

# **Report to Congress on Assessment of Feasibility and Advisability of Establishment of Rare Earth Material Inventory**



**Office of the Secretary of Defense**

**September 2012**

Submitted in response to Section 853 of the National Defense Authorization Act for  
Fiscal Year 2012 (Public Law 112-81)

Preparation of this report/study cost the Department of Defense a  
total of approximately \$92,000 for the 2012 Fiscal Year.  
Generated on 2012Sep06 1152 RefID: A-B1D8838

## **A. Introduction**

The enclosed report (Appendix C) is submitted in response to section 853 of the National Defense Authorization Act for Fiscal Year 2012 (Public Law 112-81) (Appendix A), which requires the Defense Logistics Agency to conduct an assessment of the feasibility and advisability of establishing an inventory of rare earth materials and to submit the results of that assessment to the Secretary of Defense. Section 853 also requires the Secretary of Defense to submit a report to the congressional defense committees on the findings and recommendations from the assessment, any actions the Secretary intends to take as a result of the assessment, and any recommendations for legislative or regulatory changes to ensure the long-term availability of rare earth materials. This report also responds to the request by the Senate Armed Services Committee in its report to accompany the National Defense Authorization Act for Fiscal Year 2012, S. Report 112-26, page 65, concerning recent impacts in rare earth material markets (Appendix B).

Section 853 directs the Secretary of Defense to submit to the congressional defense committees:

1. Section 853(b)(1)(A) – Findings and recommendations from the assessment by DLA Strategic Materials;
2. Section 853(b)(1)(B) – A description of any actions the Secretary intends to take regarding the plans, strategies, policies, regulations, or resourcing of the Department as a result of DLA’s findings and recommendations from its assessment; and
3. Section 853(b)(1)(C) – Any recommendations for legislative or regulatory changes needed to ensure the long-term availability of such rare earth materials.

## **B. DLA Strategic Materials Assessment**

As required by section 853, [subsections (a)(1) through (a)(9)], DLA’s assessment addressed 9 specific legislative requirements (see Appendix C):

- Section 853(a)(1) – Identify and describe the steps necessary to create an inventory of rare earth materials, including oxides, metals, alloys, and magnets, to support national defense requirements and ensure reliable sources of such materials for defense purposes.
- Section 853(a)(2) – Provide a detailed cost-benefit analysis of creating such an inventory in accordance with Office of Management and Budget (OMB) Circular A-94.
- Section 853(a)(3) – Provide an analysis of the potential market effects, including effects on the pricing and commercial availability of such rare earth materials, associated with creating such an inventory.

- Section 853(a)(4) – Identify and describe the mechanisms available to the Administrator to make such an inventory accessible, including by purchase, to entities requiring such rare earth materials to support national defense requirements, including producers of end items containing rare earth materials.
- Section 853(a)(5) – Provide a detailed explanation of the ability of the Administrator to authorize the sale of excess materials to support a Rare Earth Material Stockpile Inventory Program.
- Section 853(a)(6) – Analyze any potential requirements to amend or revise the Defense Logistics Agency-Strategic Materials Annual Material Plan (AMP) for Fiscal Year 2012 and subsequent years to reflect an inventory of rare earth materials to support national defense requirements.
- Section 853(a)(7) – Identify and describe the steps necessary to develop or maintain a competitive, multi-source supply-chain to avoid reliance on a single source of supply.
- Section 853(a)(8) – Identify and describe supply sources considered by the Administrator to be reliable, including an analysis of the capabilities of such sources to produce such materials in forms required for military applications in the next 5 years, as well as the security of upstream supply for these sources of material.
- Section 853(a)(9) – Include such other considerations and recommendations as necessary to support the establishment of such inventory.

### **C. Section 853 (b)(1)(A) Findings and Recommendations from the Assessment by DLA Strategic Materials**

Pursuant to section 853, the Administrator of DLA Strategic Materials completed an assessment of the feasibility and advisability of establishing an inventory of rare earth materials necessary to ensure the long-term availability of such rare earth materials. The assessment included an evaluation of U.S. defense requirements for rare earth material as defined under the Strategic and Critical Materials Stock Piling Act. Potential rare earth material shortfalls that might arise during a national emergency, previously assessed under Department of Defense (DoD) Base Case assumptions for the 2011 National Defense Stockpile (NDS) Requirements Report to Congress, were projected forward to the 2015 time frame.

#### **Findings from DLA’s Assessment are:**

- NDS rare earth materials shortfalls were not identified for U.S. defense requirements at the raw material level (e.g., mining and oxide production). However, uncertainties about sufficiency and reliability of certain heavy rare earth raw materials mining – along with associated higher purity oxides, related compounds, and semi-finished products utilizing heavy rare earths – make it advisable to (a) maintain a high level of

surveillance, (b) assess and establish mitigation solutions of semi-processed rare earth containing materials, and (c) maintain larger inventories of spares for defense systems.

- A sufficient supply of rare earth magnet materials and their constituent metals and alloys will likely exist for most of these materials for DoD purposes under NDS Base Case planning assumptions in the 2015 time frame and beyond<sup>1</sup>.
- Most of DoD's rare earth materials inventory requirements arise from the Military Services and Defense Agencies and their vast array of U.S. defense programs (e.g., development, production, and sustainment of military equipment). Many of the day-to-day "peacetime" (e.g. non-conflict) inventory requirements are short-term to mid-term in nature and are largely managed by U.S. defense contractors and their suppliers. Some firms expressed interest in receiving DoD help with expanded "peace time" inventory levels of imported rare earth magnet materials as well as government support for the development of domestic rare earth magnet materials production.
- Positive changes in global rare earth supply chains are occurring (e.g., new mining activities in the U.S., Australia and elsewhere); potential expansion of domestic rare earth alloy and metal production; and recently announced plans for a firm in the U.S. to initiate NdFeB magnet production at its existing ferrite magnet plant (see Section G).
- The acquisition process for new NDS materials is comprehensive and lengthy, taking approximately 3 years from identification of a requirement to receipt of authority and funding; potentially followed by an additional 1 to 5 years to acquire the full inventory, depending upon market conditions. Given this timeframe, it is likely that the situation creating the requirement could be decided favorably or unfavorably by market forces before the appropriate mitigation solution could be fully implemented.
- There is a need for the full implementation of an expanded action-oriented Planning and Preparedness Process for required materials, including rare earths.
- Ultra-pure yttrium oxide and dysprosium metal are two materials requiring finalizing of risk mitigation solutions due to the especially high concentration of foreign production of both materials.

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<sup>1</sup> Examples of rare earth magnet material compositions used by DoD include Neodymium Iron Boron (NdFeB) and Samarium Cobalt (SmCo).

## **Recommendations from DLA's Assessment are:**

- DLA Strategic Materials fully implement the Planning and Preparedness Process outlined in Appendix C.
- DLA Strategic Materials finalize solutions to address potential supply vulnerabilities for ultra-pure yttrium oxide and dysprosium metal.
- DLA Strategic Materials continue pursuing changes to the Strategic and Critical Materials Stock Piling Act (50 U.S.C. § 98) to streamline NDS release procedures, and to permit the Stockpile to be able to more quickly respond to changing markets and national security requirements.

## **D. Section 853 (b)(1)(B) Actions the Secretary Intends to Take as a Result of DLA's Assessment**

Intended actions by the Secretary in response to DLA's findings and recommendations are (1) implementation of DLA's recommended Planning and Preparedness process, and (2) the finalizing of possible action for high purity yttrium oxide and dysprosium metal.

Additional support of DLA's section 853 findings and recommendations are the continued implementation of the Department's earlier initiatives identified in its report in response to section 843 of the Ike Skelton National Defense Authorization Act for Fiscal Year 2011, Public Law No. 111-383, on the supply and demand for rare earth materials in defense applications<sup>2</sup>. These actions will ensure the long-term availability of such rare earth materials:

- DoD will engage in continuous, rigorous monitoring of markets and production levels;
- DoD will continue conducting recurring reviews of defense industrial base materials supply chains;
- DoD will make preparations for the possible need to establish contingency measures to obtain vendor-managed inventories when pre-determined market and/or supply chain indicators occur; and
- DoD will develop policy and conduct oversight to assure a secure supply of materials required for defense.

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<sup>2</sup> Report to Congress, Rare Earth Materials in Defense Applications, March 2012.

## **E. Section 853 (b)(1)(C) Recommendations for Legislative or Regulatory Changes Needed to Ensure the Long Term Availability of Rare Earth Materials**

- DoD will explore pursuing changes to the Strategic and Critical Materials Stock Piling Act (50 U.S.C. § 98) to streamline NDS release procedures, enabling the Stockpile to be able to respond more rapidly to changing markets and national security requirements.
- Two options for ensuring the long-term availability of rare earth materials are acquiring such materials within the NDS and/or establishing cost-effective recovery/recycling processes, both of which would require legislative authority under the Act. The Department has not yet determined whether to pursue either or both of these options at this time, given continued monitoring of potential requirements and sources.
- Any other regulatory changes to increase domestic supply of rare earths through the mining of existing resources is not within the purview of DoD, and DoD is not making any recommendations for any such changes within the Executive branch.

## **F. Conclusions**

- NDS rare earth materials shortfalls were not identified for U.S. defense requirements at the raw material level (e.g., mining and oxide production). However, there are uncertainties about sufficiency and reliability of supplies of certain heavy rare earth raw materials at the mining stage – along with associated higher purity oxides, related compounds, and semi-finished products utilizing heavy rare earths – that make it advisable to (a) maintain a high level of surveillance, (b) assess and establish mitigation solutions of semi-processed rare earth containing materials, and (c) maintain larger inventories of spares for defense systems.
- Ultra-pure yttrium oxide and dysprosium metal are two materials requiring finalizing of risk mitigation solutions due to the especially high concentration of foreign production of both materials.
- The Secretary concurs with the recommendations in the DLA Strategic Materials Administrator's report to implement fully the Planning and Preparedness Process outlined in the Administrator's Report, to finalize solutions to address potential supply vulnerabilities for ultra-pure yttrium oxide and dysprosium metal, and to explore pursuing changes to the Strategic and Critical Materials Stock Piling Act (50 U.S.C. § 98) to streamline NDS release procedures and permit the Stockpile to be able to respond more rapidly to changing markets and national security requirements.
- As stated in the Department's report in March 2012, in response to section 843 of the FY11 NDAA, the Department will continue to pursue its 3-pronged approach to assuring the long-term availability of these materials: diversification of supply, pursuit of substitutes, and a focus on reclamation opportunities.

## **G. Additional Reporting Requirement: Impact of Developments since Enactment of the FY11 NDAA**

In response to Senate Report 112-26, page 65, an analysis of the impact of developments since enactment of the FY11 NDAA was conducted. The assessment reviewed impacts from reduced export quotas, new taxes on rare earth exports, and the stockpiling of rare earth materials in the global rare earths marketplace.

The assessment of supply and demand for rare earth materials as part of the FY12 NDAA, section 853 report was conducted under approved NDS Base Case assumptions. Under that construct, the analysis did not identify any shortfalls of rare earths at the oxide level. Consideration was then given to demand reflected further down the supply chain in the metal, alloy and semi-finished product level.

DoD conducted a downstream supply chain assessment for neodymium-yttrium-aluminum-garnet (Nd:YAG) lasers used in target designators and range finders as well as other defense applications. That analysis revealed that the U.S. has multiple domestic suppliers of YAG laser crystals. Furthermore, the U.S. also has substantial domestic capabilities to cut, polish and coat the laser rod as well as fabricate the laser module and integrate it into final end-uses including weapons systems. However, U.S. laser crystal producers require specialized yttrium oxide whose production is heavily concentrated outside of the U.S.

Dysprosium metal was another product identified for risk mitigation. As mentioned above, the analysis conducted for section 853 under NDS Base Case assumptions did not identify a shortfall of dysprosium at the oxide level. However, vulnerabilities exist for dysprosium further downstream at the metal stage. As discussed in detail in the FY11 NDAA “Section 843 Interim Report: Assessment and Plan for Critical Rare Earth Materials in Defense Applications” (July 2011), DoD uses neodymium iron boron (NdFeB) magnets. Also as noted in the Interim Report, the U.S. does not currently manufacture any NdFeB magnets and sources them from the People’s Republic of China (PRC), Japan and Germany.

Furthermore, the Japan-based NdFeB magnet producer, Hitachi, currently holds the majority of the intellectual property and licensing rights for the manufacture of NdFeB magnets and has refused to issue more licenses. While Japan and Germany also manufacture NdFeB magnets, the upstream supply of alloy, metal, oxide and ore is heavily concentrated and tightly controlled by the PRC. On a positive note, Hitachi has announced plans to build a permanent magnet facility in China Grove, North Carolina. In other positive news, a company has announced its plans to build an NdFeB magnet facility in Japan that does not rely on Hitachi’s technology.

During the research conducted for the FY11 NDAA, section 843 report, DoD noted various developments in the rare earth market over the course of 2011, such as those cited in Senate Report 112-26. Specifically, China increased export quotas during July-December 2011 to

15,738 tons, up from 14,508 tons during the January-June 2011 timeframe, bringing the full year 2011 total to 30,246 tons.

Subsequent research revealed that China announced an additional quota of 10,680 tons for the second half of 2012, thereby bringing the full year 2012 total to 30,996 tons, up slightly from 30,246 tons for full year 2011.

During 2011, China raised export taxes on some rare earths from 15 to 25 percent. In addition, rare earth mining company production taxes were raised \$8 per kilogram, an increase from the previous rate of 50 cents per kilogram.

These and other supply restrictions, e.g., moratorium on issuance of new rare earth mining permits and prohibitions on expansion of existing mines, resulted in higher rare earth prices, especially outside of China from January through August 2011. For example, the spot price of neodymium oxide free-on-board (FOB) China increased from \$87,000 per metric ton in January 2011 to a peak of \$337,500 per metric ton in August 2011. During that same period, the spot price of dysprosium oxide FOB China increased from \$315,000 per metric ton to approximately \$2.8 million per metric ton.

DoD also observed during its analyses that: (1) supply restrictions resulted in other effects such as a potential increase in foreign business relocations to China; (2) there was increased investment in the development of new rare earth resources outside of China; (3) there were increased private sector inventory levels of rare earth-containing feedstock materials; (4) there was expanded private sector interest in reducing rare earth usage in downstream manufacturing; and (5) there was increased interest in rare earth recycling and substitutes.

As a result of higher prices, consumers of rare earths worked off inventories, maximized contractual volumes to avoid paying higher spot prices, and engaged in a variety of “thrifting” activities to reduce the amount of rare earths contained in their products. This “demand destruction” eventually pushed prices down. Generally speaking, rare earth prices have since retraced about one half to two-thirds of the run-up experienced from January through August 2011.

The volatility exhibited in rare earth prices has sparked renewed talk of Chinese government stockpiling. While no concrete data exists on volumes and timing, industry journals and news media have reported that the Chinese rare earth industry will use government funds to build a rare earth stockpile in an effort to prop up prices and to conserve what Chinese authorities argue are dwindling rare earth resources. Various media outlets are also reporting that the Chinese government’s notification of intent to buy or actual purchases have not had an influence on prices for rare earths.

Export and production quotas, export taxes, mine licensing moratoriums and other supply restrictions are tactics used to – among other goals – influence market outcomes. These policies resulted in higher prices for rare earths for much of 2011 and early 2012, and had other effects as



well. Example effects were: relocation of western country operations, involuntary inventory building of rare earth oxides by downstream consumers, increased investment in rare earth mining and separation facilities in other parts of the world, and efforts to reduce consumption of rare earths as a cost-cutting measure.

## **Appendix A**

### **FY12 NDAA Section 853**

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#### **SEC. 853. ASSESSMENT OF FEASIBILITY AND ADVISABILITY OF ESTABLISHMENT OF RARE EARTH MATERIAL INVENTORY.**

(a) REQUIREMENT.—Not later than 180 days after the date of the enactment of this Act, the Administrator of the Defense Logistics Agency Strategic Materials shall submit to the Secretary of Defense an assessment of the feasibility and advisability of establishing an inventory of rare earth materials necessary to ensure the long-term availability of such rare earth materials. The assessment shall—

- (1) identify and describe the steps necessary to create an inventory of rare earth materials, including oxides, metals, alloys, and magnets, to support national defense requirements and ensure reliable sources of such materials for defense purposes;
- (2) provide a detailed cost-benefit analysis of creating such an inventory in accordance with Office of Management and Budget Circular A-94;
- (3) provide an analysis of the potential market effects, including effects on the pricing and commercial availability of such rare earth materials, associated with creating such an inventory;
- (4) identify and describe the mechanisms available to the Administrator to make such an inventory accessible, including by purchase, to entities requiring such rare earth materials to support national defense requirements, including producers of end items containing rare earth materials;
- (5) provide a detailed explanation of the ability of the Administrator to authorize the sale of excess materials to support a Rare Earth Material Stockpile Inventory Program;
- (6) analyze any potential requirements to amend or revise the Defense Logistics Agency Strategic Materials Annual Material Plan for Fiscal Year 2012 and subsequent years to reflect an inventory of rare earth materials to support national defense requirements;
- (7) identify and describe the steps necessary to develop or maintain a competitive, multi-source supply-chain to avoid reliance on a single source of supply;

- (8) identify and describe supply sources considered by the Administrator to be reliable, including an analysis of the capabilities of such sources to produce such materials in forms required for military applications in the next 5 years, as well as the security of upstream supply for these sources of material; and
- (9) include such other considerations and recommendations as necessary to support the establishment of such inventory.

(b) FINDINGS AND RECOMMENDATIONS.—

(1) IN GENERAL.—Not later than 90 days after the date on which the assessment is submitted under subsection (a), the Secretary of Defense shall submit to the congressional defense committees—

(A) the findings and recommendations from the assessment required under subsection (a);

(B) a description of any actions the Secretary intends to take regarding the plans, strategies, policies, regulations, or resourcing of the Department of Defense as a result of the findings and recommendations from such assessment; and

(C) any recommendations for legislative or regulatory changes needed to ensure the long-term availability of such rare earth materials.

(c) DEFINITIONS.—In this section:

(1) The term “rare earth” means any of the following chemical elements in any of their physical forms or chemical combinations and alloys:

- |                  |                |
|------------------|----------------|
| (A) Scandium     | (J) Gadolinium |
| (B) Yttrium      | (K) Terbium    |
| (C) Lanthanum    | (L) Dysprosium |
| (D) Cerium       | (M) Holmium    |
| (E) Praseodymium | (N) Erbium     |
| (F) Neodymium    | (O) Thulium    |
| (G) Promethium   | (P) Ytterbium  |
| (H) Samarium     | (Q) Lutetium   |
| (I) Europium     |                |

(2) The term “capability” means the required facilities, manpower, technological knowledge, and intellectual property necessary for the efficient and effective production of rare earth materials.

# **Appendix B**

## **Senate Report 112-26 to Accompany S. 1253**

### **(FY12 NDAA)**

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#### **Assessment of Recent Impacts in Rare Earth Metals Markets**

In April 2010, the Government Accountability Office (GAO) reported (GAO-10-617R Rare Earth Materials in the Defense Supply Chain) that the use of rare earth materials is widespread in components of major defense weapon systems, including precision guided munitions, stealth technology, electric drive ship programs, missile systems, and command and control systems. The GAO report indicated that current capabilities to process rare earth metals into finished materials are limited mostly to Chinese sources. Congress addressed this issue in section 843 of the Ike Skelton National Defense Authorization Act for Fiscal Year 2011 (Public Law 111-383) by directing the Secretary of Defense to undertake an assessment of supply and demand for rare earth materials in defense applications and to develop a plan to ensure the long-term supply of required materials.

The committee directs the Department to include in the assessment and plan, an analysis of the impact of any developments since enactment of the Ike Skelton National Defense Authorization Act for Fiscal Year 2011 such as reduced export quotas, new taxes on rare earth exports, or the stockpiling of rare earth materials in the global rare earths marketplace.

# **APPENDIX C**

## **DLA Strategic Materials Administrator's Assessment Report**

**Report to Secretary of Defense  
on  
Assessment of Feasibility and Advisability of  
Establishment of Rare Earth Material  
Inventory**



**Defense Logistics Agency Strategic Materials  
Administrator**

**July 2012**

**Submitted in response to Section 853 of the National  
Defense Authorization Act for Fiscal Year 2012  
(Public Law 112-81)**

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## Executive Summary

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The FY12 National Defense Authorization Act (NDAA), section 853, requires the Administrator of the Defense Logistics Agency (DLA) Strategic Materials to complete an assessment of the feasibility and advisability of establishing an inventory of rare earth materials necessary to ensure the long-term availability of such rare earth materials.<sup>1</sup>

The assessment included an evaluation of U.S. defense requirements for rare earth material as defined under the Strategy and Critical Materials Stock Piling Act (50 U.S.C. § 98). Potential rare earth material shortfalls that might arise during a national emergency, previously assessed under Department of Defense (DoD) Base Case assumptions for the 2011 National Defense Stockpile (NDS) Requirements Report to Congress, were projected forward to the 2015 time frame.

The DLA Strategic Materials Administrator has determined that it is feasible for DoD to acquire and hold an inventory of rare earth materials, but not advisable at this time with two exceptions. Ultra-pure yttrium oxide and dysprosium metal have been determined to have especially high potential supply vulnerabilities. Solutions are being developed and will be advanced through processes addressed in this report.

### **Findings from the assessment were:**

- NDS rare earth materials shortfalls were not identified for U.S. defense requirements at the raw material level (e.g., mining and oxide production). However, there are uncertainties about sufficiency and reliability of certain heavy rare earth raw materials mining – along with associated higher purity oxides, related compounds, and semi-finished products utilizing heavy rare earths – that make it advisable to (a) maintain a high level of surveillance, (b) assess and establish mitigation solutions of semi-processed rare earth containing materials, and (c) maintain larger inventories of spares for defense systems.

A sufficient supply of rare earth magnet materials and their constituent metals and alloys will likely exist for most of these materials for DoD purposes under NDS Base Case planning assumptions in the 2015 time frame and beyond<sup>2</sup>.

Most of DoD's rare earth materials inventory requirements arise from the Military Services and Defense Agencies and their vast array of U.S. defense programs (e.g., development, production, and sustainment of military equipment). Many of the day-to-

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<sup>1</sup> See Appendix E and a copy of FY12 National Defense Authorization Act, Section 853: Assessment of Feasibility and Advisability of Establishment of Rare Earth Material Inventory.

<sup>2</sup> Examples of rare earth magnet material compositions used by DoD include Neodymium Iron Boron (NdFeB) and Samarium Cobalt (SmCo).



day “peacetime” inventory requirements are short-term to mid-term in nature and are largely the responsibility of U.S. defense contractors and their suppliers. Some firms expressed interest in receiving DoD help with expanded “peace time” inventory levels of imported rare earth magnet materials as well as government support for the development of domestic rare earth magnet materials production.

Positive changes in global rare earth supply chains are occurring (e.g. new mining activities in the U.S., Australia and elsewhere); potential expansion of domestic rare earth alloy and metal production; and recently announced plans for a firm in the U.S. to initiate NdFeB magnet production at its existing ferrite magnet plant.

The acquisition process for new NDS materials is comprehensive and lengthy, taking approximately 3 years from identification of a requirement to receipt of authority and funding; potentially followed by an additional 1 to 5 years to acquire the full inventory, depending upon market conditions. Given this timeframe, it is likely that the situation creating the requirement could be decided favorably or unfavorably by market forces before the appropriate mitigation solution could be fully implemented.

There is a need for the full implementation of an expanded action-oriented Planning and Preparedness Process for required materials, including rare earths.

Ultra-pure yttrium oxide and dysprosium metal are two materials requiring finalizing of risk mitigation solutions due to the especially high concentration of foreign production of both materials.

**Recommendations from the assessment were:**

1. DLA Strategic Materials fully implement the Planning and Preparedness Process outlined in Appendix A.
2. DLA Strategic Materials finalize solutions to address potential supply vulnerabilities for ultra-pure yttrium oxide and dysprosium metal.
3. DLA Strategic Materials continue pursuing changes to the Strategic and Critical Materials Stock Piling Act (50 U.S.C. § 98) to streamline NDS release procedures, and permitting the Stockpile to be able to respond more rapidly to changing markets and national security requirements.

## **Response Summaries – Section 853 Legislative Requirements:**

As further required by section 853, [Subsections (a)(1) through (a)(9)], this assessment addresses a number of specific legislative requirements. These 9 requirements are summarized below:

### **Section 853(a)(1) – Identify and describe the steps necessary to create an inventory of rare earth materials, including oxides, metals, alloys, and magnets, to support national defense requirements and ensure reliable sources of such materials for defense purposes.**

If a requirement should be identified for an inventory of rare earth materials for the NDS, DLA Strategic Materials will follow a 7-step process to establish an inventory:

1. Monitor defense and essential civilian industry material supply chains;
2. Identify risks and determine appropriate mitigation solutions;
3. Obtain legislative authorities and funding;
4. Identify the action in the Annual Materials Plan (AMP);
5. Implement the inventory procurement solution;
6. Receive and maintain the inventory;
7. Continuously monitor the requirement and adjust the inventory as necessary.

### **Section 853(a)(2) – Provide a detailed cost-benefit analysis of creating such an inventory in accordance with Office of Management and Budget (OMB) Circular A-94.**

A cost-effectiveness construct that is consistent with guidelines outlined in OMB Circular A-94 will be used to assess the advisability of the establishment of a rare earth material stockpile inventory. When a material requirement is identified, a set of risk mitigation measures (including traditional stockpiling, buffer inventories, blanket purchase agreements, and taking no action) will be evaluated. The cost of each of these measures will be assessed using an expected net present value construct with a planning period parameter of 5 years. Effectiveness will be assessed by measuring the baseline risk associated with a shortfall requirement and multiplying that baseline risk by the probability of failure of a given mitigation measure, resulting in a residual risk metric which can then be compared to an identified risk threshold in order to determine which mitigation measures are acceptable to the government. The mitigation measure with the lowest cost and deemed to have an acceptable level of risk (to be assessed) will therefore be judged as the most cost-effective mitigation measure in accordance with OMB Circular A-94.

**Section 853(a)(3) – Provide an analysis of the potential market effects, including effects on the pricing and commercial availability of such rare earth materials, associated with creating such an inventory.**

The Stock Piling Act includes specific guidance to avoid undue disruption of markets. To avoid producer, processor or consumer market disruptions, multi-agency analyses are conducted that include reviews of supply and demand estimates, production lead times, and elasticity of markets.

**Section 853(a)(4) – Identify and describe the mechanisms available to the Administrator to make such an inventory accessible, including by purchase, to entities requiring such rare earth materials to support national defense requirements, including producers of end items containing rare earth materials.**

The DLA Strategic Materials Administrator currently does not have unilateral authority to release assets from the National Defense Stockpile. However, if a material is determined to be in excess of requirements, military services or other federal agencies are eligible to purchase the material.

**Section 853(a)(5) – Provide a detailed explanation of the ability of the Administrator to authorize the sale of excess materials to support a Rare Earth Material Stockpile Inventory Program.**

The Administrator is authorized to manage the sale or barter of excess material in the stockpile, provided that Congress has authorized the disposal, and that sales or barter do not exceed maximum amounts stipulated in the Annual Materials Plan (AMP) approved by Congress. The sale or barter of these materials is dependent on present market demand, the recommendation of the Market Impact Committee, and the judgment of the Administrator that the sale or barter will not result in an unnecessary loss to the government.

**Section 853(a)(6) – Analyze any potential requirements to amend or revise the Defense Logistics Agency-Strategic Materials Annual Material Plan (AMP) for Fiscal Year 2012 and subsequent years to reflect an inventory of rare earth materials to support national defense requirements.**

Since rare earth inventory requirements have not been identified at this time, there is no current need to amend the DLA Strategic Materials AMP for Fiscal Year 2012. However, the AMP can be amended during any year for materials under development. In the event of identified requirements, a supplemental AMP can be proposed to Congress using steps outlined in Chapter 6.

**Section 853(a)(7) – Identify and describe the steps necessary to develop or maintain a competitive, multi-source supply-chain to avoid reliance on a single source of supply.**

The DoD undertakes a number of steps that encourage and promote competitive, multi-source supply-chains to avoid reliance on single sources of supply. Measures include U.S. policy established by Executive Order and federal statutes enacted by Congress. These policies are implemented broadly through federal acquisition regulations and DLA guidance.

**Section 853(a)(8) – Identify and describe supply sources considered by the Administrator to be reliable, including an analysis of the capabilities of such sources to produce such materials in forms required for military applications in the next 5 years, as well as the security of upstream supply for these sources of material.**

Various criteria are used to identify reliable supply sources. Within the context of the congressionally-mandated Base Case, no supply at all is assumed to be available for defense purposes from Base Case scenario adversaries or from “market dominators” (countries which account for a large proportion of global supply). Additional country reliability assessments within the context of the Base Case are determined by Defense Intelligence Agency analysts.

The worldwide picture for rare earth mining and oxide production is comprised of many different producers. Some are key U.S. allies, others are business partners and still some might be regarded as rivals. Rare earths elements are mined and oxide is produced primarily in China, although U.S. capability for rare earths mining and oxide production is improving, thanks primarily to the reopening of the Molycorp mine and construction of separation facilities in Mountain Pass, California. In addition, Australia, Austria, Brazil, Estonia, India, Malaysia, Russia, South Africa and Vietnam all contribute in various amounts to the global upstream supply of rare earth resources.

**Section 853(a)(9) – Include such other considerations and recommendations as necessary to support the establishment of such inventory.**

Development, testing and full implementation of an action-oriented Planning and Preparedness process is proposed for required materials. The process would build upon a number of activities already in place within DLA Strategic Materials and would incorporate activities to increase the reliability of contingency planning and preparedness. Key elements of the process include identification, risk assessment, mitigation considerations, action triggers, and initiation of actions.

# 1. Steps Necessary to Create an Inventory of Rare Earth Materials

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**Section 853, Subsection (a)(1): Identify and describe the steps necessary to create an inventory of rare earth materials, including oxides, metals, alloys, and magnets, to support national defense requirements and ensure reliable sources of such materials for defense purposes.**

## **A. Purpose**

Identify and describe the steps necessary to create a stockpile inventory of rare earth materials to support national defense requirements and ensure reliable sources of such materials for defense purposes.

## **B. Introduction**

This chapter provides an overview of the steps necessary for DoD/DLA Strategic Materials to create a rare earth materials stockpile inventory to support national defense requirements and ensure reliable sources of such materials for defense purposes using authorities provided under the Strategic and Critical Materials Stock Piling Act (50 U.S.C. § 98). For the purpose of this report, rare earth materials include oxides and related compounds as well as sintered rare earth permanent magnet materials and their constituents, metals and alloys.

## **C. Steps Necessary to Create a DoD/DLA Inventory of Rare Earth Materials**

Seven basic steps are necessary to create an inventory of rare earth materials in the National Defense Stockpile (NDS):

1. Monitor defense and essential civilian industry materials supply chains for shortfalls;
2. Identify shortfall risks and determine appropriate mitigation solutions;
3. Obtain legislative authorities and funding to mitigate shortfall risks;
4. Identify the action in the Annual Materials Plan (AMP);
5. Implement an inventory procurement risk mitigation solution;
6. Receive and maintain the stockpile inventory;
7. Continuously monitor the requirement and adjust the inventory as necessary.

## **D. The National Defense Stockpile (NDS)**

DLA Strategic Materials administers the NDS on behalf of the Stockpile Manager, Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)). The NDS is a sequestered stockpile inventory of strategic materials built and held to sustain the defense and essential civilian industrial base of the U.S. in the event of a national emergency. Executive or Congressional authority is required to release materials from the NDS inventory. Rules governing release are defined in sections 5 and 7 of the Strategic and Critical Materials Stockpiling Act (50 U.S.C. § 98). Section 5(b) requires Congressional authorization for disposals from the National Defense Stockpile (usually used to dispose of materials that are excess to defense needs via sales). Section 7 addresses Executive Authority to release materials from the NDS, and states:

SEC.7 (a) Materials in the stockpile may be released for use, sale or other disposition – (1) On the order of the President at any time the President determines the release of such materials is required for purposes of national defense; and (2) In time of war declared by the Congress or during a national emergency, on the order of any officer or employee of the U.S. designated by the President to have authority to issue disposal orders under this subsection, if such officer or employee determines that the release of such materials is required for purposes of national defense.

SEC.7 (b) Any order issued under subsection (a) shall be promptly reported by the President, or by the officer or employee issuing such order, in writing, to the Committee on Armed Services of the Senate and the Committee on National Security of the House of Representatives.

## **E. Procedures for Adding Materials to the NDS**

The procedures below are applicable to many types of materials, including rare earths.

1. Monitor Defense and Essential Civilian Industry Materials Supply Chains, Identify Risks and Determine Appropriate Mitigation Solutions:
  - a. Materials are listed and delisted on the DLA Strategic Materials "Materials Watch List" if they are used for defense/essential civilian applications (See Appendix B).
  - b. If analyses identify a risk to the respective material's supply chain, mitigation solutions are assessed through a "Determinations" process including:
    - 1) Identifying and proving substitute materials;
    - 2) Identifying and assessing reclamation (recycling) processes<sup>3</sup>;

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<sup>3</sup> Current legislation does not provide the necessary authority for the NDS to perform reclamation (recycling) processes.

- 3) Upgrading existing inventories;
- 4) Securing materials supplies from trusted foreign nations under Memorandums of Agreement (MOA);
- 5) Establishing government subsidized, vendor owned “buffer” inventories;
- 6) Acquiring and stockpiling the materials.

2. Obtain Legislative Authorities and Funding:

If acquisition of materials is determined to be a solution, an acquisition plan is developed that includes the following steps:

- a. The action is submitted through the Stockpile Manager and Secretary of Defense to the Congress for legislative authority.
- b. If legislative authority is approved, a request for funding is identified in the next program budget request cycle. Unless the legislative authority included specific appropriation for the acquisition, the Transaction Fund is the statutorily-mandated source of funds to be used for the acquisition.
- c. Once legislative authority and funding are approved, the action is coordinated with Market Impact Committee (MIC)<sup>4</sup> to ensure the action does not disrupt normal markets.

3. Include in the Annual Materials Plan (AMP), as appropriate:

The procedures for this step are discussed in Chapter 6 of this report.

4. Implement the Solution:

- a. Mitigation solutions that do not involve actual acquisition of materials such as substitution, reclamation, upgrades and establishing support MOAs with trusted foreign nations are developed by the DLA Strategic Materials staff and funded from annual operations budgets.
- b. Solutions that require acquisition of materials or services to hold strategic stockpile inventories of materials are funded from the NDS Transaction Fund (either from existing Principal Account funds or by specific appropriation to the Fund). Project scopes are developed by the DLA Strategic Materials technical staff.

5. Receive and Maintain the Inventory:

Materials are acquired as direct acquisitions (or through other procurement arrangements) and are stored at vendor operated or government controlled facilities. Determination is based on

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<sup>4</sup> See Chapter 3 Analysis of Potential Market Effects.

character of the material (e.g. is it hazardous or does it have a usable shelf life) and how it would be deployed in the event of an emergency.

6. Continuously Monitor the Requirement:

Once a solution is implemented, it is monitored at least semi-annually to assure the material is maintained in a form, condition, location and quantities that meet the requirements.



## 2. Detailed Cost-Benefit Analysis

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**Section 853, Subsection (a)(2): Provide a detailed cost-benefit analysis of creating such an inventory in accordance with Office of Management and Budget Circular A-94.**

In order to assess the advisability of a rare earth materials stockpile inventory under the NDS construct, a cost-effectiveness analytical process was created in accordance with OMB Circular A-94. A rare earth materials stockpile inventory or other measures are risk hedging initiatives implemented to mitigate/manage risk in the face of an uncertain future. Therefore, a cost-effectiveness approach, in place of a cost-benefit approach, was used because of the difficulty in monetizing the benefits provided to the government from a rare earth materials stockpile inventory.<sup>5</sup> Consistent with the DoD budget cycle, cost and effectiveness will be assessed using a 5 year planning period. The options offered for consideration in this analysis are two forms of inventories—government stockpiles and buffer inventories—and two other approaches—blanket purchase agreements or security of supply agreements and taking no further action<sup>6</sup>—to mitigating risk associated with possible rare earth supply disruption. Such disruptions could occur, for example, as a result of a military conflict or a political dispute with China, which is currently the principal global rare earth-supplying nation.

When the rare earth materials were analyzed for potential National Defense Stockpile Base Case shortfalls related to defense usage (the second step in the process outlined below), none were identified in the 2015 time frame. Therefore, this section describes the analytical process developed by DoD for assessing the cost-effectiveness of material supply chain risk mitigation measures but it does not recommend the adoption of any particular measures for any particular materials at this time.

### A. Outline of Cost-Effectiveness Analysis Process

The rare earth inventory cost-effectiveness analysis is outlined below; the steps in the analysis are explained in the remainder of this section.

- Identify supply chain risk mitigation measures

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<sup>5</sup> “Cost-effectiveness analysis is a less comprehensive technique, but it can be appropriate when the benefits from competing alternatives are the same or where a policy decision has been made that the benefits must be provided.” OMB Circular A-94, 5. General Principles. Here, the benefits of the alternatives are comparable in that they all seek to reduce rare earth shortfall risk to an appropriate level.

<sup>6</sup> “Analyses should also consider alternative means of achieving program objectives by examining different program scales, different methods of provision, and different degrees of government involvement. For example, in evaluating a decision to acquire a capital asset, the analysis should generally consider: (i) doing nothing; (ii) direct purchase; (iii) upgrading, renovating, sharing, or converting existing government property; or (iv) leasing or contracting for services.” OMB Circular A-94, 5 General Principles.

- Analyze risk associated with materials supply
- Analyze residual (mitigated) risk associated with materials and mitigation measures
- Determine risk threshold to ascertain acceptability of mitigation measures
- Estimate costs of mitigation measures
- Identify lowest cost acceptable mitigation measure

## **B. Rare Earth Supply Risk Mitigation Measures**

Four options for mitigating rare earth supply risk to DoD were considered in this analysis: 1) government stockpiling, 2) government subsidized private buffer inventories, 3) blanket purchase agreements (BPAs) or security of supply arrangements, and 4) taking no further action. These options were identified based on DoD experience in assessing and planning to mitigate risks to the nation from the disruption of the supply of required materials. The evaluation process for each of these options is described below with respect to its effectiveness, in terms of reducing supply disruption risk to DoD, and with respect to cost, in terms of net present value.

## **C. Materials Supply Risk Assessment**

The first step in the analysis after identifying the supply chain risk mitigation measures to consider is to assess the existing (unmitigated) risk arising out of the rare earth supply chain. In this analysis we are considering risk arising from the potential disruption of the supply of rare earth materials for use by DoD. Risk is taken to be the product of the probability that a supply chain disruption scenario would occur and the consequence to the nation of the shortfall (shortage) of rare earths that would result from that disruption.

$$\text{Shortage risk} = P_{\text{scenario}} \times C_{\text{shortage}}$$

If more than one supply disruption scenario was possible or under consideration, then the total shortage risk would be equal to the sum of the risks produced by each scenario.<sup>7</sup>

The probability of a supply disruption scenario occurring and the consequences of a material shortage caused by that scenario cannot be measured directly; thus DoD used expert judgment to ascertain both quantities for this assessment. Such judgment is based on the experts'

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<sup>7</sup> This calculation allows, strictly speaking, that multiple scenarios could occur during the period of analysis. In application, scenario probabilities are likely to be low and thus this should have little effect on the total risk calculation.

knowledge of the materials in question and their applications. Experts<sup>8</sup> consulted in the assessment included those from government, academia, and industry.

By way of further explanation, the probability used is the probability that a rare earth supply disruption scenario would occur that would create potential shortages in materials used by DoD. The probability is evaluated by experts over a specified period of time and can be reduced to the probability per year or per 5 years that the disrupting scenario will occur.

Consequences of supply disruptions are the consequences to the nation that would result from an actual shortage of each rare earth material considered, in the event of the supply disruption scenario. Consequences to the nation can be thought of as including military, economic, and diplomatic consequences potentially produced by material shortages. In this analytical process, for each material evaluated, consequences are assessed based on the magnitude of the shortage and the applications in which the material is used. Some applications are more integral than others and thus shortages of some materials are more consequential than the shortages of others.

The magnitude of a potential shortage caused by a supply disruption scenario is estimated by comparing the available supply of the material to the demands for it for defense applications. DoD, specifically DLA Strategic Materials, has a process for estimating potential material shortages that would be caused by specified supply disruption scenarios. DLA Strategic Materials uses that process and the scenario defined in the Strategic and Critical Materials Stock Piling Act to produce the biennial Report to Congress on Stockpile Requirements. In this assessment, this process identified no potential shortages of the analyzed rare earth materials related to defense usage in the 2015 time frame. Thus, the process anticipates no shortages of the materials analyzed and hence neither consequences nor risk. This is not to assert that the risk of a rare earth shortage is literally zero. It is to say that the process indicates that the risk of a shortage of the materials analyzed is low enough that DoD need not conduct further analysis of risk mitigation measures for them or implement such measures at this time. Nevertheless, to hedge against uncertainties or risks not yet fully analyzed, DoD may still deem it prudent to implement some limited rare earth shortage risk mitigation measures. The remainder of this section lays out the process that DoD would use to evaluate the cost-effectiveness of supply risk mitigation measures had potential rare earth shortages been identified at this stage.

In this cost-effectiveness analytical process, for each material considered, once the magnitude of the potential shortage is estimated, the consequences are assessed by experts considering the magnitude of the shortage and the applications in which the material is used. To

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<sup>8</sup> Experts consisted of senior retired and currently serving national security professionals, both military and civilian, and senior industry representatives. Government organizations represented were the Office of the Secretary of Defense, Defense Agencies, Military Services, and Central Intelligence Agency.

allow assessments to be compared from one material to another, the experts assess the consequences of potential material shortages on a common basis using an anchored scale.<sup>9</sup>

Once the supply disruption scenarios are selected for consideration, the probabilities of those scenarios are estimated, the potential material shortages created by each scenario are estimated and the consequences of each shortage are estimated, those data are used to estimate the existing, unmitigated, supply disruption risk for each material. An example of that calculation using notional data is set forth below.

**Table 2.1. Material Shortage Risk**

<b>Material</b>	<b>Notional Shortage</b>	<b>Scenario Probability (in 5 yrs)</b>	<b>Shortage Consequences (100 = severe)</b>	<b>Shortage Risk</b>
Example Material #1	140 MT	0.2	80	16

#### **D. Mitigation Measure Effectiveness Evaluation**

After assessing the shortage risk associated with each material under consideration, the next step in the process is to identify and evaluate the cost-effectiveness of the measures that DoD could use to mitigate the risk. As previously noted, the 4 mitigation measures that DoD has identified for the rare earths are: 1) government stockpiling, 2) private buffer inventories, 3) blanket purchase agreements or security of supply agreements, and 4) taking no further action. The first step in the evaluation is the effectiveness of the measures. Effectiveness depends on the extent to which each measure would reduce the risk associated with each potential rare earth shortage. Since the mitigation measures cannot affect the probability of a supply disruption occurring in the first place, their effectiveness turns on the extent to which they can mitigate the consequences of each shortage for which they are considered. Consequences mitigation for each measure is assessed in terms of the likelihood that the measure, if implemented, would eliminate the consequences. Because these measures, except for stockpiling, are new concepts for DoD, there is not a source of historical data from which to calculate or estimate the probability that any measure would succeed or fail to mitigate a potential rare earth shortage. Thus, DoD uses subjective expert judgment for each measure considered for each shortage. The expert judgment as to the likelihood of success is based on the nature of the relevant materials industry and actors involved in mitigating the shortage and the control of the government over the means of mitigation.

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<sup>9</sup> The scale is based on the severity of material shortfall consequences in 3 different respects: the size of the shortfall compared to annual defense demand, the use of the shortfall material in important defense applications, and the impact of the shortfall on sectors of the defense industrial base.

## E. Calculation of Residual Risk from Material Shortages

After the effectiveness of the shortage mitigation measures is evaluated, their effectiveness in mitigating the risk associated with each material shortage can be calculated. Residual risk is simply the product of shortage risk and the probability of mitigation measure failure:

$$\text{Residual shortage risk} = \text{Shortage risk} \times P_{\text{mitigation failure}}$$

Residual shortage risk reflects the overall effectiveness, for each material analyzed, of the mitigation measures considered in minimizing risk. Residual shortage risk is the quantity DoD wishes to minimize in planning for potential strategic material shortages.

An example of the calculation of residual risk for a shortage (from the example above) and 4 mitigation measures, using notional data, is set forth below.

**Table 2.2. Residual Risk from Material Shortages**

Material	Shortage Risk	Mitigation Measure	Probability of Failure	Residual Risk
Example Material #1	16	Stockpiling	0.02	0.32
	16	Buffer Inventory	0.2	3.2
	16	Blanket Purchase Agreements/Security of Supply Agreements	0.6	9.6
	16	No Action	0.8	12.8

## F. Considering Risk Mitigation across Shortage Materials

After the residual risks have been calculated for each potential material shortage and each available mitigation measure, the Department will have choices to make regarding which measures to apply to which potential shortages. The approach the Department would use in making that choice is to mitigate residual strategic materials risk on a material by material basis by applying a common risk threshold (or maximum risk) to all the materials and choosing a shortage mitigation measure for each material that would reduce risk for each material to a specified level to be determined. That allows the Department to use the common risk threshold to manage risk from material shortages across a range of materials and mitigation measures. This approach is similar to the risk management approach the Department takes, in a general sense, with other kinds of risks arising from military threats to U.S. interests—aiming to mitigate risks down to some acceptable level. It is also similar to the approach traditionally taken by the Department to mitigate strategic materials risk, in which material would be recommended for stockpiling to cover all shortages identified in the DoD planning process. However, this process

allows the Department to consider alternatives to stockpiling that may be able to mitigate risk to an acceptable level at a lower cost. As discussed at the end of this section, this approach facilitates making cost-risk tradeoffs by allowing the Department to select the lowest-cost mitigation measure that would meet the risk threshold for each material.

An example of how this approach would be used to consider risk mitigation across shortage materials is set forth below using Example Material #1 from above and a second example material. As with all examples in this section, the figures are notional and do not reflect actual analytic results:

**Table 2.3. Considering Risk Mitigation Across Shortage Materials**

Scenario Probability	Shortage Consequences	Shortage Risk	Mitigation Measure	Probability of Failure	Residual Risk
0.2	80	16	Stockpiling	0.02	0.32
0.2	80	16	Buffer Inventory	0.2	3.2
0.2	80	16	Contingency Contract	0.6	9.6
0.2	80	16	No Action	0.8	12.8

Example Material #1, shortage: 140 metric tons

Scenario Probability	Shortage Consequences	Shortage Risk	Mitigation Measure	Probability of Failure	Residual Risk
0.2	20	4	Stockpiling	0.02	0.08
0.2	20	4	Buffer Inventory	0.05	0.2
0.2	20	4	Contingency Contract	0.08	0.32
0.2	20	4	No Action	0.1	0.4

Example Material #2, shortage: 55 metric tons

If, in this example, a common risk threshold of less than or equal to 0.4 (shaded in blue) was applied to both materials, that would show that the mitigation measure of stockpiling was available for Example Material #1 and the mitigation measures of stockpiling, buffer inventory, contingency contracting, and no further action were available for Example Material #2.

## G. Cost Comparison across Mitigation Measures

The next step in the process after evaluating the effectiveness of potential strategic materials risk mitigation measures is to estimate their costs so that their cost-effectiveness can be evaluated. OMB A-94 Circular stipulates that net present value is the standard criterion for comparing government policies and/or programs. Net Present Value is defined as the

“discounted monetized value of expected net benefits (i.e., benefits minus costs)”; its equation is seen below, where  $i$  = discount rate and  $t$  = year index.

$$NPV = \frac{(Benefits - Costs)}{(1 + i)^t}$$

The context within which we measure costs and benefits for a rare earth materials stockpile inventory and associated measures is dependent on an amended version of the Congressionally Mandated Base Case, described in 50 U.S.C. § 98. Therefore, our analysis uses the probability of the Base Case, as determined by Subject Matter Experts (SMEs) in the risk analysis, to weight certain expenditures and benefits. Hence, the criterion we use to compare costs across policies is an Expected Net Present Value, where costs and benefits are weighted by the probability of a given scenario (in this case, an amended Base Case). The exact details of these weighting schemes are dependent on the specific mitigation measures in consideration (discussed in the following sections).

The discount rate in our analysis (0.4 percent) is taken from OMB A-94 Circular. It represents the real discount rate to be applied during a period of analysis of 5 years. Therefore, the criterion used in the subsequent cost analysis is Expected Net Present Value, given by the following equation:

$$Expected\ NPV = \sum_{t=0}^4 \frac{Expected\ Net\ Cash\ Flow}{(1 + i)^t}$$

## H. Cost of Stockpiling a Rare Earth Inventory

The cost of stockpiling a rare earth inventory is primarily dependent on the amount of material to be inventoried, market price at the time of acquisition, and on-going storage and operation costs. Stockpiling is the only risk mitigation measure whose expenditure could be recouped by the government in the event the material is no longer needed and could be sold. Therefore, a monetized benefit can be included in the calculation of NPV that represents the amount which the government could effectively recoup, weighted by the probability of a conflict not occurring.

Hence, the value of stockpiling can be calculated using the Expected Net Cash Flow given in Table 2.4. across a 5 year planning period. In the following table,  $x$  = material amount,  $MP$  =

market price,  $S$  = storage costs,  $r$  = expected recoupment percentage,<sup>10</sup> and  $p$  = probability of conflict within 5 years.

**Table 2.4. Expected Net Cash Flow for Stockpiling a Rare Earth Inventory**

Year Index	0	1	2	3	4
Expected Net Cash Flow	$MPx + S$	$S$	$S$	$S$	$S + rMPx(1 - p)$

The expected net cash flow is designed to represent the purchase of all material in the first year. If a purchase of this magnitude would negatively impact the market (see Chapter 3), the acquisition could be spread out over multiple years. The cost of storage variable,  $S$ , is included in the expected cash flow of stockpiling a material. For the purposes of this analysis, the operation costs at 3 depot sites (Scotia, NY, Warren, OH and Hammond, IN) were collected. Operation costs included leases, security, communications, utilities, vehicles, facility maintenance, equipment maintenance and recapitalization. These operation costs were aggregated and divided by the total indoor square footage (SF) to yield a \$/SF/year value for each site. Using the amount of material in consideration, coupled with the density requirement at each site (not to exceed 1000 lbs/SF), a total square footage required for each material could be calculated. Hence, the total amount required to store the material amount could be determined for each of the 3 facilities. The maximum value of these 3 amounts was used for the storage value in the expected cash flow for stockpiling equation.

Overall, the storage costs are a small percentage of the acquisition cost of a material. At each of the 3 facilities, there is sufficient space for new material storage.

## I. Cost of Creating a Buffer Inventory of Rare Earths

A policy alternative to creating a traditional stockpile is the creation of a buffer stock inventory, in which the government provides a subsidy to a third party to purchase, store and maintain a specified amount of inventory. The cost of subsidizing a buffer stock will be dependent on the agreed upon details in the contract between the government and the third party, but institutional knowledge predicts that an annual buffer stock subsidy is approximately 15 percent of acquisition costs<sup>11</sup>. However, since the material is vendor owned and maintained, the government must continue providing a yearly subsidy. In the event of a conflict, the government must purchase the material to meet requirements which will require legislative authority. The

<sup>10</sup> Although the planning period used in this cost analysis is 5 years, it is recognized that stockpiled material is typically held by the government for longer periods of time. The effect of that on the estimated price the government would realize when selling stockpiled material is taken into account in the derivation of the value of the expected recoupment percentage,  $r$ .

<sup>11</sup> The planning figure for buffer stocks (15 percent of acquisition costs) is currently undergoing further research and confirmation.



price of the material in the event of a conflict can be negotiated to be roughly equivalent to the price the vendor paid at the time of acquisition. This acquisition in the event of a conflict is weighted by the probability of the conflict, distributed uniformly across the planning period (5 years).

Hence, the Expected Net Cash Flow associated with creating a buffer stock can be seen in Table 2.5, where  $x$  = material amount,  $MP$  = market price, and  $p$  = probability of conflict sometime in the next 5 years.<sup>12</sup>

**Table 2.5. Expected Net Cash Flow for Creating a Rare Earth Buffer Inventory**

Year Index	0	1	2	3	4
Expected Net Cash Flow	$0.15MPx$ $+\frac{p}{5}MPx$	$0.15MPx$ $+\frac{p}{5}MPx$	$0.15MPx$ $+\frac{p}{5}MPx$	$0.15MPx$ $+\frac{p}{5}MPx$	$0.15MPx$ $+\frac{p}{5}MPx$

## **J. Cost of Establishing a Contingency Contract or Security of Supply Arrangement**

Traditional stockpiling and buffer stocks both require an expenditure of cash prior to a conflict. Two other policy options, blanket purchase agreements and security of supply agreements, require no cash expenditure before a scenario. Blanket purchase agreements are agreements between the government and a company regarding the purchase of material in the event of a contingency or conflict. Similarly, security of supply agreements can be drafted to ensure the purchase of material in the event of a conflict, but are contract vehicles between the government and a foreign government. These arrangements would require the use of current government resources to institute and establish, but these monetary costs are relatively minor and are already folded into current operations budgets.<sup>13</sup>

As seen in Table 2.6, there is no expenditure for blanket purchase agreements or security of supply agreements prior to a scenario. The only potential cash flow is the necessary acquisition of a material once a conflict has begun. The market price of a material in the event of a conflict may be significantly higher than the current market price. Hence, this acquisition is calculated using the market price of a material in conflict and is weighted by the probability of conflict, distributed uniformly across the planning period (in this case, 5 years). In Table 2.6,  $x$  = material amount,  $MP_{max}$  is the market price of a material in the event of a conflict and  $p$  = probability of conflict sometime in the next 5 years.

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<sup>12</sup> The total expected cost for the 5 year period is distributed evenly across each year of the planning period because the approach assumes that conflict is equally likely in each year.

<sup>13</sup> In order for the government to enter into agreements with foreign nations or companies, there may be political capital considerations that are not explicitly outlined here.

**Table 2.6. Expected Net Cash Flow for Contingency Contracts or Security of Supply Agreements**

Year Index	0	1	2	3	4
Expected Net Cash Flow	$+\frac{p}{5}MP_{max}x$	$+\frac{p}{5}MP_{max}x$	$+\frac{p}{5}MP_{max}x$	$+\frac{p}{5}MP_{max}x$	$+\frac{p}{5}MP_{max}x$

**K. Cost of Taking No Action**

According to OMB Circular A-94, all cost-effectiveness analyses should explicitly consider the alternative of “doing nothing,” or taking no further action. The cost of taking no action requires no cash expenditure or use of government resources preceding a conflict. However, if a conflict occurs and a requirement for a material emerges, the government will need to acquire that material at the market price, which may be significant.

Table 2.7 shows the expected net cash flow for taking no action. The expected net cash flow is identical to that for blanket purchase agreements and security of supply agreements, because the government will be required to acquire the material for stipulated requirements at the market price in the time of conflict, whether a previous contract is instituted or not. The distinction between blanket purchase agreements /security of supply agreements and taking no action lies in the effectiveness analysis (blanket purchase agreements/security of supply agreements will be more likely to yield material in the event of a conflict). In Table 2.7,  $x$  = material amount,  $MP_{max}$  is the market price of a material in the event of a conflict and  $p$  = probability of conflict sometime in the next 5 years.

While the expected net cash flow for taking no action is the same as that for blanket purchase agreements or security of supply agreements, blanket purchase agreements or security of supply agreements have the added benefit of reducing the risk that a supply of material would not be available. This would also reduce the time to acquire material, since most contractual terms would be pre-negotiated. Determination of time to implement a mitigation measure is Step 6 in the 10 step Planning and Preparedness Process outlined in Appendix A. On the other hand the negotiation of blanket purchase agreements or security of supply agreements would likely carry non-monetary staff time and political capital costs for the Department (or the government as a whole). Thus it would likely not be practical to enter into such agreements with every possible material supplier, even if the analysis would suggest such agreements as way of reducing risk without incurring monetary cost.

**Table 2.7. Expected Net Cash Flow for Taking No Action**

Year Index	0	1	2	3	4
Expected Net Cash Flow	$+\frac{p}{5}MP_{max}x$	$+\frac{p}{5}MP_{max}x$	$+\frac{p}{5}MP_{max}x$	$+\frac{p}{5}MP_{max}x$	$+\frac{p}{5}MP_{max}x$

**L. Determining the Market Price of a Material during a Conflict**

The market price of a material in conflict will vary based on source of supply, type of disruption scenario, fungibility of the market and other variables. Comparisons of risk mitigation measure costs, when made, will also consider uncertainties associated with such price estimates.

**M. Choosing Risk Mitigation Measures across Shortage Materials**

The last step in the process after the costs of mitigation measures have been evaluated is to select the measure to apply to each material suffering a potential shortage. As noted above, the approach the Department would use is to mitigate residual strategic materials risk on a material by material basis by applying a common risk threshold (or maximum risk) to all the materials and choosing a shortage mitigation measure for each material that would reduce risk for each material to the specified level. The risk threshold applied by the Department would be based on consideration of the specific risks from material shortages (probabilities and consequences) identified during the analytical process. The specific mitigation measure chosen for each material would be the one that reduced risk to the specified threshold at the lowest cost. This approach allows the Department to make cost-risk tradeoffs by adjusting the threshold applied across the materials: as the risk threshold is raised, more mitigation options become available, which creates more opportunities to reduce risk to the required level at lower cost.

This approach is illustrated below using the examples from earlier:

**Table 2.8. Considering Risk Mitigation Across Shortage Materials**

Shortage Risk	Mitigation Measure	Probability of Failure	Residual Risk	Mitigation Cost
16	Stockpiling	0.02	0.32	\$22.8 M
16	Buffer Inventory	0.2	3.2	\$17.1 M
16	Contingency Contract	0.6	9.6	\$12 M
16	No Action	0.8	12.8	\$12 M

Example Material #1, shortage: 140 metric tons, price: \$163/kg

**Cont. Table 2.8. Considering Risk Mitigation Across Shortage Materials**

<b>Shortage Risk</b>	<b>Mitigation Measure</b>	<b>Probability of Failure</b>	<b>Residual Risk</b>	<b>Mitigation Cost</b>
4	Stockpiling	0.02	0.08	\$21.8 M
4	Buffer Inventory	0.05	0.2	\$16 M
4	Contingency Contract	0.08	0.32	\$10 M
4	No Action	0.1	0.4	\$10 M

Example Material #2, shortage: 55 metric tons, price: \$396/kg

If, in this example, a common risk threshold of less than or equal to 0.4 (shaded in blue) was applied to both materials, that would show that the mitigation measure of stockpiling was available for Example Material #1 and the mitigation measures of stockpiling, buffer inventory, contingency contracting, and no further action were available for Example Material #2. If the least cost options that met the threshold were chosen, no action would be chosen for Example Material #2 and stockpiling (the only option) would be chosen for Example Material #1. Nevertheless, as noted above, notwithstanding the results of the quantitative analysis, DoD may still deem it prudent to implement additional material shortage risk mitigation measures to hedge against uncertainties or risks not yet fully analyzed.

This cost-effectiveness approach can be applied to the analysis of any strategic material. DoD will use a similar approach in evaluating potential mitigation measures for strategic materials risk in its 2013 National Defense Stockpile Requirements Report to Congress.

### 3. Analysis of Potential Market Effects

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**Section 853, Subsection (a)(3): Provide an analysis of the potential market effects, including effects on the pricing and commercial availability of such rare earth materials, associated with creating such an inventory.**

The Stock Piling Act includes specific guidance to avoid undue disruption of markets as described in 50 U.S.C. § 98e, subsection (b) entitled “Federal Procurement Practices,” which states:

*“(2) efforts shall be made in the acquisition and disposal of such materials to avoid undue disruption of the usual markets of producers, processors, and consumers of such materials and to protect the United States against avoidable loss.”*

In assessing the potential for market disruption, DLA Strategic Materials considers the markets of producers, processors, and consumers of materials, as mandated in the above excerpt from the Stock Piling Act. That is, in addition to impacting other buyers in the marketplace, DLA Strategic Materials acquisitions have the potential to disrupt production schedules and the markets of key producers. Markets can be disrupted in the sense that DLA Strategic Materials acquisition may capture supplies needed by other market participants. Disruption may also manifest as a spike in prices that users must pay for the supplies they do acquire.

A key mechanism for avoiding market disruption is the Market Impact Committee (MIC), established in 50 U.S.C. § 98h-1. The MIC includes members from the Department of Agriculture, Department of Commerce (DoC), Department of Energy, Department of the Interior, Department of State (DoS), Department of the Treasury, Department of Homeland Security, DoD and others. DoS and DoC serve as co-chairs and are responsible for publishing any planned inventory acquisitions in the federal register for public comment.

Supported by the MIC, DLA Strategic Materials will thus devise plans and schedules for inventory acquisition that will not unduly disrupt markets. As the operational manager of the National Defense Stockpile, DLA Strategic Materials has historical experience in recognizing the potential for undue disruption and planning accordingly. In evaluating potential acquisitions, DLA Strategic Materials analysts quantitatively assess the potential impact of a purchase using information including: the size of the proposed acquisition, current and future demand estimates, current and future production estimates, production lead times, and the likely responsiveness of supply and demand. The potential impact of alternative schedules and quantities are considered if necessary.

## 4. The Mechanisms Available to make such an Inventory Accessible

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**Section 853, Subsection (a)(4): Identify and describe the mechanisms available to the Administrator to make such an inventory accessible, including by purchase, to entities requiring such rare earth materials to support national defense requirements, including producers of end items containing rare earth materials;**

According to 50 U.S.C. § 98f, “materials in the stockpile may be released for use, sale or other disposition—

(1) On the order of the President, at any time the President determines the release of such materials is required for purposes of national defense; and

(2) In time of war declared by the Congress or during a national emergency, on the order of any officer or employee of the U.S. designated by the President to have authority to issue disposal orders under this subsection, if such officer or employee determines that the release of such materials is required for purposes of the national defense.”

While most of the duties associated with stockpile maintenance and management are delegated to the USD(AT&L) and the DLA Strategic Materials Administrator, the ability to release material cannot be delegated, per 50 U.S.C. § 98h-7. Hence, the Administrator does not have sole authority to release assets in the National Defense Stockpile to entities requiring rare earth materials to support national defense requirements, including producers of end items containing rare earth materials.

When excess materials are identified as disposable inventory in the Annual Materials Plan (AMP), military services and other federal agencies may purchase material under authorities granted in Federal Acquisition Regulation, 8.003. However, the Transaction Fund must be compensated from the respective military services annual appropriated funds, absent Congressional action negating this requirement. The military services or federal agencies may then, in turn, provide contractors or producers the purchased material. A legislative proposal for FY13 that would allow NDS Manager to release materials as needed for defense purposes would help streamline the process.

## **5. The Ability of the Administrator to Authorize the Sale of Excess Materials**

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**Section 853, Subsection (a)(5): Provide a detailed explanation of the ability of the Administrator to authorize the sale of excess materials to support a Rare Earth Material Stockpile Inventory Program.**

### **A. Background**

Responsibility for the management of the NDS resides with the USD(AT&L). Daily operations are the responsibility of DLA Strategic Materials. Before materials can be acquired, or before excess materials may be disposed of via sale, Congressional authorization for the action must be obtained via the legislative proposal process. After legislative authority is obtained, the requirements of the Annual Materials Plan (AMP) must be addressed. The AMP is the primary document related to the acquisition and disposal of materials in the stockpile. It stipulates what materials (including amounts and grades) may be disposed of and acquired in the coming fiscal year. The AMP originates from DLA Strategic Materials and is sent to the MIC, which publishes proposed sales in the Federal Register for public comment. Final changes are made in accordance with public comments and further MIC review. After internal coordination within DLA, the AMP is subject to a coordination process throughout DoD – up to the USD(AT&L). Once concurrence is reached, the AMP is submitted to Congress. Section 11(b) of the Act requires the AMP to be submitted to Congress by February 15 of the year prior to the fiscal year covered by the AMP. If a supplemental AMP for a fiscal year is submitted to Congress during the fiscal year, the Act requires a 45 day waiting period before actions called for in the supplemental AMP may be executed. At the end of the waiting period, the DLA Strategic Materials Administrator can proceed with the acquisitions and disposals identified in the AMP.

The DLA Strategic Materials Administrator is authorized to manage the sale of excess materials in the stockpile, provided sales do not exceed material amounts stipulated in the AMP. In other words, AMP quantities are not sales goals, but established ceilings on yearly sales. If the AMP has already been submitted, a supplemental amendment to the AMP may include a modification of these maximum sale amounts. A supplement to the AMP may add new materials for disposal or sale. Hence, the sale of excess materials currently in the stockpile is a potential option to support a rare earth materials stockpile inventory, dependent on a defined need and the current value of disposable inventory.

The sale of excess materials can support the establishment of a rare earth material stockpile inventory in two ways:

1. Sale of excess materials and subsequent use of funds to purchase specified rare earth materials.
2. Establishment of a barter agreement with a third party to acquire rare earth material in exchange for current inventory authorized for disposal.

The primary obstacle to establishing a rare earth material stockpile inventory is the time associated with gaining authority for sale and acquisition through the process of legislative authority, and AMP approval. The process to obtain legislative authority can take between 12 and 24 months. Currently, the drafting, coordination and approval process of a fiscal year AMP can take up to 9 months. The drafting, coordination and approval process for a supplemental AMP can take up to 6 months. These times do not include execution of sales and acquisitions stipulated in the AMP, so the overall time to establish a rare earth inventory once requirements are identified could be extensive, making establishment of an inventory less feasible.

## **B. Barter Opportunities**

According to 50 U.S.C. § 98e, subsection (c), “The President shall encourage the use of barter in the acquisition...of strategic and critical materials...when acquisition or disposal by barter is authorized by law and is practical and in the best interest of the United States.” Barter arrangements must be made available at fair market values and consider transportation and additional expenses.

If a need for rare earth materials is identified, excess materials can be valued using metal exchanges and other pricing sources to equate the excess materials to the amount of rare earth inventory required. Recommendations could then be developed for how excess materials might be bartered in exchange for the specified rare earth materials. A barter arrangement must be treated as an acquisition for the purposes of meeting NDS obligations in the identified fiscal year. Additionally, there exists the requirement that a barter arrangement must not increase or decrease the balance in the Transaction Fund.

Past barter efforts have been contractually drafted so that the government reserves the right to pay for the material in question by either excess materials or cash. The contractor may submit a bid on any excess material in the stockpile made available; this excess material can be taken in satisfaction of payment for the material being acquired by the government. This process allows for a quicker acquisition of materials than a direct sale with subsequent acquisition. Future efforts could be modeled after past successful contractual arrangements.



### **C. Determination of Inventory Authorized For Disposal**

DLA Strategic Materials uses the analytic process documented in the biennial NDS Requirements Report to the Congress to determine which materials are in shortage and which materials are in excess. Materials determined to be in shortage are not authorized for disposal unless directed by Congress.

Additionally, there are 3 congressional programs which are funded through the revenues from the sale of specified strategic materials. The material amounts are authorized for disposal, but the proceeds from the sales have been earmarked for particular programs or budgetary needs, and are not available for the purposes set forth in section 9 of the Act.

Taking into account congressional program deductions, Table 5.1 lists inventories authorized for disposal as of August 31, 2012. Market values are current as of August 31, 2012. It is important to note that annual maintenance, operation costs and potential environmental clean-up and site reclamation costs (approximately \$125M annually) must be funded from the Transaction Fund.

**Table 5.1. NDS Inventory Authorized for Disposal (as of August 31, 2012)**

<b>Material</b>	<b>Unit</b>	<b>Total Inventory Quantity</b>	<b>Inventory Quantity Authorized for Disposal</b>	<b>Value of Inventory Authorized for Disposal(\$M)</b>
Beryl	ST	1	0	\$0.0
Beryllium Metal Vac Cast	ST	7	7	\$2.3
Beryllium Metal HPP	ST	92	22	\$6.7
Chromium - Ferro High Carbon	ST	104,963	104,963	\$172.6
Chromium - Ferro Low Carbon	ST	56,742	56,742	\$184.9
Chromium Metal-combo electro & alumni	ST	4,512	4,512	\$67.1
Cobalt	LB Co	663,709	663,709	\$15.5
Columbium Metal Ingots	LB Cb	22,156	0	\$0.0
Germanium Metal	KG	16,362	0	\$0.0
Manganese Ferro High Carbon	ST	383,528	383,528	\$531.8
Manganese Metallurgical Grade Ore	SDT	322,025	322,025	\$1.7
Mercury	LB	9,781,604	9,781,604	\$0.0 <sup>16</sup>
Platinum	Tr Oz	8,380	8,380	\$12.6
Platinum - Iridium	Tr Oz	568	0	\$0.0
Quartz Crystals	LB	15,729	0	\$0.0
Talc - Block & Lump	ST	954	954	\$0.2
Talc - Ground	ST	685	685	\$0.1
Tantalum Carbide Powder	LB Ta	3,802	0	\$0.0
Tin	MT	4,020	0	\$0.0
Tungsten Metal Powder	LB W	275,741	275,741	\$2.9
Tungsten Ores & Concentrates	LB W	31,296,977	9,406,400	\$70.0
Zinc	ST	7,992	7,992	\$17.2
<b>Total</b>				<b>\$1,085.528</b>

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<sup>16</sup> “The mercury inventory is presently in long-term storage and is unavailable for sale.”

As seen in Table 5.1, there are materials in the stockpile, currently valued at approximately \$1.1B, which are determined to be in excess and are authorized for sale. However, potential sale or barter of materials is dependent the following:

1. The presence of a market demand for the disposable inventory. Materials commonly traded on official markets are ideal candidates for sale and/or bartering because of a present demand and a determined market price.
2. The recommendation of the MIC within the AMP that the proposed disposal will not unreasonably affect the material market.
3. The judgment of the DLA Strategic Materials Administrator that a sale or barter will not result in an unacceptable loss to the government.
4. Operations, maintenance and environmental costs (~\$125M) are accounted for and can be covered in the event of a sale.

## **6. Requirements to Amend or Revise the Defense Logistics Agency Strategic Materials Annual Material Plan for Fiscal Year 2012**

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**Section 853, Subsection (a)(6): analyze any potential requirements to amend or revise the Defense Logistics Agency Strategic Materials Annual Material Plan for Fiscal Year 2012 and subsequent years to reflect an inventory of rare earth materials to support national defense requirements;**

With the exception of yttrium oxide and dysprosium metal, with solutions under development, no NDS rare earth stockpile inventory requirements have been identified at this time. Specific legislation authorizing acquisition has not been submitted and therefore there is no need to amend the Fiscal Year 2012 AMP to address rare earths. Nevertheless, amending the AMP in any given year can be done with ample planning and time for it to be approved before the end of the fiscal year. This generally requires that work begin no later than February of the fiscal year. If thorough acquisition pre-planning (e.g., preparation for requisite contracting functions such as requests for information, statements of work, solicitations, evaluations of offers, etc.) takes place before the amendment of the AMP and the provision of funding, DLA Strategic Materials could award a contract for the acquisition of materials about 2 to 3 months after the amending of the AMP (depending on the dollar value). The process for amending or supplementing the AMP is as follows.

- The first step is to identify the materials to be contained in the supplemental AMP and the quantity required for each. Requirements for materials and quantities that DLA Strategic Materials intends to act upon with the AMP are established using the NDS Requirement Reports to Congress that are prepared biennially.
- The second step is to acquire material data from the U.S. Geological Survey (USGS) and create the Material Data Sheet for each material for which DLA is seeking authority in the new AMP. Material Data Sheets contain production and consumption data and any relevant DLA Strategic Materials sales information. They are utilized by the MIC to understand how the quantity DLA Strategic Materials seeks will impact the market for that material.
- The next step is to engage the MIC and get its approval of the supplemental AMP. The MIC is co-chaired by the Departments of Commerce and State. Other agencies that have a seat on the MIC are the Departments of the Interior, Treasury, Energy, Agriculture, and Homeland Security. To engage the MIC, DLA Strategic Materials notifies the MIC co-chairs of the need to meet to consider the supplemental AMP. DLA Strategic Materials then develops all of the supporting documents for the MIC meeting. Those documents are: Material Data Sheets, a summary of the AMP for the

year for which DLA Strategic Materials seeks authority, and a summary of the projected AMPs for each of the 4 years after the year DLA Strategic Materials seeking authority. Finally, DLA Strategic Materials provides a supporting narrative which explains its plans for each of the materials included in the AMP for the year in which it seeks authority. At that point, DLA Strategic Materials would meet with the MIC and discuss the supplemental AMP.

- After posting in the Federal Register for public comment, the MIC provides written verification that the supplemental AMP would not cause undue market disruption. The proposed AMP is then reviewed by DLA Acquisition, Comptroller, General Counsel, Legislative Affairs and the DLA Director. Prior to USD(AT&L) approval, OSD coordination must be obtained from Logistics and Material Readiness, DoD General Counsel, Comptroller, Legislative Affairs, Manufacturing and Industrial Base Policy, and Acquisition Resources and Analysis. DLA Strategic Materials normally has authority to act upon the supplemental AMP 45 days after USD(AT&L) sends the supplemental AMP to Congress.
- Acquisition planning can take place prior to AMP approval but formal solicitation of offers leading to materials acquisition cannot take place without AMP authority and available funding. After they are available, if thorough acquisition pre-planning has taken place (which itself can take several months), DLA Strategic Materials contracting solicits and evaluates offers and awards a materials acquisition contract in about 2 to 3 months. The length of time needed in Procurement Action Lead Time (PALT) is driven by dollar threshold. For example, for an acquisition of up to \$5M, it is 140 days. However, for a BPA it could be as little as 40 days.

## **7. The Steps to Develop or Maintain a Competitive, Multi-Source Supply-Chain to Avoid Reliance on Single Sources of Supply**

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### **Section 853, Subsection (a)(7): Identify and describe the steps necessary to develop or maintain a competitive, multi-source supply-chain to avoid reliance on a single source of supply.**

The DoD undertakes a number of different types of steps that encourage and promote competitive, multi-source supply-chains to avoid reliance on single sources of supply. Related measures include U.S. policy established by Executive Order and federal statutes enacted by Congress. These broad steps are widely implemented through federal acquisition regulations as well as specifically through DLA guidance and business practices.

DoD is responsible for promoting full and open competition through the use of competitive procedures in procuring goods and services including the acquisition of required materials under the Strategic and Critical Materials Stock Piling Act. DoD also supports implementation of national resource policies under the Defense Production Act (DPA) that includes support for a competitive domestic industrial base for materials required for national defense.

To the maximum extent possible<sup>17</sup>, and in accordance with Federal Acquisition Regulations (FAR), DoD's competitive procedures include a variety of steps that help to develop, maintain and increase competitive, multi-source supply chains and reduce reliance on single sources of supply. Consistent with this policy, DoD expects to benefit from competitive procedures that encourage the diversification of supply chains and reduce the government's cost to efficiently fulfill requirements for defense materials.

Specific steps in the area of U.S. policies that provide for DoD's competitive procedures and measures for developing and maintaining a competitive, multi-source supply are included in a number of federal statutes concerning a variety of DoD business practices. Examples include:

- 10 U.S.C. § 2319 – Encouragement of New Competitors (e.g., supportive provisions for: qualification requirements; quality assurance demonstration; testing and evaluation; and standard specifications).
- 10 U.S.C. § 2304 – Contracts: Competition Requirements (e.g., requirements for: full and open competition; competitive procedures; ensuring reliable sources of supply; maintaining essential capabilities; and promote competition).

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<sup>17</sup> There exist various statutory exemptions, waivers and other exclusions from the use of competitive procedures (e.g., minimum procurement thresholds, timely support of urgent warfighter needs, and other exceptional circumstances). See 10 U.S.C. §§ 2319 and 2304 for examples.

- 41 U.S.C. § 1705 – Advocates for Competition (e.g., advocate for competition and challenge barriers to full and open competition).

In cases when DoD is reliant on a single source of supply in a foreign country – or reliant on an industrial base of firms concentrated in a foreign country(s) – DoD uses specific policies and programs to help develop and/or maintain U.S.-based sources of materials required for U.S. defense. Examples include:

- 50 U.S.C. §§ 2091 – 2099a: Defense Production Act (e.g., government assistance for Strengthening Domestic Capability).
- 50 U.S.C. §§ 2533a – 2533b: Specialty Metals clause (e.g., government protections of the U.S. defense industry from becoming overly dependent on foreign sources of supply, especially in times of conflict).

Specific steps to develop or maintain multi-source supply chains for NDS material requirements are similarly advanced by DLA senior leadership and promulgated in DLA’s 2010-2017 Strategic Plan and annual Director’s Guidance.<sup>18</sup> Related steps include focused engagements with industry partners to reduce material acquisition costs by applying innovative approaches to increasing competition, providing incentives and maximizing economies of scale. Examples<sup>19</sup> of steps to achieve these objectives and those that support multi-source supply chains include a number of DLA initiatives:

- Long-Term Contracting
- Performance Based Logistics
- Strategic Supplier Agreements

Further steps to develop and maintain competitive, multi-source supply chains for required NDS materials are provided for in the Stock Piling Act and associated stockpile management requirements for *competitive procedures* to be used in the acquisition of NDS materials.

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<sup>18</sup> DLA’s fiscal 2012 *Director’s Guidance* was first issued in October 2011 and revised in April 2012.

<sup>19</sup> Ibid.

Specific steps available to the Administrator of DLA Strategic Materials to develop and maintain competitive, multi-source supply chains include the use of multi-award contracts.<sup>20</sup> Multi-award contracts provide for contract awards to multiple suppliers and multiple awardees can subsequently compete for follow on delivery order requirements (i.e., procurement). Two leading examples of the use of multi-award contracts to support competitive, multi-source supply chains include two kinds of contingency contracting measures: Blanket Purchase Agreements and Buffer Inventory Contracting.<sup>21</sup>

- Blanket Purchase Agreements (BPAs): BPAs are a contingency contract measure that serves as an alternative to acquiring NDS materials through traditional contracting means. BPAs can be established with multiple suppliers and therefore substantially diversify and increase the government's access to vendors and available inventories.<sup>22</sup>

Establishing a BPA between the government and prospective suppliers does not in itself constitute an actual obligation by the government to purchase anything, but rather puts in place terms of an agreement in the event the government needs to purchase materials in the future, such as in the case of a future national emergency.

BPAs provide a simplified method of fulfilling anticipated and potentially repetitive acquisitions by establishing, in effect, "charge accounts" with pre-qualified suppliers.<sup>23</sup>

BPAs establish conditions of a future sale (e.g., product specifications, delivery schedule, minimum and maximum order limits and price or a pricing index). The terms for acquiring materials are negotiated when a BPA is initially established with a qualified supplier.<sup>24</sup> In addition to reducing the cost for executing acquisitions (e.g., lower administrative and transaction costs), BPAs are intended to reduce acquisition lead times associated with government acquisitions such as those necessary during a future national emergency.<sup>25</sup>

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<sup>20</sup> In addition to increasing competition and supporting multi-source supply chains, multi-award contracts provide other potential benefits to DoD including: realizing economies of scale; leveraging the government's buying power; and providing the government flexibility to meet uncertain DoD requirements. Conversely, multi-award contracts may also increase the cost of procurements – in contrast to single supplier awards – due to reduced acquisition efficiencies because of multi-award contracting. More specifically, DoD notes that the Stock Piling Act does not generally envision recurring purchases once stockpile inventorying goals are met. Therefore it may also be in the U.S. government's best interest to purchase needed inventory as efficiently as possible, even if that results in awarding a contract to the lowest price responsible bidder.

<sup>21</sup> Unless otherwise note herein, these definitions for Blanket Purchase Agreements and Buffer Inventory Contracting are working definitions used by DLA Strategic Materials.

<sup>22</sup> See also FAR Subpart 8.405-3 and Blanket Purchase Agreements.

<sup>23</sup> Excerpts from DoD BPA Contractor Instruction and Guidelines.

<sup>24</sup> Ibid.

<sup>25</sup> Excerpts from DoD BPA Contractor Instruction and Guidelines. See also FAR Subpart 8.405-3 and further details about BPAs.



Buffer Inventory Contracting (BIC): Compared to a BPA, a BIC is a more progressive contingency contracting measure for increasing the U.S. government's ability to acquire materials for potential NDS requirements. In a manner similar to establishing BPAs with multiple suppliers, BICs can also be established with multiple suppliers and therefore help to develop and maintain a competitive, multi-source supply chain and avoid reliance on a single source of supply. In addition to the government competing BIC opportunities among different suppliers, contract awards can be made to multiple suppliers. Multiple suppliers can also later compete for subsequent material acquisitions that occur when the government demands material for delivery, such as in the event of a future national emergency.

BICs involve the government subsidizing a supplier(s) to increase their inventory beyond normal levels. Participating suppliers are first qualified and then contractually required to maintain a level of a specified material that the government might purchase if and when the need arises.

Unlike a BPA, BICs guarantee that specified materials are both located in the U.S. and accessible to the government with specified quantities and lead times. The government in effect is financing an option (i.e., call) to acquire a material that may or may not be exercised. As with NDS material acquisitions generally, BICs are used when the supply of a material faces a substantial risk of interruption. They are intended to buffer (i.e., bridge) against a risk to supply until markets either correct themselves, new supplies are established, or demand for a material is reduced by substitutes. The government can ultimately obtain BIC materials and establish a traditional stockpile by exercising their right to purchase vendor-held inventories. Buffer inventories may be used instead of traditional stockpiling if the government cannot or does not wish to acquire materials -- either due to legislative constraints, market factors or budget limitations. However, should there be a subsequent need to acquire the materials, legislative and other requirements apply.

While the DoD recognizes the utility of multiple-award contracts to develop or maintain competitive, multi-source supply-chains, it also recognizes the need to assess inherent trade-offs between helping to build and sustain diversified sources of supply and maximizing the effectiveness of its purchases (see chapter 2, Detailed Cost Benefit Analysis).

To conclude, the DoD uses a number of steps to encourage and promote efforts to develop, maintain or expand a competitive, multi-source supply-chain. Examples range from supportive U.S. policy codified in federal statute (e.g., the Stock Piling Act) and by Executive Order (e.g., National Defense Resources Preparedness). Related initiatives are implemented across the DoD through the FAR (e.g., BPAs and Subpart 8.405-3), as well as through leadership guidance provided by DLA's Director, and stockpile inventorying business practices available to the Administrator of DLA Strategic Materials. Related steps are undertaken by DLA leadership and promulgated in DLA's 2010-2017 Strategic Plan and DLA's annual Director's Guidance.

Implementation steps to develop and maintain competitive, multi-source supply chains for required materials are available to the Administrator of DLA Strategic Materials through the use of multi-award contracts – including BPAs and BICs.

## **8. Supply Sources Considered by the Administrator to be Reliable and Analysis of Capabilities for Military Applications**

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**Section 853, Subsection (a)(8): Identify and describe supply sources considered by the Administrator to be reliable, including an analysis of the capabilities of such sources to produce such materials in forms required for military applications in the next 5 years, as well as the security of upstream supply for these sources of material.**

### **A. Overview**

In making country supply reliability decisions for his principal requirements assessments, the DLA Strategic Materials Administrator builds upon the congressionally-mandated mission of the NDS “to decrease and to preclude, when possible, a dangerous and costly dependence by the U.S. upon foreign sources for supplies in times of national emergency.”<sup>26</sup>

### **B. Methodology**

For evidence to make decisions concerning material supply sources reliable enough to meet defense needs in the NDS context, the Administrator DLA Strategic Materials draws upon explicit classified assessments prepared by Office of the Under Secretary of Defense for Policy (OUSD(P)) and by the Defense Intelligence Agency (DIA) as to which countries are designated as adversaries in an approved NDS Base Case.<sup>27</sup> In this documented reliability assessment process, no defense needs may be met by designated adversaries during the conflict period (the first year of the 4-year Base Case). After the conflict period, in the remaining 3 years of the Base Case (the “regeneration period”), some of the former adversaries’ production may be drawn upon to meet defense needs – but only if those former adversaries are not deemed “market dominators.” Market dominators are defined in this reliability assessment process as foreign supply sources that are typically producing fifty percent or more of global production of the material in question. If a foreign country is a market dominator, no defense needs may be met by

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<sup>26</sup> The Strategic and Critical Materials Stock Piling Act (50 U.S.C. § 98, section 2(b)).

<sup>27</sup> See Joint Publication 2-0. Joint Intelligence, 22 June 2007. Chapter II, page 7. Intelligence assessments must be factually correct, convey an appreciation for facts and the situation as it actually exists, and provide the best possible estimate of the enemy situation and COAs based on sound judgment of all information available. The accuracy of intelligence products may be enhanced by placing proportionally greater emphasis on information reported by the most reliable sources. Source reliability should be evaluated through a feedback process in which past information received from a source is compared with the actual “ground truth” (i.e., when subsequent events, reports, or knowledge confirm the source’s accuracy). DIA’s country reliability assessments are classified SECRET//NOFORN.

them in any part of the 4-year scenario. Moreover, this “market dominator rule” applies whether the country is deemed to be an adversary, a former adversary, or a non-adversary.

In this reliability assessment process, some supplies of former adversaries that are not market dominators may still be deemed reliable enough by DIA to meet some defense needs in the regeneration period, but only if (and to the extent that) DIA judges them as able and willing to supply such materials to the U.S. during that part of the approved scenario. To the extent that DIA judges them as both able and willing to supply some material to meet U.S. defense needs during the regeneration period, then the DLA Strategic Materials Administrator accepts a portion of those former adversaries’ production capabilities as available in the regeneration period to meet U.S. defense needs.<sup>28</sup>

For those countries not deemed to be adversaries, former adversaries, or market dominators, some of their production may be deemed reliable enough to meet some U.S. defense needs throughout the *entire* Base Case scenario (that is, in the conflict year as well as in the regeneration period). As stated above, no (foreign) market dominators, not even non-adversaries, are considered reliable enough to meet U.S. defense needs in the Base Case. The specific share of non-adversary and non-market dominators’ production capabilities that is deemed reliable enough to be used to meet defense needs in the Base Case will be an explicit function of how able and willing DIA assesses them to be for supply of such materials to the U.S. during the various parts of the overall scenario.

Overall, the reliability criteria that the DLA Strategic Materials Administrator uses for purposes of identifying production that can meet defense needs in the context of the NDS Base Case include two criteria that simply preclude the DoD from counting upon being able to use *any* of that particular country’s production for U.S. defense purposes: no adversaries and no market dominators. For other countries, their reliability as suppliers for defense purposes will be determined by just how able and willing DIA judges them to be to satisfy U.S. defense demands in the Base Case. Those specific country reliability scores are classified. Table 8.1 summarizes these reliability criteria.

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<sup>28</sup> DIA’s Director for Analyses, assigns to the Defense Resource and Infrastructure (DRI) Office, which has regional material experts and who have been performing reliability supply assessments for the DLA Strategic Materials Administrator for many years, the task of assessing reliable supply sources. Their office assesses reliability of approximately 175 countries to supply materials to the U.S.

**Table 8.1: Foreign Production Deemed Reliable Enough to Meet Defense Needs in the NDS Base Case**

Reliability Criteria	Conflict Period (Year 1)	Regeneration Period (Years 2-4)
Adversary Production Available	No	Not Applicable
Former Adversary Production: Available to the Extent DIA estimates them to be both able and willing	Not Applicable	Yes
Market Dominator Production Available	No	No
Other Foreign Countries' Production: Available to the Extent DIA estimates them to be both able and willing	Yes	Yes

The DLA Strategic Materials Administrator has employed this approach to assess country reliability for many cycles of the biennial requirements reports to the Congress<sup>29</sup> and plans to use an approach comparable to the one summarized here as DoD moves more deeply into assessments of potential gaps and shortfalls in downstream forms of required materials.

### **C. Downstream/Upstream Assessments**

Section 853, subsection (a)(8) calls for “identifying and describing supply sources considered by the Administrator to be reliable, *including an analysis of the capabilities of such sources to produce such materials in forms required for military applications in the next 5 years, as well as the security of upstream supply for these sources of material.*”

In analyzing the capability of sources to produce such materials, in the forms that are required for military application in a secure, upstream environment, the DLA Strategic Materials Administrator submits a biennial NDS Requirements Report.

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<sup>29</sup> Regarding country reliability, DoD imposes reductions in estimated imports of strategic materials based specifically on (classified) reliability assessments of foreign suppliers in the context of the Base Case scenario. These assessments consider both the *willingness* of foreign governments to supply materials to the U.S. during the specified scenarios and the *ability* of foreign economies to produce and deliver anticipated materials.

Table 8.2 contains a brief overview, by country, of key production capabilities for rare earth materials of relevance to DoD.

**Table 8.2. Rare Earth Supply Chains - Upstream Supply Sources**

<b>Country</b>	<b>Ore Mining</b>	<b>Oxide Production</b>	<b>Metal Production</b>	<b>Alloy Production</b>	<b>Sintered NdFeB Magnet Production</b>
Australia	x		x	x	
Austria		x	x	x	
Brazil	x				
China	x	x	x	x	x
Estonia		x			
Finland					x
France			x	x	x
Germany			x	x	x
India	x	x			
Japan			x	x	x
Malaysia		x			
Russia	x				
South Africa	x	x			
U.K.					x
U.S.	x	x	x	x	
Vietnam	x	x	x		

#### **D. Overview**

The worldwide picture for rare earth mining and oxide production is comprised of many different producers. Some are key U.S. allies, others are business partners and still some might be regarded as rivals. Rare earths elements are mined and oxide is produced primarily in China (Baotou Steel’s Rare Earth Element Division, Minmetals and Jiangxi Copper). U.S. capability

for rare earths mining and oxide production is improving, primarily due to the reopening of the Molycorp mine and construction of separation facilities in Mountain Pass, California. In addition, Australia (Lynas Corporation), Austria (Treibacher Industries), Brazil (World Mineral Resources (WMR)), Estonia (Molycorp Sillamäe), India (Minerals Division at Chavara, Manavalakurichi, Orissa Sands Complex (OSCOM) and Rare Earths Division at Aluva), Malaysia (Lynas Advanced Materials Plant (LAMP)), Russia (Lovozerky GOK) and South Africa (Great Western Mineral Group (GWMG)) all contribute in various amounts to the global upstream supply of rare earth resources.

In examining the global picture for metal and alloy production there are fewer countries. Some are key U.S. allies, others are regional partners and then there are other producers who might be viewed as rivals. China remains a dominate producer of metals and alloys because many companies have production facilities located in China to take advantage of the favorable economic, environmental and manufacturing incentives.

Characterizing the overall picture for sintered NdFeB magnet production, the field of producers dwindles. This is partly due to the fact that there are intellectual property rights involved and few licensing agreements. However, there have been recently announced developments that may positively impact NdFeB magnet supply. First, Hitachi has announced plans to begin NdFeB magnet production in the U.S. by 2013. Second, Molycorp has announced a joint venture in Japan to begin producing NdFeB magnets that do not rely on Hitachi's patents. Lastly, key Hitachi patents are set to expire in 2014 which could further expand global production of NdFeB magnets.

## **9. Other Considerations and Recommendations to Support the Establishment of a RE Material Stockpile Inventory**

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**Section 853, Subsection (a)(9): Include such other considerations and recommendations as necessary to support the establishment of such inventory.**

While it has been determined to be feasible for DoD to acquire and hold an inventory of rare earth materials, such action is not considered advisable at this time with two exceptions. Ultra-pure yttrium oxide and dysprosium metal have been determined to have potential supply vulnerabilities and solutions are being developed. Ultra-pure yttrium is needed to produce YAG crystals for key military laser applications while dysprosium is needed for high temperature NdFeB magnets and other specialty materials used in a wide variety of important defense applications. In the case of both materials – ultra-pure yttrium and dysprosium metal – production is highly concentrated outside of the U.S. As such, appropriate action will be taken through processes addressed in this report to mitigate the shortfalls.

Using the Planning and Preparedness Process outlined in Appendix A, DLA Strategic Materials will pursue the implementation of appropriate mitigation measures for known supply chain issues, e.g., yttrium and dysprosium. The Materials Watch List Process outlined in Appendix B will be used to monitor and quantify future material supply chain issues.

The acquisition process for new NDS materials is comprehensive and lengthy, taking approximately 3 years from identification of a requirement to receipt of authority and funding; potentially followed by an additional 1 to 5 years to acquire the full inventory, depending upon market conditions. Given this timeframe, it is likely that the situation creating the requirement could be decided favorably or unfavorably by market forces before the appropriate mitigation solution could be fully implemented.

Since the acquisition process is such a key element for establishing a NDS rare earth inventory, DLA Strategic Materials will continue pursuing changes to the Strategic and Critical Materials Stock Piling Act (50 U.S.C. § 98) to streamline NDS purchase and release procedures, permitting the Stockpile to be able to respond more rapidly to changing markets and national security requirements.

DLA has proposed and will continue to propose changes to NDS legislation to adjust to changing global industrial and materials market conditions. Legislative proposals to acquire materials for the NDS will also be advanced when those solutions best serve the interests of the nation.



# Appendix A

## Proposed Preparedness Plan

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### A. Overview

The DLA Strategic Materials Administrator proposes the development and testing of an action-oriented Planning and Preparedness Process for non-fuel materials that would be in continuous operation within DoD.

This process would build upon a number of activities that are already in place within DLA Strategic Materials. It would also incorporate, in collaboration with the Stockpile Manager and other relevant organizations within DoD, several new and important activities to increase the fidelity of contingency planning and preparedness for defense materials.

### B. A Proposed 10 Step Planning and Preparedness Process

The overall process proposed here has 10 major steps, as outlined in the table below.

**Table A-1. 10 Step Planning and Preparedness Process**

Step	Key Goal	Approach	Specifics
1	Identify "Materials of Concern"	Elicit Nominees from Services/Agencies	Issue Elicitation Letter
2	Assess Potential Shortfalls in Scenarios of Concern	Use NDS Requirements Process; use downstream case studies	Process as described in 2011 Requirements Report to Congress; case studies as in FY-11 NDAA section 843 Interim Report
3	Assess Risks of Shortfalls	Use DLA Strategic Materials risk assessment process	As described in Ch 2 of this current report
4	Identify Promising Mitigation Options	Use DLA Strategic Materials risk mitigation assessment process	As described in Ch 2 of this current report
5	Assess Cost-effectiveness and basic timeliness of options to address shortfall risks	Use DLA Strategic Materials risk mitigation assessment process	As described in Ch 2 of this current report

**Cont. Table A-1. 10 Step Planning and Preparedness Process**

6	Assess how long it will take to implement promising options, e.g. acquire inventory	Use DLA Strategic Materials risk mitigation assessment process	As described in Ch 2 of this current report
7	Assess how much time is available to implement promising options to address important potential shortfalls/ acquire inventory	Establish and use intelligence community panels and industry panels to assess important indicators that a disruption scenario may occur	Panels would meet quarterly and results would be integrated by DLA Strategic Materials and reported to Stockpile Manager
8.1	Establish important draft paperwork to initiate most promising mitigation options if triggers occur	Build a plan manual and case book	DLA Strategic Materials and Stockpile Manager will build and test manual and case book in table top exercises and field tests as feasible
8.2	Trigger: If time needed to implement mitigation options is estimated to be equal to or greater than time that is estimated to be available to overcome shortfalls, act to implement mitigation plans as soon as feasible	Initiate Mitigation Actions as appropriate	DLA Strategic Materials and Stockpile Manager would submit appropriate taskings within DoD and submit budgetary and/or legislative requests to the Congress as appropriate
9	Reassess Time available to implement mitigation options	Use same panels and process as in step 7 above	DLA Strategic Materials and Stockpile Manager would oversee/integrate
10	Continue to Act/Adjust	Use all steps as above	DLA Strategic Materials and Stockpile Manager would oversee/integrate

The following section now fleshes out some of these 10 steps in somewhat greater detail.

**Step 1:** Identify “Materials of Concern”—from DoD (Military Services and Defense Agencies) and others.

**Approach:** Use an elicitation letter such as the DLA Director sent for the 2013 NDS Requirements Report.

**Step 2:** Assess Potentials Shortfalls for “Materials of Concern” at two levels for all important scenario(s) --“scenarios of concern.” Disruption scenarios would be examined as follows:

- a. At the “Raw Material”– level, as in the traditional NDS Requirements planning process.
- b. At the downstream-level of concern – as in more detailed “deep-dives” into supply chains, such as the Interim FY11 NDAA section 843 Report to Congress assessment of sintered NdFeB magnets.

**Approach:** Use processes as described in the 2011 NDS Requirements Report to Congress and in the FY11 NDAA section 843 Interim Report to Congress.

**Step 3:** Assess Risks of Shortfalls.

**Approach:** Risk of shortfalls are defined as the product of the probability that a supply chain disruption scenario would occur and the consequence to the nation of the shortfall (shortage) of rare earths that would result from that disruption. DoD will use expert judgment to ascertain both quantities for this assessment. Experts consulted in the assessment will include those from government, academia, and industry. For more information, see Chapter 2.

**Step 4:** Identify Risk Mitigation Options.

**Approach:** Risk Mitigation Options will be identified based on DoD experience (in DLA Strategic Materials) in assessing and planning to mitigate risks to the nation from the disruption of the supply of materials required for defense. For more information, see Chapter 2.

**Step 5:** Assess the Cost-effectiveness and basic timeliness of promising mitigation options.

**Approach:** The cost of each mitigation measure will be assessed using an expected net present value in accordance with OMB Circular A-94. Effectiveness will be assessed by measuring the baseline risk associated with a shortfall requirement and multiplying that baseline risk by the probability of failure of a given mitigation measure (which will include consideration of the timeliness of the measure and the time available to respond to the threatened shortage). The result is a residual risk metric which can then be compared to an identified risk threshold in order to determine which mitigation measures are acceptable to the government. For more information, see Chapter 2.

**Step 6:** Assess how much time is likely to be needed (minimum, average, worst case) to implement various promising mitigation options in order to overcome estimated shortfalls (under non-emergency conditions and also under emergency conditions).

**Approach:** The timeliness of Risk Mitigation Options is included in the effectiveness analysis (i.e., mitigation measures which take too long to implement will be more likely to fail). Assessments will be based on DLA Strategic Materials' experience in assessing and planning to mitigate risks to the nation from the disruption of the supply of materials required for defense. For more information, see Chapter 2.

**Step 7:** Assess how much time is plausibly available (especially before the disruption scenarios are expected to occur) to implement mitigation options that will overcome estimated shortfalls.

**Approach:** Several panels of Intelligence Community, Industry, and other subject matter experts would be formed and tasked to prepare assessments of time available (and any other relevant "triggers") on a regular basis. Results would be integrated by DLA Strategic Materials and provided to the Stockpile Manager for consideration and further action. Portions of relevant National Intelligence Estimates could be prepared/utilized for this purpose.

**Step 8.1: Act** – As part of a regular, deliberate planning and preparedness process.

- a. Prepare draft for key items including:
  - Letters from appropriate OSD officials, i.e., the Stockpile Manager, requesting information from the Services concerning what specific items they will need to sustain key systems/programs during a disruption, such as what specific sintered -NdFeB magnets (e.g., by federal ID numbers), or what samarium cobalt magnets they will need, in what quantities, on what schedules;
  - Formal paperwork for inventory acquisition;
  - Contracts for contingency production of key components;
  - Supplemental NDS budget proposals for such purchases;
  - Plans to increase Defense Priorities and Allocation Systems (DPAS) ratings with specific plants, mines, etc.;
  - Plans to release federal inventory (e.g., NDS inventory) on a priority basis to program managers and their vendors that have been assigned priority.
- b. Conduct tests of this process through periodic table top exercises:
  - Periodic exercises could be structured to test key parts of the preparedness plans by challenging assumptions and “red-teaming” the preparedness plans.
- c. Conduct selected field tests of key parts of the process:
  - Example: Where feasible, arrange one or more small peacetime contracts as preliminary tests of important parts of the contingency plan, e.g., DoD could arrange to buy some NdFeB-magnets from a planned emergency-plan source in order to establish a connection; see how it works; and evaluate capabilities, capacities, and availability of needed inputs for the plant.

**Approach:**

- a. Draft documents to be prepared by DLA Strategic Materials in conjunction with the Stockpile Manager.
- b. Tests of the processes to be designed and conducted by DLA Strategic Materials in conjunction with the Stockpile Manager (see Appendix D for sample test questions with potential contingency suppliers).

**Step 8.2: Act** – As part of an accelerated/crisis planning/preparedness/ action process.

If time available (as estimated in step 7) is less than or equal to time needed to implement promising options to overcome projected shortfalls (as estimated in step 6), then:

- a. DLA Strategic Materials Administrator proposes that relevant DoD decision-makers, especially the Stockpile Manager, approve appropriate actions as prepared in step 8.1a;
- b. The Stockpile Manager, and others as appropriate, approves actions that have been proposed above; decision-makers modify proposed actions as needed and call for adjusted versions;
- c. Congress approves some proposed actions; delays or denies others; and
- d. DoD implements approved actions/proposals as appropriate.

**Step 9:** DoD reassesses time available to implement mitigation options in light of changing circumstances, including effects of its actions.

**Approach:** Use the same assessment processes that are in place for step 7 above.

**Step 10:** Adjust U.S. actions and assessments in view of results of step 9.

**Approach:** Use all relevant parts of the cycle of steps as described above.

## **C. Triggers**

**Overview:** Following are DLA Strategic Materials proposed “triggers” – indicators of a heightened risk of material shortfalls that could prompt government actions such as initiating a stockpiling initiative to address those prospective shortfalls. It should be noted that specific figures provided below for the triggers are illustrative and will be researched to determine appropriateness.

### **Triggers for the Intelligence community:**

1. Has the probability of the NDS Base Case (or of other key designated scenarios) decreased, increased or stayed the same in the past 6 months?
2. What, if anything, has changed that would cause the company to change this probability?

### **Triggers for Industry:**

1. Are you having difficulty accessing necessary rare earth materials and, if so, which ones and why?
2. Have lead times changed in the past 6 months and, if so, in which direction and why?
3. What is your baseline (normal) level of inventory in terms of days of supply? What is your current raw material inventory level in terms of days of supply? Has this changed in the past 6 months and, if so, in which direction and why?

4. What is your baseline operating rate (production/capacity ratio)? What is your current operating rate? Has this changed in the last 6 months and, if so, in which direction and why?
5. Where do you source your raw materials and in what percentages?
6. If a major supplier becomes partially or fully unavailable (for 1, 3, 6 months) can other suppliers fill the gap and how long would it take to arrange that?
7. In the event of a disruption that lasts 1, 3, or 6 months what is your "time to recover?"
8. For companies currently filling DoD contracts: how long would it take you to respond to an increase in orders of 25, 50, or 100 percent?
9. For companies not currently filling DoD contracts: Using current expertise and existing equipment, could you fulfill a DoD spec product and how long would it take if we provided the requirement?

**For DLA Strategic Materials:**

1. What is the current Demand/Supply (D/S) balance using just domestic supply? How is it trending?
2. What is the current D/S balance using domestic plus friendly foreign supply? How is it trending?
3. What is the current D/S balance using global supply? How is it trending?
4. Industry would be responsible for reporting out quarterly if possible on questions Triggers for Industry questions 4 and 5 and DLA would be responsible for tracking.

**Potential Decision Points for these Triggers:**

1. Inventory/sales ratio in terms of days of supply: normally this is 30 days. This figure is generated by calculating the inventory/shipments ratio and multiplying that figure by the number of days in the month. If days of supply reaches 27 days and stays there for 90 days then this is a trigger for implementing a mitigation solution.
2. Supply/Demand balance <1. If it stays there for 90 days then this is a trigger
3. Operating rates (baseline to be determined). Operating rates are defined as actual (not planned) production divided by operating capacity (capacity that is operable and not shut for market reasons or maintenance). Surveys and discussions with industry would need to occur to establish a baseline, or standard, operating rate for that industry. In addition, producers and downstream processors would need to provide information regarding the timing and duration for when operating rates became "high" in relation to the baseline.

4. Triggers for Industry questions 7-9 could serve as overall triggers in the sense that if the answer to 7 is "long" (more than 6 months) and answers to 8 and 9 are "we don't know" or "no" then the Department needs to act now (depending on the material or component)

#### **D. The Way Ahead**

The DLA Strategic Materials Administrator proposes that the above action-oriented planning and preparedness process be coordinated with the Stockpile Manager and then tested with all deliberate speed.

Developing and implementing such a process will be facilitated by strong, ongoing collaboration between the Stockpile Manager and the DLA Strategic Materials Administrator through all of its steps.

## **Appendix B**

### **Materials Watch List Process**

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DLA Strategic Materials begins its research process by establishing a materials “Watch List.” In order to be placed on the Watch List a materials must meet certain criteria which are explained below.

DLA Strategic Materials employs a staff of experienced economists and market analysts that continuously monitor materials markets for “trading anomalies.” These anomalies can take a variety of forms and can be characterized as short-term (tactical) or long-term (strategic) disturbances. In the short-term price spikes, industrial accidents, labor action, natural disaster, terrorism, or logistics bottlenecks (e.g. congestion at ports) can cause short- and medium-term disruptions (defined as 6 months to 1 year) in the flow of materials. The process involves determining the nature, cause, severity and consequences of these short-term disturbances. DLA leadership and the Stockpile Manager receive notification when the disruption could potentially involve the closure or temporary idling of a key link in the defense industrial base, the partial or complete stoppage in the flow of a required material, or the increased reliance on a foreign supplier.

Trading anomalies can also involve long-term disruptions to supply chains and material flows. These types of disturbances typically involve longer term “megatrends” that take years and often decades to play out. Megatrends are long-term societal shifts that change not only the type but very nature of human activity. These include things like technological change, major changes in the composition of the economy, industrialization, and demographic shifts. Specific past examples include the development of the combustion engine, the industrial revolution, urbanization, light-weighting of transportation, miniaturization of electronics, the internet and, the evolution of social media. Potential future examples could be the impacts of cyber security challenges and robotic warfare.

In order to determine the impacts of these changes, the analyst must research the phenomenon’s rate of change such as the deployment and adoption of a new technology and the material usage intensity of the technology. In the social sphere the analyst must research the implications that, for example, a rising global middle class would have on lifestyles in an era of the 24/7 news-cycle and access to social media. Long-term (10 – 15 year) trends can be thought of as strategic and the solution to possible material shortfalls that stem from such long-term societal changes might include thrifting (using less), recycling, substitution or engineering the material out of the design.

There are 4, sometimes overlapping, ways that a material on the Watch List can transition to the review phase: (1) The Biennial Requirements Report to Congress, (2) Emerging



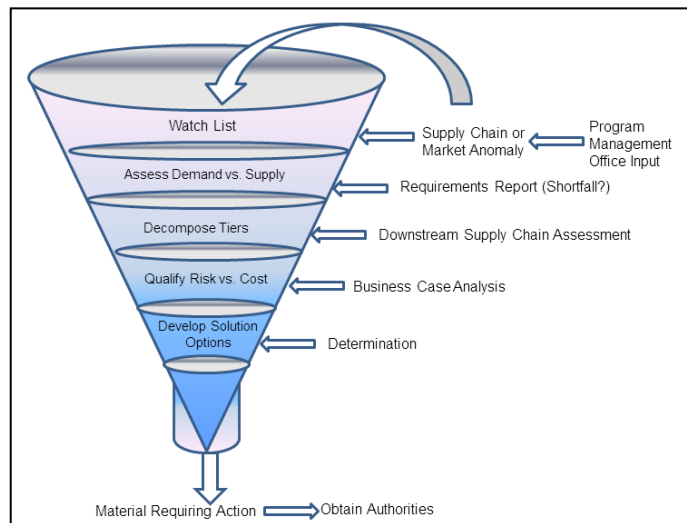
requirement via contact by the Department's acquisition community, (3) Economic research, (4) Executive or Congressional direction.

### Biennial Requirements Report to Congress:

Secretary of Defense submits to Congress identifying stockpile requirements biennially. Each report includes the Secretary's recommendations with respect to stockpile requirements and identifies national emergency planning assumptions used by the Secretary to make these recommendations. Requirements identified in the "Biennial Report to the Congress on Stockpile Requirements," also referred to as the "Requirements Report" are based on national emergency planning assumptions of a military conflict scenario, consistent with the scenario used by the Secretary in budgeting and defense planning purposes. Assumptions include consideration for the length and intensity of the assumed military conflict, military force structure to be mobilized, losses anticipated from enemy action, military, industrial, and essential civilian requirements to support the national emergency, availability of supplies of materials from foreign sources during the mobilization, military conflict and replenishment periods, domestic production of materials during the mobilization period and military conflict, and the subsequent period of replenishment, taking into consideration possible shipping losses and civilian austerity measures required during the mobilization period and military conflict.

### Emerging Requirements:

Defense and industry program managers will on occasion contact DLA Strategic Materials with rapidly emerging strategic materials supply chain issues. DLA Strategic Materials also has several processes for reaching out to defense and industry managers to solicit information regarding status of strategic materials supply chains. Examples of initiatives under these processes include participation in a wide variety of industry forums and membership on a number of working groups such as the White House Science and Technologies Working Group, the Critical Energetics Working Group and the Critical Technologies Working Group of the Space and Industrial Base Council. Supply chain issues, especially at the semi-processed level and downstream in production processes, surface through contacts with these groups and associated networks. These materials are added to the Watch List and expeditiously moved through the process.



**Figure B-1. Research Process for Stockpiling Materials**

### Economic Research:

As mentioned above, DLA Strategic Materials economists conduct continual market surveillance and forecasts of global markets, having access to industry journals, news agencies, and trading platforms (e.g. Reuters, Bloomberg) as well as access to research from consultants, academia and governments on the global market for materials required for defense. In addition, they have an industry outreach department that acts as a liaison between DLA and private industry to ascertain and evaluate both short- and long-term material availability, industrial base capability, and supply chain vulnerabilities.

The initial goal of economic research is to determine whether or not a material belongs on the “Watch List.” Certain criteria must be met in order to qualify. On the supply-side, these criteria include:

- a) Is the material a co- or by-product?
- b) Are we import dependent?
- c) Does a large share of the imports come from an unreliable country or a country with poor governance?
- d) Is production concentrated in one or a few countries?
- e) Is production concentrated in one or a few producers?
- f) Is the regulatory environment conducive to mining?
- g) Is the cost to mine and refine this material rising?
- h) What is the crustal abundance?
- i) Is refining capacity growing, stagnant, or declining? At what rate?

Demand side analysis presents additional challenges due to the difficulty in estimating DoD demand for materials that are often buried deep in the supply chain several tiers below the Original Equipment Manufacturer (OEM) or even Tier 1 suppliers. While many OEMs and Tier 1 suppliers expend enormous effort and resources to understand their supply chain, full knowledge of the complete materials supply chain is simply not practicable or feasible in many cases. In addition, given the sensitive nature of the data (not to mention the cost that would be incurred to collect data from the “bottom-up”), estimating the Department’s consumption of materials is an enormous undertaking. While DoD is the single-largest buyer of many materials, developments in the commercial sector are what really “drive” the demand for materials. Fortunately, there is a rich body of data available from governments, private consulting groups, associations, non-profits, and some of the lower tier companies themselves that can greatly facilitate demand-side analysis for materials. While not perfect, this approach offers a basis for estimating future demands of defense materials and serves as a key variable to qualify a material for the “Watch List.”

The purchase and consumption of a material is a “derived demand” in that it is determined by the activity level and growth of that material’s underlying end-use application. There are, of course, exceptions since precious metals such as gold and platinum are purchased for their intrinsic value, as a store of value and for investment purposes. Still, even for these materials, their purchase and consumption is ultimately tied to some underlying economic activity.

Some of the demand-side questions include:

- a) What are the main commercial end-uses/applications for the material and at what rate are they growing?
- b) How fast is technology developing and what are the material implications?
- c) What is the adoption rate of technologies, particularly “green” technology?
- d) What is the usage of materials per unit of product? How is that variable trending?
- e) How quickly is the middle-class growing globally?
- f) What implications do the internet and social media have on lifestyles?
- g) Is demand for the material growing below, at, or above the rate of GDP growth?

If, in the analyst’s judgment, a material meets a sufficient number of these supply-side and demand-side criteria the material is placed on the “Watch List.” Being so designated does not imply that there is a shortage or any particular problem with the material. It simply means that DLA Strategic Materials is watching it. The Watch List is updated when a significant new piece of information becomes available and/or after discussions with senior management.

#### Next Steps

**Downstream Assessments** – Downstream assessments are performed for materials that have identified shortfalls or other issues.

Aspects of Downstream Assessments include:

- a) Is the material in the National Defense Stockpile inventory?
- b) Was the material in shortfall in the last iteration of the Requirements Report?
- c) Was the material close to shortfall in the last iteration of the Requirements Report?
- d) Has a Program Office identified a potential problem with the material?
- e) Are supply chain issues related to domestic mining, processing or manufacturing?
- f) Do the issues extend across multiple tiers of the process (mining, processing and manufacturing) that will require resolution at multiple levels of the supply chain?
- g) Can mitigation solutions be developed and implemented within the authorities of the Act?
- h) Are funds available to implement mitigation solutions?

**Business Case Analyses** – The next step in the research process depends upon whether the Downstream Assessment reveals a potential shortfall (defense or essential civilian) and/or a Program Office identifies an existing, real-time availability issue. In these cases, DLA Strategic Materials will conduct downstream supply chain “deep dives” that decompose the supply chain in as much detail as time and the available data will allow. From that research a Business Case Analysis (BCA) is developed which details the problem, identifies the risk and its consequences, and recommends mitigation solutions along with the respective costs and benefits. From the BCA, a final Determination can be used to develop recommended actions (including doing nothing) along with associated costs and benefits. The BCA and Determination can also be used in the legislative proposal and budgetary processes.

**Development of the Annual Materials Plan** – If the Business Case Analysis and Determination documents justify an action by the NDS such as sale, other disposal, buffer stocks, vendor-managed inventory, upgrade, rotation, barter, or stockpiling, the material in question is put on the Annual Materials Plan (AMP). The AMP is a statutorily required document that is assembled by NDS staff and reviewed by the Market Impact Committee (MIC). The MIC is an inter-agency committee consisting of the NDS, Department of Defense, Department of Energy, Department of Commerce, Department of State, U.S. Geological Survey (USGS), Department of Agriculture, Department of Treasury, and Homeland Security and is co-chaired by the Departments of Commerce and State. The AMP consists of the quantities of materials that would result in any adjustment to NDS inventory including sales of materials deemed in excess to the Department’s needs, other disposal, barter, upgrades, buffer stocks, vendor-managed inventory, or actual stockpiling.

The AMP is part of an overall document package that assesses the potential market impact of possible NDS activity. NDS staff work with staff from the USGS to assemble global demand and supply data for each material included on the AMP. In this way, NDS and the MIC can measure the share of global demand and production (as a percent) of possible NDS activities. It is important to recognize that AMP quantities are not sales or acquisition goals but, rather, upper targets that would be met only if market conditions warrant that level of activity. After the AMP is reviewed by the MIC it is published in the Federal Register for 30 days awaiting public comment. Comments from industry and private citizens are solicited to ascertain how NDS activities may affect their business. Typically, comments are sent to the co-chairs who forward them to NDS staff for formal response and coordination. After the 30 day period is over, the AMP is sent to Congress for approval for a waiting period of an additional 45 days. If the Congress does not respond after 45 days, NDS can assume that the AMP has been accepted.

## **Appendix C**

# **Rare Earths Shortfalls in a One-Year NDS Base Case Conflict Scenario**

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This appendix examines rare earth supply, demand, and “top-level” shortfalls in a 1-year conflict scenario, set in 2015.<sup>1</sup>

The following 7 rare earths were considered: dysprosium, erbium, europium, gadolinium, neodymium, praseodymium, and yttrium. These particular rare earths were selected based on assessments performed as part of the section 843 report.

The rare earth commodity specialist at the U.S. Geological Survey (USGS) provided basic demand and supply data, as well as U.S. steady-state consumption values of rare earths. From these, demand data for 2015 were developed, by looking at the forecasts of economic demand in the industry sectors in which rare earths are used and projecting rare earth demand to be consistent with the forecasted economic demand. The supply values were the USGS commodity specialist’s forecasts of estimated rare earth production, by country, for 2015. All demand and supply values were for rare earth oxides and similar compounds. The objective of the analysis was to determine if estimated supply of rare earth compounds was sufficient to meet the estimated demand for them. The analysis did not consider possible constraints or bottlenecks in the processing of rare earth compounds into metal or finished products.

The underlying data on baseline military demands for goods and services were the same as in the Base Case of the 2011 National Defense Stockpile study.<sup>2</sup> They are consistent with the Council of Economic Advisors’ forecast of the U.S. economy that supported the President’s budget released in February 2010. The forecasted data for 2015 were used.

Most of the conflict-related assumptions were similar to those of the 2011 NDS Base Case.

- The platforms lost and munitions expended in the conflict were the same as in the Base Case. However, since this is a 1-year scenario, only 1 year’s worth of the demands for goods and services to rebuild weapons was included. For example, if a certain weapon took a 4 year lead time to build, only a quarter of that weapon loss generated demands for goods and services in the scenario.
- The percentage decrements to imports and exports of goods and services were the same as in the first year of the Base Case.

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<sup>1</sup> These top-level assessments are similar in nature to the kinds of assessments performed in the 2011 National Defense Stockpile Study. See *Strategic and Critical Materials 2011 Report on Stockpile Requirements*, Under Secretary of Defense for Acquisition, Technology and Logistics, January 2011.

<sup>2</sup> *Strategic and Critical Materials 2011 Report on Stockpile Requirements*.

- The decrements and delays to material supply due to war damage, shipping losses, infrastructure or similar unreliability, and anti-U.S. sentiment were the same as in the first year of the Base Case.
- Supply from adversaries was unavailable for a year—which in this 1-year scenario means completely unavailable.

In addition, a market share factor of 25 percent was applied to foreign supply: the U.S. was assumed able to obtain 25 percent of foreign supply after all the delays and decrements mentioned above were considered. The 25 percent value is approximately the U.S. fraction of global gross domestic product excluding the Peoples’ Republic of China. (The computation is based on GDP estimates from the CIA World Factbook. The use of GDPs to compute market share is comparable to what was done in the 2011 NDS Requirements Report.)

The results of this scenario indicate that there are no defense shortfalls. At least at the oxide/compound oxide level, U.S. supply, plus whatever supply is available from reliable enough countries, is projected by to be sufficient to cover defense demand by 2015.

An excursion was also performed, in which only U.S. supply was allowed to satisfy defense demand. Table C-1 shows the results.

**Table C-1. Rare Earth Defense Supply Shortfalls:  
One-Year Conflict Case where Only U.S. Supply Can Satisfy Defense Demand**

		Shortfall in metric tons of oxide equivalent	in millions of dollars
	Rare Earth	Defense*	Defense*
1	Dysprosium	1	1.02
2	Erbium	7	1.09
3	Europium	0	0
4	Gadolinium	0	0
5	Neodymium	0	0
6	Praseodymium	0	0
7	Yttrium	103	12.41
	Total	111	14.52

\* Totals might not add because of rounding.

In this excursion, some defense shortfalls do arise. Dollar valuations were computed based on prices current as of the summer of 2011. It is recognized that rare earth prices are subject to considerable fluctuation; the dollar values in Table C-1 should be regarded as illustrative only.

# **Appendix D**

## **Example of Contingency Planning and Roles for U.S. Suppliers during a National Emergency**

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### **Overview**

This appendix provides representative discussion topics for contingency planning and roles for U.S. suppliers during a national emergency:

In planning for the unlikely event of a major supply chain disruption of sintered NdFeB magnets – and their rare earth constituent materials to produce them (e.g., metals and alloys) -- for U.S. defense requirements, the DoD is trying to understand the capabilities and capacities that might be able to help DoD meet its most important requirements for NdFeB magnets during a national emergency.

### **Sample Issues/Questions**

DoD would like to understand what the capabilities and capacities would be available to produce sintered NdFeB magnets for U.S. defense requirements.

- (1) Can you tell us what types of NdFeB magnets you would be able to produce, and how quickly you could produce them after receiving an order for them, in the 2013-2014 timeframe?
- (2) Specifically, which grades of sintered NdFeB blocks do you plan on being able to produce in the 2013-2014 timeframe and which grades of sintered NdFeB magnet blocks do you currently not plan on being able to produce during this period?
- (3) Specifically, which types of net-shaped sintered NdFeB magnets do you plan on being able to produce in the 2013-2014 timeframe and which types of net-shaped sintered NdFeB magnets do you currently not plan on being able to produce during this period?
- (4) What information about the specific magnets, and the quantities that DoD needs, do you need to have in order to be able to sufficiently address the following question: are there any NdFeB magnets that DoD needs that you would not be able to produce in the quantities that DoD might need them?
- (5) What arrangements would you like to make beforehand with DoD in order to facilitate an effective contingency/emergency production relationship with DoD?
- (6) Where would you get needed inputs (e.g., heavy rare earths, metals, and alloys) to produce the various types of magnets in such a disruption?



- (7) Would you have enough inputs in inventory (i.e., on-hand) or in your supply chain pipeline to be able to provide DoD what it would need during such a disruption? How much more would you need of these various inputs?
- (8) Are you able to play a supporting role for DoD in a potential disruption scenario?
- (9) How may DoD assist you in preparing for such a supporting role in a potential disruption scenario?

## **Appendix E**

### **FY12 NDAA Section 853**

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#### **SEC. 853. ASSESSMENT OF FEASIBILITY AND ADVISABILITY OF ESTABLISHMENT OF RARE EARTH MATERIAL INVENTORY.**

(a) REQUIREMENT.—Not later than 180 days after the date of the enactment of this Act, the Administrator of the Defense Logistics Agency Strategic Materials shall submit to the Secretary of Defense an assessment of the feasibility and advisability of establishing an inventory of rare earth materials necessary to ensure the long-term availability of such rare earth materials. The assessment shall—

- (1) identify and describe the steps necessary to create an inventory of rare earth materials, including oxides, metals, alloys, and magnets, to support national defense requirements and ensure reliable sources of such materials for defense purposes;
- (2) provide a detailed cost-benefit analysis of creating such an inventory in accordance with Office of Management and Budget Circular A-94;
- (3) provide an analysis of the potential market effects, including effects on the pricing and commercial availability of such rare earth materials, associated with creating such an inventory;
- (4) identify and describe the mechanisms available to the Administrator to make such an inventory accessible, including by purchase, to entities requiring such rare earth materials to support national defense requirements, including producers of end items containing rare earth materials;
- (5) provide a detailed explanation of the ability of the Administrator to authorize the sale of excess materials to support a Rare Earth Material Stockpile Inventory Program;
- (6) analyze any potential requirements to amend or revise the Defense Logistics Agency Strategic Materials Annual Material Plan for Fiscal Year 2012 and subsequent years to reflect an inventory of rare earth materials to support national defense requirements;
- (7) identify and describe the steps necessary to develop or maintain a competitive, multi-source supply-chain to avoid reliance on a single source of supply;
- (8) identify and describe supply sources considered by the Administrator to be reliable, including an analysis of the capabilities of such sources to produce such materials in forms required for military applications in the next 5 years, as well as the security of upstream supply for these sources of material; and

(9) include such other considerations and recommendations as necessary to support the establishment of such inventory.

(b) FINDINGS AND RECOMMENDATIONS.—

(1) IN GENERAL.—Not later than 90 days after the date on which the assessment is submitted under subsection (a), the Secretary of Defense shall submit to the congressional defense committees—

(A) the findings and recommendations from the assessment required under subsection (a);

(B) a description of any actions the Secretary intends to take regarding the plans, strategies, policies, regulations, or resourcing of the Department of Defense as a result of the findings and recommendations from such assessment; and

(C) any recommendations for legislative or regulatory changes needed to ensure the long-term availability of such rare earth materials.

(c) DEFINITIONS.—In this section:

(1) The term “rare earth” means any of the following chemical elements in any of their physical forms or chemical combinations and alloys:

- |                  |                |
|------------------|----------------|
| (A) Scandium     | (J) Gadolinium |
| (B) Yttrium      | (K) Terbium    |
| (C) Lanthanum    | (L) Dysprosium |
| (D) Cerium       | (M) Holmium    |
| (E) Praseodymium | (N) Erbium     |
| (F) Neodymium    | (O) Thulium    |
| (G) Promethium   | (P) Ytterbium  |
| (H) Samarium     | (Q) Lutetium   |
| (I) Europium     |                |

(2) The term “capability” means the required facilities, manpower, technological knowledge, and intellectual property necessary for the efficient and effective production of rare earth materials.

**Appendix F**  
**Strategic and Critical Materials Stock Piling Act,**  
**Section 14, Biennial Report on Stockpile**  
**Requirements (50 U.S.C. § 98h-5)**

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(a) Not later than January 15 of every other year, the Secretary of Defense shall submit to Congress a report on stockpile requirements. Each such report shall include—

- 1) The Secretary's recommendations with respect to stockpile requirements; and
- 2) The matters required under subsection (b).

(b) Each report under this section shall set forth the national emergency planning assumptions used by the Secretary in making the Secretary's recommendations under subsection (a)(1) with respect to stockpile requirements. The Secretary shall base the national emergency planning assumptions on a military conflict scenario consistent with the scenario used by the Secretary in budgeting and defense planning purposes. The assumptions to be set forth include assumptions relating to each of the following:

- 1) The length and intensity of the assumed military conflict.
- 2) The military force structure to be mobilized.
- 3) The losses anticipated from enemy action.
- 4) The military, industrial, and essential civilian requirements to support the national emergency.
- 5) The availability of supplies of strategic and critical materials from foreign sources during the mobilization period, the military conflict, and the subsequent period of replenishment, taking into consideration possible shipping losses.
- 6) The domestic production of strategic and critical materials during the mobilization period, the military conflict, and the subsequent period of replenishment, taking into consideration possible shipping losses.
- 7) Civilian austerity measures required during the mobilization period and military conflict.

(c) The stockpile requirements shall be based on those strategic and critical materials necessary for the U.S. to replenish or replace, within 3 years of the end of the military conflict scenario required under subsection (b), all munitions, combat support items, and weapons systems that would be required after such a military conflict.

(d) The Secretary shall also include in each report under this section an examination of the effect that alternative mobilization periods under the military conflict scenario required under

subsection (b), as well as a range of other military conflict scenarios addressing potentially more serious threats to national security, would have on the Secretary's recommendations under subsection (a) (1) with respect to stockpile requirements.

(e) The President shall submit with each report under this section a statement of the plans of the President for meeting the recommendations of the Secretary set forth in the report.