industry previously performed all steps in the rare earths supply chain and produced the majority of the global supply but no longer has the capability. DOD reported in 2014 that there have been no availability issues and expects none in the near term. DOD has been generally directed by law since at least 2011 to take actions concerning supply chain vulnerabilities for materials, such as rare earths. The Defense Logistics Agency/aStrategic Materials (DLA/aStrategic Materials) has had management responsibility since 1988 to store select materials—which may include rare earths—in the National Defense Stockpile to mitigate potential shortages.

The Joint Explanatory Statement accompanying the Carl Levin and Howard P. “Buck” McKeon National Defense Authorization Act (NDAA) for Fiscal Year 2015 included a provision for GAO to review DOD efforts to manage risks in its rare earths supply chain, including DLA/aStrategic Materials’ stockpiling efforts. We assessed the extent that DOD (1) determined which rare earths, if any, are critical to national security; and (2) has identified and mitigated risks associated with rare earths, including the effects of a potential supply disruption.

To determine the extent DOD identified which rare earths, if any, were critical to national security, we reviewed DOD reports from 2011 to 2015 to understand the analyses and criteria that DOD conducted and used to

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<sup>1</sup>Rare earth materials refer to items that contain one or more of 17 similar metals, which have unique properties, such as magnetism at high temperatures. The rare earths are an International Union of Pure and Applied Chemistry named group.

<sup>2</sup>GAO, *Rare Earth Materials in the Defense Supply Chain*, [GAO/a10n/a617R](#) (Washington, D.C.: Apr. 14, 2010).

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determine critical rare earths. We also reviewed the actions of DOD components—Air Force, Army, and Navy—to determine if they had identified critical rare earths. In addition, we interviewed DOD and other agencies' officials, such as at the United States Geological Survey, with defense-related industrial base knowledge.

To assess the extent to which DOD has identified risks and taken action to mitigate the risks associated with rare earths, including the effects of a potential supply disruption, we reviewed DOD reports from 2011 to 2015 to understand the analyses conducted, risks identified, and mitigating actions. We also reviewed the actions of DOD components to determine if they had identified any risks in the rare earths supply chain. In addition, we interviewed DOD and other agencies' officials with knowledge of the defense industrial base and management of the National Defense Stockpile.

We conducted interviews and collected information for a non-generalizable sample of 20 cases selected for illustrative purposes based on rare earths and risk management processes, including three DOD offices with purview over weapon systems, three defense contractors, and seven companies. We reviewed DOD's sources of data for its analytical processes. We determined that the information that we collected were sufficiently reliable for our report. We assessed DOD's policies, procedures, and practices against criteria in applicable statutes, *Standards for Internal Control in the Federal Government*, and GAO's framework for risk assessment.<sup>3</sup> A more detailed discussion of our scope and methodology is provided in appendix I.

We conducted this performance audit from February 2015 to February 2016 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

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<sup>3</sup>Ike Skelton National Defense Authorization Act for Fiscal Year 2011, Pub. L. No. 111n/a383 § 843; 10 U.S.C. § 187; 10 U.S.C. § 139c and 50 U.S.C. § 98 et seq. GAO, *Standards for Internal Control in the Federal Government*, [GAO/AIMDn/a00n/a21.3.1](#) (Washington, D.C.: Nov. 1999). *Risk Management: Further Refinements Needed to Assess Risks and Prioritize Protective Measures at Ports and Other Critical Infrastructure*, [GAOn/a06n/a91](#) (Washington, D.C.: Dec. 15, 2005).

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that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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## Background

Rare earths contain one or more of the following 17 elements in the periodic table: the lanthanides that begin with lanthanum (atomic number 57) through lutetium (atomic number 71) and two nonn/alanthanides that have similar properties, yttrium and scandium (see figure 1).

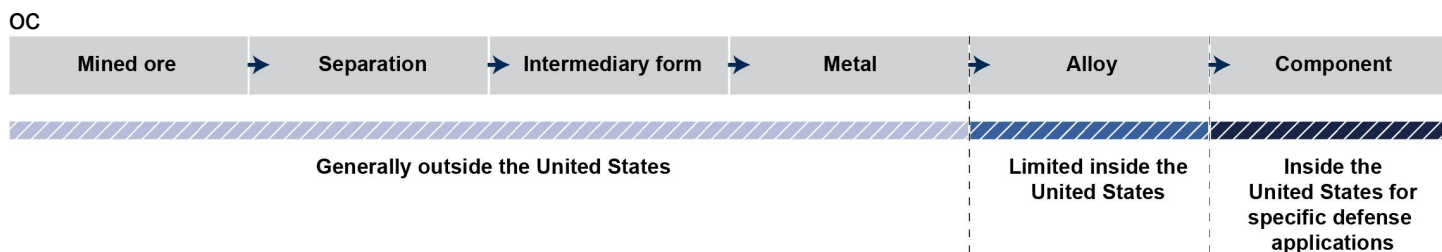




often classified as either heavy or light based, in part, on their chemical properties. According to the United States Geological Survey, heavy rare earth elements are generally less abundant and more expensive due to their scarcity, more unique characteristics, and strong demand relative to the light rare earth elements.<sup>4</sup> DOD has a particular interest in two heavy rare earth elements, yttrium and dysprosium.

Rare earth elements are generally found in mined ore, separated and converted into intermediary forms, such as oxides, and further processing depends on the application. For example, the intermediary form can be turned into a metal, and added to other materials to form an alloy for use in semin/afinished metal components that are incorporated into end products. The United States was the leader in global production of rare earth oxides, metals, and alloys from the 1960s through the 1980s but currently has limited capability. According to a 2013 Congressional Research Service report, global production is prevalent outside the United States due, in part, to lower labor costs and more lenient environmental standards.<sup>5</sup> At present, the United States generally relies on imports from global manufacturers of rare earths, such as metals, alloys, and magnets. See figure 2 for a representative rare earth metals supply chain that is generally outside the United States.

**Figure 2: Generalized Rare Earth Materials Supply Chain for Metal Components**



Source: GAO analysis and presentation of U.S. government and industry reports and interviews. | GAO-16-161

<sup>4</sup>According to the United States Geological Survey, the heavy rare earth elements include yttrium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and lutetium. United States Geological Survey, *Preliminary Estimates of the Quantities of Rare/Earth Elements Contained in Selected Products and in Imports of Semimanufactured Products to the United States, 2010*, Open/Report 2013-1072 (Reston, Va.: 2013).

<sup>5</sup>Congressional Research Service, *Rare Earth Elements in National Defense: Background, Oversight Issues, and Options for Congress*, R41744 (Dec. 23, 2013).

The United States is a major consumer of defense and commercial end products containing rare earths, however, its demand for rare earths is approximately nine percent of the global demand, according to DOD estimates. Also, DOD demand is approximately only one percent of the United States demand. Recent studies have shown that rare earths are essential to the production, sustainment, and operation of U.S. military equipment. Reliable access to the necessary material, regardless of the overall level of defense demand, is a bedrock requirement for DOD.<sup>6</sup> Some defense applications with rare earths are coatings for jet engines, missile guidance systems, antimissile defense systems, satellites, and communication systems. Examples of commercial products with rare earths are automotive catalytic converters, petroleum refining chemicals, flat panel displays, permanent magnets, and rechargeable batteries for hybrid vehicles.

Since 2010, DOD has conducted studies and published reports on various rare earths issues in response to congressional mandates (see table 1 below).

**Table 1: Select Department of Defense Reports on Rare Earth Materials**

<b>Date</b>	<b>Report title</b>
March 2012	<i>Report to Congress Rare Earth Materials in Defense Applications</i>
September 2012	<i>Report to Congress on Assessment of Feasibility and Advisability of Establishment of Rare Earth Material Inventory</i>
September 2012	<i>Report on Feasibility and Desirability of Recycling, Recovery, and Reprocessing Rare Earth Elements</i>
April 2013	<i>Recovery of Rare Earth Elements from Fluorescent Lighting Materials</i>
February 2014	<i>Diversification of Supply Chain and Reclamation Activities Related to Rare Earths</i>
February 2014	<i>Report to Congress on Implementation of Rare Earth Elements Strategy in the Joint Strike Fighter Program</i>

Source: GAO presentation of Department of Defense reports. | GAO/a16n/a161

DOD also periodically issues two reports on the defense industrial base and on “critical” and “strategic and critical” materials.<sup>7</sup> The *Annual Industrial Capabilities Report to Congress* provides analyses of sectors of the defense industrial base such as aircraft and ground vehicles and summarizes the

<sup>6</sup>DOD, Office of the Under Secretary of Defense (Acquisition, Technology & Logistics), *Report of Meeting Department of Defense Strategic Materials Protection Board* (Dec. 12, 2008).

<sup>7</sup>“Critical” and “strategic and critical” are terminology identified in statute. See table 3 for the definitions.

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department's efforts to identify the availability of materials, such as rare earths. The biennial *Strategic and Critical Materials Report on Stockpile Requirements* summarizes DLAN/aStrategic Materials' analyses of materials for the National Defense Stockpile.

In addition, in July 2014 the DOD Inspector General issued a report assessing whether DOD effectively planned for lifen/acyclic sustainment of rare earth elements for the defense industrial base.<sup>8</sup> The DOD Inspector General found that DLAN/aStrategic Materials lacked procedures to validate supply and demand data for its stockpiling model. Further, the Inspector General identified internal control weaknesses related to the assessment of rare earth element supply and demand for defense applications. Specifically, the Inspector General found that DOD lacked a comprehensive and reliable approach to assess rare earth element supply and demand. The DOD Inspector General recommended that DLAN/aStrategic Materials have a plan for using verified and validated data to improve forecasts for the stockpile. DLAN/aStrategic Materials generally agreed, noting that its model is being reviewed and will be accredited.

Three organizations in the department have related statutory requirements to manage risks from DOD's use of "critical" and "strategic and critical" materials, such as rare earths. The three organizations are DLAN/aStrategic Materials and the Office of the Deputy Assistant Secretary of Defense for Manufacturing and Industrial Base Policy (MIBP), both in the Office of the Undersecretary of Defense for Acquisition, Technology and Logistics (OUSD(AT&L)), and the Strategic Materials Protection Board (SMPB). Their select responsibilities are shown in table 2 below.

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<sup>8</sup>U.S. Department of Defense, Inspector General, *Procedures to Ensure Sufficient Rare Earth Elements for the Defense Industrial Base Need Improvement*, DODIG/a2014n/a091 (Alexandria, Va.: July 3, 2014).

**Table 2: Three Department of Defense (DOD) Organizations and Their Select Statutory Responsibilities for Managing Material Risks**

Organization	Select responsibilities	Legal source of responsibility
Defense Logistics Agency/aStrategic Materials (DLAn/aStrategic Materials)	<ul style="list-style-type: none"> <li>Determine materials deemed strategic and critical to national security.</li> <li>Preclude, when possible, a dangerous and costly dependence by the United States upon foreign sources for supplies of such materials in times of national emergency.</li> <li>Issue a biennial report to Congress detailing stockpiling recommendations for the National Defense Stockpile based on certain national emergency planning assumptions. The National Defense Stockpile maintains a domestically held inventory of strategic and critical materials, and certain other materials acquired for or transferred to the stockpile.</li> </ul>	United States Code, Title 50, Section 98, et seq., as added, amended, and delegated
Office of the Deputy Assistant Secretary of Defense for Manufacturing and Industrial Base Policy (MIBP) <sup>a</sup>	<ul style="list-style-type: none"> <li>Ensure reliable sources of materials critical to national security, such as specialty metals, armor plate, and rare earth elements.</li> <li>Establish DOD policies for developing and maintaining the defense industrial base of the United States and for continued reliable resource availability from secure sources.</li> <li>Provide policy and oversight of matters related to materials critical to national security to ensure a secure supply of such materials to DOD.</li> <li>Provide recommendations and acquisition policy guidance on supply chain management and supply chain vulnerability throughout the entire supply chain, from suppliers of raw materials to producers of major end items.</li> </ul>	United States Code, Title 10, Section 139c, as amended
Strategic Materials Protection Board (SMPB) (MIBP, chair; DLAn/aStrategic Materials, vican/achair) <sup>b</sup>	<ul style="list-style-type: none"> <li>Analyze the risk associated with each material SMPB designated as critical to national security and the effect on national defense that the nonavailability of such material would have.</li> <li>Determine the need to provide a long term secure supply of materials designated as critical to national security to ensure that national defense needs are met.</li> <li>Recommend a strategy to the Secretary of Defense to ensure a secure supply of materials designated as critical to national security and recommend other strategies as appropriate to strengthen the industrial base with respect to materials critical to national security.</li> <li>Meet and publish recommendations regarding materials critical to national security not less frequently than once every 2 years in the Federal Register.</li> </ul>	United States Code, Title 10, Section 187, as amended

Source: GAO summary of select DOD responsibilities from United States Code. | GAO/a16n/a161

<sup>a</sup>The Deputy Assistant Secretary for Defense for MIBP is the principal advisor to the Under Secretary of Defense for Acquisition, Technology and Logistics in the performance of the Under Secretary's duties relating to the responsibilities listed here. 10 U.S.C. § 139c(b).

<sup>b</sup>The National Defense Authorization Act for Fiscal Year 2013 named the Deputy Assistant Secretary of Defense for MIBP as the chairman and the Administrator of the DLAn/aStrategic Materials, or any successor organization, as the vican/achairman.

In addition to MIBP and DLAn/aStrategic Materials representation, the SMPB membership is departmentn/wide and includes designees of the Assistant Secretary of the Army for Acquisition, Logistics and Technology

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and the Assistant Secretary of the Navy for Research, Development, and Acquisition.

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## DOD Has Identified Certain Materials as Critical but Approach Not Comprehensive

From 2011 to 2015, DOD identified certain materials, including rare earths, as critical to meet its individual statutory responsibilities, but has not taken a comprehensive approach to identify which of these materials are critical to national security. Based on GAO's prior work, the Office of the Deputy Under Secretary of Defense for Industrial Policy, the predecessor of MIBP, stated that it was collaborating with the Defense Logistics Agency's National Defense Stockpile Center to create departmentn/awide criteria for the terms "critical" and "strategic," and expected to report the results of this effort at the end of calendar year 2008.<sup>9</sup> As of November 2015, there were no departmentn/awide criteria for these terms, but DOD officials said that they were considering discussing the definitions and possibly proposing a group of materials that meet the SMPB's definition of critical to national security. SMPB and OUSD(AT&L) and two of its offices—MIBP and DLAN/aStrategic Materials—have separate, existing statutory definitions for critical materials. See table 3 for the varying definitions of critical materials by organization.<sup>10</sup>

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<sup>9</sup>GAO, *Department of Defense: A Departmentwide Framework to Identify and Report Gaps in the Defense Supplier Base Is Needed*, [GAOn/a09n/a5](#) (Washington, D.C.: Oct. 7, 2008).

<sup>10</sup>Ike Skelton NDAA for Fiscal Year 2011, Pub. L. No. 111n/a383, § 843 (identification of critical rare earth materials in response to statutorily/n/required DOD assessment of supply and demand for critical rare earth materials in defense applications, identifying which, if any, rare earth material meets both of the criteria listed in table 3 here for the Under Secretary of Defense for AT&L); 10 U.S.C. § 187(e); 10 U.S.C. § 139c(d); and 50 U.S.C. § 98hn/a3(1).

**Table 3: Critical Materials Definitions by Organization**

Department of Defense Organization	Office of the Under Secretary of Defense for Acquisition, Technology and Logistics	Strategic Materials Protection Board	Manufacturing and Industrial Base Policy	Defense Logistics Agency/aStrategic Materials
Terms	Critical rare earth materials in defense applications	Materials critical to national security	Materials critical to national security	Strategic and critical materials
Statutory definitions	(a) The rare earth material is critical to the production, sustainment, or operation of significant U.S. military equipment and	(a) Upon which the production or sustainment of military equipment is dependent and	(a) Upon which the production or sustainment of military equipment is dependent and	(a) Would be needed to supply the military, industrial, and essential civilian needs of the United States during a national emergency and
	(b) The rare earth material is subject to interruption of supply, based on actions or events outside the control of the government of the United States	(b) The supply of which could be restricted by actions or events outside the control of the government of the United States	(b) The supply of which could be restricted by actions or events outside the control of the government of the United States	(b) Are not found or produced in the United States in sufficient quantities to meet such need

Source: GAO presentation of statutory definitions. | GAO/a16n/a161

The DOD organizations, generally using their respective definitions and analyses for their individual responsibilities, identified between three and eight of the rare earths as having met the definitions at least once from 2011 to 2015. Overall, 15 of the 17 rare earths were identified as critical at some point in the last 5 years. None of the organizations identified cerium or promethium as having met the definitions during that time period. See table 4 for the rare earths that each DOD organization separately identified as critical in defense applications, critical to national security, or as strategic and critical in different reports.

**Table 4: Rare Earth Materials Meeting Various Definitions of Critical by Office and Report from 2011 to 2015**

Rare earth materials	Office of the Undersecretary of Defense for Acquisition, Technology and Logistics report 2012	Manufacturing and Industrial Base Policy report 2013	Defense Logistics Agency—Strategic Materials report on stockpile requirements 2011	Defense Logistics Agency—Strategic Materials report on stockpile requirements 2013	Defense Logistics Agency—Strategic Materials report on stockpile requirements 2015
Scandium	n/a	n/a	n/a	yes	n/a
Yttrium	yes	no <sup>a</sup>	yes	yes	yes <sup>b</sup>
Lanthanum	n/a	n/a	n/a	n/a	yes
Cerium	n/a	n/a	n/a	n/a	n/a
Praseodymium	yes	n/a	yes	n/a	n/a
Neodymium	yes	n/a	yes	n/a	n/a
Promethium	n/a	n/a	n/a	n/a	n/a
Samarium	n/a	n/a	yes	n/a	n/a
Europium	yes	n/a	yes	n/a	yes
Gadolinium	yes	n/a	n/a	n/a	n/a
Terbium	n/a	no	yes	yes	n/a
Dysprosium	yes	no	yes	yes	n/a
Holmium	n/a	no	n/a	n/a	n/a
Erbium	yes	no	n/a	yes	n/a
Thulium	n/a	no	n/a	yes	n/a
Ytterbium	n/a	no	n/a	n/a	n/a
Lutetium	n/a	no	n/a	n/a	n/a

Source: GAO presentation of Department of Defense Reports. | GAO/a16n/a161

<sup>a</sup>Manufacturing and Industrial Base Policy identified heavy rare earth materials as a category at a higher risk for a supply disruption in 2013. It has not identified any rare earth materials as meeting its definition of materials critical to national security.

<sup>b</sup>Defense Logistics Agency—Strategic Materials specifically identified high purity yttrium oxide.

DOD’s identification of which rare earths, if any, are critical to national security is fragmented.<sup>11</sup> Three DOD organizations separately identified

<sup>11</sup>GAO considers programs or activities to be fragmented when more than one federal agency (or more than one organization within an agency) is involved in the same broad area of national need, which may result in inefficiencies in how the government delivers services. GAO, *Fragmentation, Overlap, and Duplication: An Evaluation and Management Guide*, GAO/a15n/a49SP (Washington, D.C.: Apr. 14, 2015).

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five different lists of rare earths during this time frame using their respective definitions of critical to national security. According to GAO's risk management framework, comprehensive management of risk is a necessary step for agencies, like DOD, to manage and assess risk to help make informed decisions and prioritize resource investments.<sup>12</sup> The SMPB, with the duty of designating specific materials as critical to national security, has reported to Congress in 2007, 2008, and 2011 that its focus is to assess the criticality of materials and to identify which materials are critical to national security, but has not done so.<sup>13</sup> The SMPB acknowledged that identifying the materials critical to national security is necessary to ensure consistency among the DOD offices. However, in a February 2014 letter from MIBP to DLAN/aStrategic Materials, the respective offices of the chair and vice chair of the SMPB, that discusses cooperation concerning the SMPB, the designation of materials critical to national security was not one of the areas outlined for proposed coordination. DOD officials told us that they are generally working toward coordinating MIBP's sector analyses of the defense industrial base—such as aircraft and ground vehicles—with DLAN/aStrategic Materials' analyses that support recommendations for materials to stockpile in order to have a more comprehensive understanding of supply chains.

DLAN/aStrategic Materials' responsibility for determining materials to stockpile under certain scenarios has been considered by some within

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<sup>12</sup>GAO developed a framework for risk management based on industry best practices and other criteria, such as past GAO work and feedback from academic experts in risk management. The risk management framework is divided into five major phases: (1) setting strategic goals and objectives, and determining constraints; (2) assessing the risks; (3) evaluating alternatives for addressing these risks; (4) selecting the appropriate alternatives; and (5) implementing the alternatives and monitoring the progress made and results achieved. [GAO/a06n/a91](#). GAO, *Risk Management: Strengthening the Use of Risk Management Principles in Homeland Security*, [GAO/a08n/a904T](#) (Washington, D.C.: June 25, 2008).

<sup>13</sup>The SMPB, in December 2008, reported only beryllium met its definition of a material critical to national security, that is, a strategic material for which (1) DOD dominates the market for the material; (2) DOD's full and active involvement and support are necessary to sustain and shape the market; and (3) there is significant and unacceptable risk of supply disruption. The House Report accompanying the NDAA for Fiscal Year 2010 expressed concern about the narrow limits of SMPB's definition. H.R. Rep. No. 111n/a168, at 350 (2010). The Ike Skelton NDAA for Fiscal Year 2011 added a new definition of materials critical to national security for SMPB purposes to mean those materials upon which the production or sustainment of military equipment is dependent and the supply of which could be restricted by actions or events outside the control of the government of the United States. Pub. L. No. 111n/a383, § 829. To date, the SMPB has not designated any materials as critical to national security.



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DOD as a means to ensure materials critical to national security are available. For example, MIBP officials told us that they rely on DLAN/aStrategic Materials' analyses and expertise for other responsibilities such as MIBP's Title 10 responsibilities of ensuring reliable sources of materials critical to national security. However, DLAN/aStrategic Materials officials caveat their analyses as being valid for a single point in time and for decisions related to their title 50 responsibilities for the National Defense Stockpile, and not for other statutory responsibilities such as identification of materials critical to national security in the Title 10 definitions. To demonstrate that its analyses are valid for a specific point in time, DLAN/aStrategic Materials officials indicated that the identification of rare earths that meet the definition for strategic and critical may differ over time, unlike OUSD(AT&L)'s and MIBP's lists, which have not changed. In addition, the DODn/acreated emergency scenarios may change for each biennial analysis, which affects DLAN/aStrategic Materials identification of which materials meet the definition for strategic and critical. Moreover, DLAN/aStrategic Materials officials told us that they are not responsible for designating if a material is strategic and critical but are tasked with determining if a material is estimated to have a shortfall in a given year based upon DOD emergency scenarios.

In addition to DOD's differing lists of critical rare earths, weapon system officials at the military departments that we spoke with also have identified what they consider as critical rare earths in their systems, but this information is not reported consistently or departmentn/awide. These officials do not have a definition for critical materials nor do they have an agreed upon departmentn/awide list of critical rare earths, but they know which rare earths provide enabling functionality in the weapon systems. For example, a subject matter expert on lasers at Naval Surface Warfare–Crane told us that the rare earth component in certain defense lasers is what creates and focuses the light beam. In another example, officials at the Army Program Executive Office for Ammunition told us that rare earth magnets enable guided artillery ammunition to move in flight to the target. Further, Army Research Laboratory officials told us that they could better focus their work on specific rare earths if there was a departmentn/awide list of rare earths critical to national security.

Implementation of controls consistent with federal internal control standards provides management with some added confidence regarding the achievement of objectives, provides feedback on how effectively an entity is operating, and helps reduce risks affecting the achievement of the entity's objectives. In particular, these standards state that

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management is to use data to create quality information that is appropriate, current, complete, accurate, accessible, and provided on a timely basis; and internally communicate the necessary quality information. Information and communication are necessary to create an effective internal control system that informs the allocation of resources in relation to the areas of greatest risk relevant to achieving the entity's objectives, such as efficient operations.<sup>14</sup>

From an industry perspective, we spoke with five defense and petroleum corporations that took steps to assess risk to help make informed decisions and prioritize resource investments. Company officials we spoke with generally said that they determine what materials are critical by obtaining data and communicating across product lines. Officials from three corporations stated that they have a process to gather data throughout the company and decide what materials may be critical to the company as a whole. For example, an official from one company stated that it regularly collects data from manufacturing divisions across the company and differentiates critical materials by their ability to create a production line stoppage. For potential material shortages that can stop production, for example, company officials may have regular meetings with the suppliers, forecast supplies 6 months into the future, adjust contracting arrangements, and have mitigation actions in place.

Given the differing interpretations of what rare earths are critical according to the individual responsibilities of each organization, DOD has not taken the next step to identify an appropriate, complete, timely list of department-wide rare earths critical to national security. Without taking a comprehensive department-wide approach to determine which rare earths, if any, are critical to national security, DOD is not in the best position to communicate and effectively focus resources across the department and align efforts to ensure the supply of rare earths critical to national security.

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<sup>14</sup>[GAO/AIMDn/a00n/a21.3.1.](#)

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## DOD Identifies Supply Disruption Risk in a Limited Manner and Has Not Proactively Analyzed the Impact of Rare Earths Unavailability

Rare earths risk assessment is, in part, a function of the probability of a supply disruption and the vulnerability of a weapon system or supply chain to the disruption. Although DOD regularly identifies supply disruption risks, it has not taken a comprehensive approach to assess and mitigate those risks, including analyzing the effect of unavailability of rare earths designated as critical to national security which is statutorily required. Fortunately, these types of supply disruptions have not materialized over the last several years, but DOD's current ability to respond may not be sufficient should they materialize in the future. Specifically, DLAN/aStrategic Materials estimates the risk of supply shortfalls through a biennial assessment process and makes recommendations for acquiring certain materials for the National Defense Stockpile. MIBP also has taken some action to identify supply disruption risks, but its mitigating strategy is reactive in nature. However, the SMPB, chaired and vice-chaired by officials of MIBP and DLAN/aStrategic Materials respectively, with the responsibility for analyzing the effect of unavailability of materials such as rare earths critical to national security may have on national defense, has not done so. Moreover, DOD has not established internal controls to measure risk and the effectiveness of its mitigating actions. Rather, DOD has taken actions without knowing the extent of the underlying risks that the unavailability of rare earths would have on its weapon systems specifically and national defense generally.

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## DLAN/aStrategic Materials Estimates the Risk of Supply Shortfalls Using National Emergency Scenarios and Recommends Materials to Stockpile

DOD identifies potential supply disruption risks and takes some mitigating actions through DLAN/aStrategic Materials' biennial process of assessing material shortfall risks and making recommendations to acquire certain materials for the National Defense Stockpile. The assessments are not designed to be comprehensive but are limited to a four-year time frame related to DOD defined national emergencies. The resulting shortfall risks are an estimated deficiency of materials for essential civilian and defense needs during a period of recovery after accounting for existing mitigating options, such as substitution of other materials to fill the deficiency. In each of its 2011, 2013, and 2015 assessments, DLAN/aStrategic Materials considered between three and seven specific rare earths at risk for a shortfall—15 in all.

The assessment process is limited to DODn/acreated national emergency scenarios. These scenarios cover a four-year time frame in which the first year is assumed to be a period of conflict, and years two through four are assumed to be a period of recovery. The one year period of conflict takes into consideration the following conditions: (1) a catastrophic attack on a U.S. city by a foreign terrorist organization or rogue state, (2) two near simultaneous major combat operations, (3) conflict damage from a

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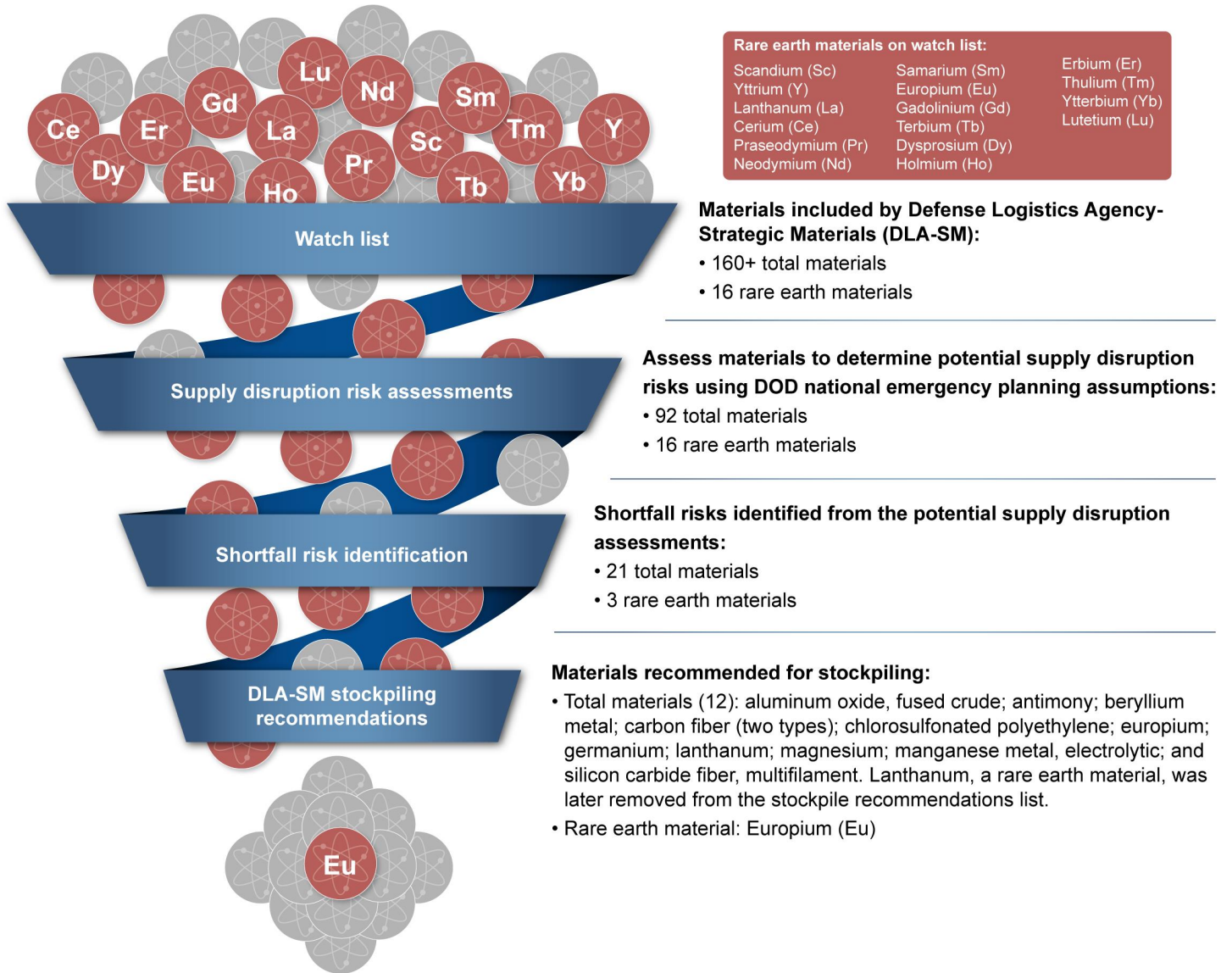
highly capable enemy, and (4) ongoing military operations such as a military presence in a foreign country. According to DOD officials, rare earths from the National Defense Stockpile have not been used.

DLAn/aStrategic Materials' process to assess material shortfalls, in order to meet select statutory requirements, is methodical and has many steps. Among the ongoing data collection and analysis efforts, first, DLAn/aStrategic Materials includes materials of concern on a "watch list" based on input from other DOD organizations. Second, it conducts initial research to determine which materials on the watch list to further analyze based on the potential for a supply disruption of the materials that may lead to a shortfall deficiency. This initial research is, in part, based on demand and supply data from industry and public sources. Third, DLAn/aStrategic Materials uses estimating models to assess shortfall risks. Fourth, to address mitigating actions, DLAn/aStrategic Materials uses its judgment to determine which materials with shortfall risks that it will recommend for stockpiling to the Congress. See figure 3 for materials that DLAn/aStrategic Materials assessed in 2015, including rare earths.<sup>15</sup>

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<sup>15</sup>DOD, Under Secretary of Defense for Acquisition, Technology and Logistics, *Strategic and Critical Materials 2015 Report on Stockpile Requirements*, 9n/a05A8E24 (Jan. 2015).

**Figure 3: Defense Logistics Agency/aStrategic Materials 2015 Assessment of Materials and Stockpiling Recommendations**



Source: GAO analysis of Defense Logistics Agency--Strategic Materials report from 2015. | GAO-16-161

DLA/aStrategic Materials may conduct additional research, referred to as “deep dives,” on select materials or products to inform its decision on materials to recommend for stockpiling. See table 5 for a list of additional research conducted on rare earths from 2011 through 2015.

**Table 5: Defense Logistics Agency/Strategic Materials Deep Dives on Rare Earth Materials from 2011 to 2015**

Rare earth material	Time frame
Terbium	2011
Neodymium iron boron magnets	2011n/apresent
Samarium cobalt magnets	2011n/a2012
Yttrium	2012n/a2015
Scandium	2013n/a2015
Recycled rare earth materials	2013n/a2014
Europium	2015 (pending)
Ytterbium	2015 (pending)

Source: GAO analysis of Defense Logistics Agency/Strategic Materials reports from 2011 to 2015. | GAO/a16n/a161

To mitigate shortfall risks, DLAN/Strategic Materials recommended stockpiling dysprosium and yttrium in 2013, and europium in 2015. See figure 4 below for the rare earths DLAN/Strategic Materials identified with shortfall risks and recommended for stockpiling.

**Figure 4: Department of Defense Shortfall Risks Identified from 2011 to 2015**

Identified with supply disruption risks	Recommended for stockpiling		
	2011	2013	2015
	<ul style="list-style-type: none"> <li>• Yttrium</li> <li>• Praseodymium</li> <li>• Neodymium</li> <li>• Samarium</li> <li>• Europium</li> <li>• Terbium</li> <li>• Dysprosium</li> </ul>	<ul style="list-style-type: none"> <li>• Yttrium</li> <li>• Dysprosium</li> <li>• Scandium</li> <li>• Terbium</li> <li>• Erbium</li> <li>• Thulium</li> </ul>	<ul style="list-style-type: none"> <li>• Europium</li> <li>• Yttrium<sup>a</sup></li> <li>• Lanthanum</li> </ul>

Source: GAO analysis of Defense Logistics Agency-Strategic Materials reports from 2011 – 2015. | GAO-16-161

<sup>a</sup>Defense Logistics Agency–Strategic Materials specifically identified high purity yttrium.

DLAN/Strategic Materials may identify a shortfall risk but not take mitigating actions for various reasons. For example, erbium and thulium had shortfall risks in 2013, but DLAN/Strategic Materials did not recommend stockpiling them due to limited defense applications; limited data; and prioritization of more important materials, such as yttrium. In another instance, lanthanum had a shortfall risk in 2015, but DLAN/Strategic Materials did not recommend it for stockpiling due to the

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availability of the material from companies in Australia, with which the United States has an agreement for priority delivery for defense needs.<sup>16</sup>

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### MIBP Identified Some Risks Related to Ensuring a Secure Supply of Rare Earths but Its Mitigation Strategy Is Reactive

MIBP also took actions to address supply disruption risks by identifying the risk of unavailability of heavy rare earths—those that are generally less abundant and more expensive due to their scarcity—used in defense applications. Heavy rare earths are at risk for a supply disruption due to the concentration of production outside the United States, which MIBP described in OUSD(AT&L)'s 2013 *Annual Industrial Capabilities Report to Congress*, the last one completed at the time of our review. MIBP based its analysis, in part, on public and industry supply and demand forecasts for rare earths and interviews with federal officials, subject matter experts, military service officials, and industry representatives, among other sources, according to officials.

To mitigate the risk, MIBP's strategy relies on the market: (1) to find new sources of rare earths driven by increasing demand, (2) to discover substitutes for rare earths, and (3) to support initiatives for recycling rare earths from waste products. MIBP's strategy is reactive, that is waiting for a supply disruption to occur and relying on the market to respond. Moreover, it may not be realistic. First, industry experts said that new mines and processing facilities are not economically viable as prices for rare earths have decreased and remain low. Second, Army officials, weapon systems subject matter experts, and industry representatives said that substitutes for some rare earths are not preferred or do not exist at this time. Third, while stating in 2012 that recycling initiatives could mitigate some supply risks, DOD determined that recycling is not economically feasible in 2014.<sup>17</sup>

In addition, MIBP does not have internal controls necessary to implement and monitor its strategy. Specifically, it has not established metrics to assess the extent to which its strategy could have mitigated the risk for a

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<sup>16</sup>The bilateral Security of Supply arrangement between Australia and the United States allows DOD to request priority delivery for DOD contracts, subcontracts, or orders from companies in Australia. Similarly, the arrangement allows Australia to request priority delivery for their contracts and orders with U.S. companies.

<sup>17</sup>Department of Defense, Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, *Diversification of the Supply Chain and Reclamation Activities Related to Rare Earths*, 7n/aA4D556E (Feb. 2014).

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potential supply disruption of heavy rare earths. Nor has it defined the terms “reliable sources” and “secure supply” that are necessary to establish such metrics according to internal controls that call for identifying acceptable risk tolerances for what is reliable and secure. According to DOD officials, potential measures could be past performance history, including timeliness of delivery, or the financial health of companies in the rare earths supply chain. Further, MIBP has not defined the metrics for evaluating the extent of risk and the effectiveness of its strategy because, as indicated earlier it relies on the market to respond to a supply disruption. Without such metrics, it will be difficult for MIBP to monitor and adjust its mitigating actions.

In addition to its stated strategy, MIBP officials said to identify potential supply disruption risks for materials, such as rare earths, they rely on the military departments and program offices to elevate issues so that MIBP can react to them as they “bubble up.” Similarly in our 2008 report on DOD’s industrial policy, we found that DOD used an informal approach to identify suppliers/base concerns, often relying on the military services, program offices, or prime contractors to identify and report these concerns, including gaps or potential gaps. We further found that as there was no requirement for when to report such gaps to higher/level offices, knowledge of defense suppliers/base gaps across DOD could be limited.<sup>18</sup> Currently, MIBP partly relies on the Joint Industrial Base Working Group, which consists of department/wide representatives, to identify industrial base issues, such as rare earths unavailability or supply risk. We found that no guidance exists for when military departments and program offices are to report rare earth supply disruption risks, but MIBP officials reported that rare earths have never come up as an issue in the working group.

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## DOD Has Not Analyzed the Effects of a Supply Disruption on National Defense

The SMPB, chaired and vice-chaired by MIBP and DLAN/aStrategic Materials, has not taken a broader approach to comprehensively address the underlying risks of the unavailability of rare earths, including determining the effects and possible mitigating actions of the unavailability of rare earths, by leveraging the dispersed expertise that exists in the department. The current approach is thus fragmented. For example, although MIBP has offered a strategy to ensure a reliable supply, SMPB has not taken the additional step of assessing and building

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<sup>18</sup>[GAO/a09n/a5](#).



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upon MIBP's work to develop and recommend a department-wide strategy. Further, although DLA's Strategic Materials' stockpiling efforts are proactive, according to DOD officials, the department has never used the rare earths from the National Defense Stockpile and does not know the time and cost to establish the capability to process the stockpiled material into a usable form, a necessary step to implement mitigating actions. Currently, there is a limited commercial capability in the United States for processing certain types of rare earths used in defense applications, according to government and industry officials. We previously reported in April 2010 that rebuilding a domestic rare earths supply chain may take significant time and money.<sup>19</sup> Industry representatives we spoke with during this review agreed that while there is domestic expertise, with limited domestic capability, turning certain stockpiled rare earths into a useable form would most likely have to be conducted outside the United States, which may also introduce risks of a supply disruption. SMPB has also not built upon DLA's Strategic Materials work to understand what is necessary to use the stockpiled materials.

According to defense officials, complete data on the use of rare earths in the defense industrial base are limited and challenging to collect, which can limit assessments of the defense supply chain needed to comprehensively address risks. For example, the Defense Contract Management Agency–Industrial Analysis Center, which conducts analyses of the industrial base for DOD, surveyed prime contractors and select subcontractors of acquisition category I programs—with a procurement cost of more than \$2.79 billion—about their supply chains for rare earths.<sup>20</sup> According to Industrial Analysis Center officials, only 10 percent of surveys sent to prime contractors for 79 acquisition category I programs in July 2014 were returned with meaningful information. The prime contractors reported that among the reasons for not responding were concerns about the release of sensitive information and non-disclosure agreements with suppliers.

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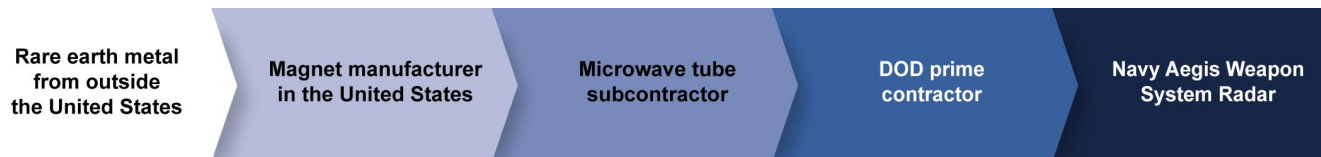
<sup>19</sup>[GAO/a10n/a617R](#).

<sup>20</sup>According to DOD Instruction 5000.02n/a *Operation of the Defense Acquisition System* (Jan. 7, 2015), acquisition category I programs are major defense acquisition programs with a dollar value for all increments of the program estimated by the Defense Acquisition Executive to require an eventual total expenditure for research, development, and test and evaluation of more than \$480 million or, for procurement, of more than \$2.79 billion in fiscal year 2014 constant dollars.

Although officials from MIBP and DLAN/aStrategic Materials also told us that their offices do not have the resources to track rare earths through defense supply chains from ore to weapon system, the SMPB has not leveraged the department’s dispersed expertise in order to analyze the impact of unavailability on national defense. We found DOD officials who understood the vulnerability and effect of unavailability of rare earths based on their knowledge of the supply chain for select weapon systems. For example, a DODn/a-wide subject matter expert in radars at Naval Surface Warfare Center–Crane told us that rare earth magnets enable microwave tubes to effectively focus the radar’s energy. Without the magnets, the radars cannot function and provide the needed capability to the warfighter. Further, he said that there are no substitutes for the rare earths in these magnets. His assessment was based, in part, on his knowledge of and relationships with subn/atier contractors and weapon system program officials. See figure 5 for a graphic example of how rare earths enter the defense supply chain for radars based on information from a defense industrial base report on radars, a subject matter expert and other DOD officials, and company representatives. He added that after the potential unavailability of rare earths in 2010, the Navy made a deliberate effort to understand the materials, vendors, and supply chains for DOD radars in order to determine the impact if rare earths were unavailable. We found the Navy’s efforts are similar to some of the company approaches, discussed earlier, for managing risk. DLAN/aStrategic Materials officials later said that it is not always necessary to track a material through the supply chain to the weapon system to make a stockpiling recommendation but did so when beneficial. For example, for scandium used in ships, DLAN/aStrategic Materials did conduct a study that went from mine to platform and included program offices and prime contractors in their research due to specific manufacturing issues.

**Figure 5: Example of Rare Earth Materials in the Radar Supply Chain**

Rare earth material magnets enable microwave tubes to effectively focus the radar’s energy.



Source: DOD report and interviews with DOD officials and company representatives. | GAO-16-161

Federal internal control standards state that management should define objectives clearly to enable the identification of risks and define risk

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tolerances in specific and measurable terms, including defining what is to be achieved, who is to achieve it, how it will be achieved, and time frames for achievement.<sup>21</sup> Ultimately, SMPB has a goal of ensuring availability of rare earths that are critical to national security. DOD has taken actions without knowing the extent of the underlying risks the unavailability of rare earths have on its weapon systems specifically and national defense generally. By taking a comprehensive approach to meet this goal, such as addressing processing of stockpiled materials from identified shortfalls and defining metrics to measure risk and mitigating actions, the SMPB may be better positioned to guide other DOD offices when to report rare earths availability issues and to analyze the impact of the unavailability of the materials.

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<sup>21</sup>[GAO/AIMDn/a00n/a21.3.1.](#)

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## Conclusions

Reliable access to the material it needs, such as rare earths, is a bedrock requirement for DOD. Accordingly, a department-wide approach that facilitates DOD focusing its resources on those rare earths that are critical to national security would enable the department to meet its needs before supply for a specific rare earth becomes an emergency. However, DOD has no comprehensive, department-wide approach to determine which rare earths are critical to national security, and how to deal with potential supply disruptions to ensure continued, reliable access. It is important that such an approach includes, for example, leveraging the dispersed expertise in the department to identify which rare earths are critical, analyzing risks to their supply and the effects of a potential disruption, and taking actions to mitigate the specific risks. Developing a comprehensive approach for ensuring a sufficient supply of rare earths for national security needs—one that can establish criticality, assess supply risks, and identify mitigating actions—would better position DOD to help ensure continued functionality in weapon system components should a disruption occur, even though supply disruptions in rare earths have not occurred over the last several years. SMPB, with its statutory responsibility and leadership from MIBP and DLA/Strategic Materials, is well-positioned to take the lead on such an approach.

There is not yet agreement on what constitutes “critical” rare earths. While various organizations’ definitions of critical may be similar, DOD has identified 15 of the 17 rare earths as critical over the last 5 years. This makes establishing priorities to analyze supply risk difficult. DLA/Strategic Materials does a methodical job of analyzing risks for all materials, but its focus is a four-year timeframe with stockpiling as its mitigation tool. MIBP relies on other DOD organizations to identify and elevate risks, relies primarily on the market to resolve supply disruptions, and has not put in place measures to evaluate the success of its mitigating actions. The efforts by the military departments, such as the Navy, to identify and mitigate risks by monitoring the defense supplier base have been limited in scope or lacked department-wide involvement. Without clear definitions and metrics to identify associated risk tolerances, it will be difficult for MIBP to monitor and adjust its mitigating actions.

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## Recommendations for Executive Action

To fully identify and mitigate risks associated with the availability of rare earths, we recommend that the Secretary of Defense take the following three actions:

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- Direct the SMPB to designate which, if any, rare earths are critical to national security in order to provide a common DOD understanding of those materials and focus resources.
  - Direct the SMPB to analyze the effect of unavailability of rare earths designated as critical to national security and develop a strategy to help ensure a secure supply for those designated critical to national security.
  - Direct MIBP to define reliable sources and secure supply for rare earths in measurable terms and to provide metrics to determine the effectiveness of its actions to better ensure continued availability.

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## Agency Comments and Our Evaluation

We provided a draft of this report to DOD for review and comment. DOD concurred with all our recommendations. DOD's written comments are reprinted in appendix II. DOD and the United States Geological Survey also provided technical comments that we incorporated into the report as appropriate.

DOD concurred with our first two recommendations to the Secretary of Defense to direct the SMPB to designate which rare earths, if any, are critical to national security and to analyze the effects of the unavailability of rare earths critical to national security. In DOD's written response it identified that the SMPB will convene a meeting with the purpose of accomplishing both these tasks before the end of fiscal year 2016.

DOD also concurred with our recommendation to the Secretary of Defense to direct MIBP to define reliable sources and secure supply for rare earths and provide metrics to determine the effectiveness of its actions. In response DOD wrote that MIBP addresses this recommendation by carrying out its responsibilities under 10 U.S.C. § 139c by providing its input to the Secretary of Defense's *Biennial Report on Stockpile Requirements* and that the metrics and analyses used in *Biennial Report on Stockpile Requirements* do evaluate the effectiveness of the department's actions. However, we are concerned whether the *Biennial Report on Stockpile Requirements* addresses the department's responsibilities under 10 U.S.C. § 139c. As stated earlier in the report, in carrying out responsibilities under 50 U.S.C. § 98 et seq., DLAN/aStrategic Materials officials caveat their analyses as being valid for a single point in time and for decisions related to the National Defense Stockpile and not for other statutory responsibilities such as MIBP's identification of materials critical to national security in 10 U.S.C. § 139c. Further, MIBP, in its response, has not explained how its input for the *Biennial Report on Stockpile Requirements* will define reliable sources

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and secure supply, and what metrics that the report will provide to determine the effectiveness of the department's mitigation efforts.

In addition, DOD, in its technical comments, disagreed with our characterization that DOD has no department-wide approach for critical materials. We agree that DLA's Strategic Materials' process may be ongoing, methodical, and incorporate information from DOD, government, and industry sources, however, as stated in the report, the assessments are limited to a four-year time frame related to DOD defined national emergencies. Further, during our review, DLA's Strategic Materials officials told us that they caveat their analyses as being valid for a single point in time and for decisions specifically related to the National Defense Stockpile, and thereby not necessarily for determining criticality for national security purposes. We continue to believe our findings demonstrate the need for a comprehensive approach for ensuring a sufficient supply of rare earths for national security needs—one that can establish criticality, assess supply risks, and identify mitigating actions—beyond planning scenarios used for purposes of the National Defense Stockpile. Such an approach would better position DOD to help ensure continued functionality in weapon system components should a disruption occur.

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We are sending copies of this report to the appropriate congressional committees and the Secretary of Defense. In addition, the report is available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-4841 or [makm@gao.gov](mailto:makm@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix III.



Marie A. Mak  
Director  
Acquisition and Sourcing Management

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*List of Committees*

The Honorable John McCain  
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The Honorable Jack Reed  
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Committee on Armed Services  
United States Senate

The Honorable Thad Cochran  
Chairman  
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The Honorable Rodney Frelinghuysen  
Chairman  
The Honorable Pete Visclosky  
Ranking Member  
Subcommittee on Defense  
Committee on Appropriations  
House of Representatives

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# Appendix I: Objectives, Scope, and Methodology

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The Joint Explanatory Statement accompanying the Carl Levin and Howard P. “Buck” McKeon National Defense Authorization Act (NDAA) for Fiscal Year 2015 included a provision for GAO to review the Department of Defense’s (DOD) efforts to identify and mitigate risks in its rare earth materials (rare earths) supply chain, including the Defense Logistics Agency’s Strategic Materials’ (DLA/aStrategic Materials) stockpiling efforts. We assessed the extent that DOD (1) determined which rare earths, if any, are critical to national security; and (2) has identified and mitigated risks associated with rare earths, including the effects of a potential supply disruption.

To determine the extent DOD identified which rare earths, if any, were critical to national security, we reviewed DOD reports from 2011 to 2015 to understand the analyses and criteria that DOD conducted and used to determine critical rare earths. We selected 2011 to 2015, because we last reported on rare earths in 2010. We reviewed DOD reports from the Office of the Undersecretary of Defense for Acquisition, Technology, and Logistics including the biennial *Strategic and Critical Materials Report on Stockpile Requirements for the National Defense Stockpile* and the *Annual Industrial Capabilities Report* from 2011 through 2015 to determine the analyses DOD had conducted to identify which rare earths may be critical. We reviewed relevant legislation including the Strategic and Critical Materials Stock Piling Act (50 U.S.C. § 98 et seq.), 10 U.S.C. § 139c that outlines the responsibilities of the Office of the Deputy Assistant Secretary of Defense for Manufacturing and Industrial Base Policy (MIBP), and 10 U.S.C. § 187 that outlines the duties of the Strategic Materials Protection Board (SMPB). We also reviewed available meeting minutes from the SMPB from 2007 through 2015. Further we reviewed relevant DOD components’ actions to determine if they had separately identified any critical rare earths in their supply chains. We interviewed DOD officials from MIBP, SMPB, and DLA/aStrategic Materials, which is the program manager of the National Defense Stockpile. In addition, we collected data, documents, and conducted interviews with officials from the DOD components, such as Defense Procurement and Acquisition Policy and the Office of the Assistant Secretary of Defense for Logistics and Materiel Readiness, the military departments—Air Force, Army, and Navy—and their respective research laboratories, and members of the Joint Industrial Base Working Group. We collected data supporting DLA/aStrategic Materials assessment of materials from 2011 to 2015, documents, and conducted interviews with officials at other offices and agencies that had knowledge of rare earths, the defense industrial base, and the National Defense Stockpile including: Office of the Inspector General; Defense Logistics Agency, Warstopper



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Program; Congressional Research Service; the Department of the Interior, United States Geological Survey; Department of Commerce, Bureau of Industry and Security; and the Department of Energy.

To assess the extent to which DOD has identified risks and taken action to mitigate the risks associated with the availability of rare earths, and analyzed the effects of a potential supply disruption, we reviewed DOD reports from 2011 to 2015 to understand the analyses DOD had conducted to identify risks related to the availability of rare earths and any mitigating actions. We reviewed DOD reports from the Office of the Undersecretary of Defense for Acquisition, Technology, and Logistics including the biennial *Strategic and Critical Materials Report on Stockpile Requirements for the National Defense Stockpile* and the *Annual Industrial Capabilities Report* from 2011 through 2015 to determine the analyses DOD had conducted to identify and mitigate risks from rare earths. We reviewed relevant legislation including the Strategic and Critical Materials Stock Piling Act (50 U.S.C. § 98 et seq.), 10 U.S.C. § 139c that outlines the responsibilities of MIBP, and 10 U.S.C. § 187 that outlines the duties of the SMPB. In addition, we reviewed applicable policies, such as DOD Instruction 5000.60, *Defense Industrial Base Assessments* (July 18, 2014), to determine additional requirements for DOD in managing risks in its rare earths supply chain. We also reviewed available meeting minutes from the SMPB from 2007 through 2015. Further we reviewed relevant DOD components' actions to determine if they had separately identified any risks from rare earths in their supply chains and taken mitigating actions. We interviewed DOD officials from MIBP, SMPB, and DLAN/aStrategic Materials, the program manager of the National Defense Stockpile. We also collected documents and conducted interviews with the Institute for Defense Analyses, a notn/afor/aprofit corporation that operates three federally funded research and development centers, that conducts research and created and operates the econometric model for DLAN/aStrategic Materials; and with Oak Ridge National Laboratory, a federally funded research and development center that developed the Strategic Materials Analysis and Reporting Topography software tool. In addition, we collected data, documents, and conducted interviews with officials from the DOD components, such as Defense Procurement and Acquisition Policy and the Office of the Assistant Secretary of Defense for Logistics and Materiel Readiness, the military departments—Air Force, Army, and Navy—and their respective research laboratories, and members of the Joint Industrial Base Working Group. We collected data, documents, and conducted interviews with officials at other offices and agencies that had knowledge of rare earths, the defense industrial base, and the National Defense

Stockpile including: Defense Contract Management Agency–Industrial Analysis Center; Office of the Inspector General; Defense Logistics Agency, Warstopper Program; Congressional Research Service; the Department of the Interior, United States Geological Survey; Department of Commerce, Bureau of Industry and Security; and the Department of Energy.

We conducted interviews and collected information for a nonn/ageneralizable sample of 20 cases for illustrative purposes on rare earths and materials risk management that included:

- Three DOD offices (Naval Surface Warfare Center–Crane both Radars and Lasers, and Army Program Executive Office for Ammunition) with purview over at least seven weapon systems selected on rare earths in the weapon systems;
- Three vendors of rare earth components selected on rare earths in their products;
- Two rare earths companies selected on rare earths in their products;
- One trade association selected on its involvement in the rare earth industry;
- Six individuals selected on their knowledge of rare earths;
- Three defense contractors selected on their defense products and materials risk management processes; and
- Two companies, including a petroleum company, selected on their materials risk management processes.

We reviewed DOD’s sources of data for its analytical processes. Based on our review, we determined that the information that we collected were sufficiently reliable for our report. We assessed DOD’s policies, procedures, and practices against criteria in applicable statutes, *Standards for Internal Control in the Federal Government*, and GAO’s framework for risk assessment.<sup>1</sup>

We conducted this performance audit from February 2015 to February 2016 in accordance with generally accepted government auditing

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<sup>1</sup>Ike Skelton National Defense Authorization Act for Fiscal Year 2011, Pub. L. No. 111-383 § 843; 10 U.S.C. § 187; 10 U.S.C. § 139c and 50 U.S.C. § 98 et seq. GAO, *Standards for Internal Control in the Federal Government*, [GAO/AIMD-00-21.3.1](#) (Washington, D.C.: Nov. 1999). *Risk Management: Further Refinements Needed to Assess Risks and Prioritize Protective Measures at Ports and Other Critical Infrastructure*, [GAO-06-91](#) (Washington, D.C.: Dec. 15, 2005).

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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.

# Appendix II: Comments from the Department of Defense



LOGISTICS AND  
MATERIEL READINESS

ASSISTANT SECRETARY OF DEFENSE  
3500 DEFENSE PENTAGON  
WASHINGTON, DC 20301-3500

FEB 1 2016

Ms. Marie A. Mak  
Director, Acquisition and Sourcing Management  
U.S. Government Accountability Office  
441 G Street, N.W.  
Washington, DC 20548

Dear Ms. Mak:

Thank you for the opportunity to provide comments on this draft report. This is the Department of Defense (DoD) response to the Government Accountability Office (GAO) Draft Report, GAO-16-161, "RARE EARTH MATERIALS: Developing a Comprehensive Approach Could Help DoD Better Manage National Security Risks in the Supply Chain" dated December 18, 2015 (GAO Code 100072). Detailed comments on the report recommendations are enclosed.

Sincerely,

  
David J. Berteau

Enclosure:  
As stated

GAO Draft Report Dated December 18, 2015  
GAO-16-161 (GAO CODE 100072)

“RARE EARTH MATERIALS: DEVELOPING A COMPREHENSIVE APPROACH  
COULD HELP DOD BETTER MANAGE NATIONAL SECURITY RISKS IN THE  
SUPPLY CHAIN”

DEPARTMENT OF DEFENSE COMMENTS  
TO THE GAO RECOMMENDATION

**RECOMMENDATION 1:** The Government Accountability Office (GAO) recommends that the Secretary of Defense direct the Strategic Materials Protection Board (SMPB) to designate which, if any, rare earths are critical to national security in order to provide a common DoD understanding to those materials and focus resources.

**DoD RESPONSE:** Concur. As Chair and Vice Chair of the Strategic Materials Protection Board, MIBP and DLA Strategic Materials will convene a meeting of the Board with the purpose of designating which, if any, rare earths are critical to national security prior to the end of the 3rd quarter of Fiscal Year 2016.

**RECOMMENDATION 2:** The Government Accountability Office (GAO) recommends that the Secretary of Defense direct the SMPB to analyze the effect of unavailability of rare earths designated as critical to national security and develop a strategy to help ensure a secure supply for those designated critical to national security.

**DoD RESPONSE:** Concur. As Chair and Vice Chair of the Strategic Materials Protection Board, MIBP and DLA Strategic Materials will convene a meeting of the Board with the purpose of analyzing the effect of unavailability of rare earths designated as critical to national security prior to the end of the 3rd quarter of Fiscal Year 2016. In accordance with 10 U.S.C. §187, the SMPB will recommend a strategy to help ensure a secure supply for those designated critical to national security before the end of Fiscal Year 2016.

**RECOMMENDATION 3:** The Government Accountability Office (GAO) recommends that the Secretary of Defense direct Manufacturing and Industrial Base Policy (MIBP) to define reliable sources and secure supply for rare earths in measurable terms and to provide metrics to determine the effectiveness of its actions to better ensure continued availability.

**DoD RESPONSE:** Concur. MIBP responds to this recommendation in carrying out its responsibilities under 10 U.S.C. 139(c) relating to ensuring reliable sources of materials critical to national security, such as specialty metals, armor plate, and rare earth elements. These efforts include MIBP’s input to the Secretary of Defense’s Biennial Report on Stockpile Requirements. MIBP supports the metrics and analyses used in Biennial Report on Stockpile Requirements such as the Risk Assessment and Mitigation Framework for Strategic Materials (RAMF-SM) to evaluate the effectiveness of the Department’s actions.

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# Appendix III: GAO Contact and Staff Acknowledgments

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## GAO Contact

Marie A. Mak, 202n/a512n/a4841 or [makm@gao.gov](mailto:makm@gao.gov)

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## Staff Acknowledgments

In addition to the contact name above, the following staff members made key contributions to this report: Penny Berrier, Assistant Director; James Kim; Matthew Jacobs; Jeffrey Harner; Stephanie Gustafson; Bob Swierczek; Roxanna Sun; Marie Ahearn; Jean McSween; Katrina Pekarn/aCarpenter; Pedro Almoguera; Godwin Agbara; Chris Murray; and Darnita Akers.

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# Appendix IV: Accessible Data

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## Agency Comment Letter

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### Text of Appendix II: Comments from the Department of Defense

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WASHINGTON , DC 20301n/a3500

LOGISTICS AND MATERIEL READINESS

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David J. Berteau

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Enclosure: As stated

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Page 2

GAO Draft Report Dated December 18, 2015 GAOn/a16n/a161 (GAO CODE 100072)

"RARE EARTH MATERIALS: DEVELOPING A COMPREHENSIVE APPROACH COULD HELP DOD BETTER MANAGE NATIONAL SECURITY RISKS IN THE SUPPLY CHAIN"

DEPARTMENT OF DEFENSE COMMENTS TO THE GAO RECOMMENDATION

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