



May 2018

STRATEGIC PETROLEUM RESERVE

DOE Needs to Strengthen Its Approach to Planning the Future of the Emergency Stockpile

GAO Highlights

Highlights of [GAO-18-477](#), a report to Congressional Requesters

Why GAO Did This Study

More than 4 decades ago, Congress authorized the creation of the SPR to reduce the impact of disruptions in supplies of petroleum products. DOE manages the SPR. As a member of the International Energy Agency, the United States is obligated to maintain reserves equivalent to at least 90 days of the previous year's net imports (imports minus exports). The SPR's storage and related infrastructure is aging, and DOE has plans to modernize these facilities. Since 2015, Congress has mandated crude oil sales. As of March 2018, the SPR held about 665 million barrels of crude oil.

GAO was asked to examine the SPR's ability to meet U.S. energy security needs. This report examines, among other things, the extent to which (1) DOE has identified the optimal size of the SPR, and (2) DOE's plans for modernizing the SPR take into account the effects of congressionally mandated crude oil sales. GAO reviewed DOE's plans and studies, and interviewed agency officials and nine experts selected based on prior work, referrals, and a literature review.

What GAO Recommends

GAO is making four recommendations, including that DOE (1) supplement the 2016 review by conducting an additional analysis, (2) ensure that the agency periodically reexamines the size of the SPR, and (3) consider a full range of options for handling potentially excess assets as it conducts its study, among other things. DOE agreed with two, partially agreed with one, and disagreed with another recommendation on refined product reserve studies. GAO maintains that the recommendations are valid.

View [GAO-18-477](#). For more information, contact Frank Rusco at (202) 512-3841 or ruscof@gao.gov.

May 2018

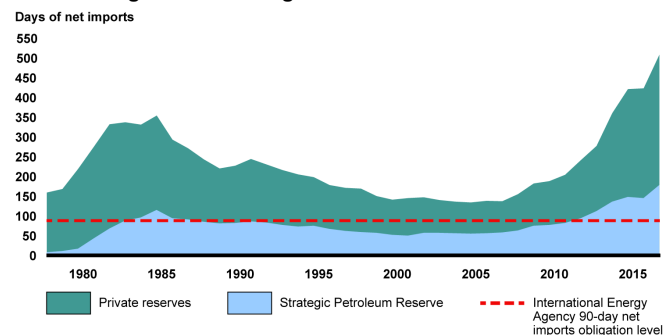
STRATEGIC PETROLEUM RESERVE

DOE Needs to Strengthen Its Approach to Planning the Future of the Emergency Stockpile

What GAO Found

The Department of Energy (DOE) has not identified the optimal size of the Strategic Petroleum Reserve (SPR). In 2016, DOE completed a long-term strategic review of the SPR after its last comprehensive examination conducted in 2005. The 2016 review examined the benefits of several SPR sizes, but it did not identify an optimal size and its review was limited in several ways. In particular, DOE did not fully consider recent and expected future changes in market conditions, such as the implications of falling net imports, or the role that increased levels of private reserves (reserves held by private companies for their own purposes) may play in responding to supply disruptions. These changes have contributed to SPR and private reserves reaching historically high levels on a net imports basis (see figure). These changes are expected to continue to evolve—according to government projections, the United States will become a net exporter in the late 2020s before again becoming a net importer between 2040 and 2050. GAO has found that agencies should reexamine their programs if conditions change. Without addressing the limitations of its 2016 review and periodically performing reexaminations in the future, DOE cannot be assured that the SPR will be sized appropriately into the future.

U.S. Holdings in the Strategic Petroleum Reserve and Private Reserves, 1977-2017



Source: GAO analysis of U.S. Energy Information Administration (EIA) data. | GAO-18-477

DOE has taken steps to take into account congressionally mandated sales of SPR crude oil in its \$1.4 billion modernization plans for SPR's infrastructure and facilities. The SPR is projected to hold 405 million barrels of oil by the end of fiscal year 2027. However, DOE's current plans are based on information analyzed prior to recently mandated sales. According to DOE officials, the agency began a study in March 2018 to assess the effects of these sales on the SPR's modernization. However, this study is not examining all options for handling any excess SPR assets that may be created by currently mandated sales or any additional sales that may be mandated in the future, inconsistent with an agency order on real property asset management that calls for identifying excess assets. For example, DOE does not plan to examine the potential to lease unused SPR storage capacity to the private sector because DOE is not currently authorized to enter into such leases, according to agency officials. If authorized, leasing capacity could generate revenues that could help offset the costs of modernization. By not examining a full range of options, DOE risks missing beneficial ways to modernize the SPR while saving taxpayer resources.

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Abbreviations

DOE	Department of Energy
EIA	Energy Information Administration
IEA	International Energy Agency
SPR	Strategic Petroleum Reserve

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May 30, 2018

The Honorable Lisa Murkowski
Chairman
The Honorable Maria Cantwell
Ranking Member
Committee on Energy and Natural Resources
United States Senate

The Honorable Lamar Alexander
Chairman
Subcommittee on Energy and Water Development
Committee on Appropriations
United States Senate

The Honorable Greg Walden
Chairman
The Honorable Frank Pallone, Jr.
Ranking Member
Committee on Energy and Commerce
House of Representatives

The Honorable Fred Upton
House of Representatives

More than 4 decades ago, Congress authorized the creation of the Strategic Petroleum Reserve (SPR)—currently the world’s largest government-owned stockpile of emergency crude oil—to reduce the impact of disruptions in supplies of petroleum products.¹ The reserve is managed by the Department of Energy (DOE) and as of March 2018 held 665.5 million barrels of crude oil, worth about \$42 billion.² In the decades since its creation, the structure of the SPR generally has not changed—it has always held crude oil in salt caverns along the Gulf Coast—though markets for crude oil and petroleum products—products such as gasoline and diesel that are refined from crude oil for final consumption—have

¹Energy Policy and Conservation Act, Pub. L. No. 94-163, §§ 151(b), 154(a), 89 Stat. 871, 881-882 (1975) (codified as amended at 42 U.S.C. §§ 6231(b), 6234(a)).

²This calculation is based on average market oil prices as of March 2018 of about \$63 per barrel, the price of West Texas Intermediate, which is a domestic oil used as a benchmark for pricing.

changed significantly. Throughout most of the SPR's history, domestic crude oil production was generally in decline while consumption of petroleum products was generally increasing, causing the United States to rely increasingly on imported crude oil and petroleum products. However, the SPR now operates in a context of increasing U.S. crude oil production (the United States is now one of the world's largest crude oil producers), relatively stable consumption, and shrinking net crude oil and petroleum product imports. Moreover, whereas the Arab oil embargo of 1973-1974 led to shortages and long lines at gas pumps around the country, prices now change to accommodate supply and demand so that physical crude oil shortages are less of a concern than they were in the 1970s when the SPR was created. Meanwhile, as we reported in 2017, the SPR has primarily been used in response to domestic supply disruptions, such as those caused by hurricanes. However, the SPR has been limited in this role because it is almost entirely composed of crude oil and not petroleum products such as gasoline.³ As a result, the SPR may not be effective at mitigating the effects of petroleum product disruptions such as those that have occurred when hurricanes knocked out petroleum product refineries or distribution infrastructure. Members of Congress and others have raised questions about the appropriate size of the SPR as well as the effectiveness of its current storage and delivery infrastructure in meeting the nation's evolving energy security needs.

According to DOE's 2014-2018 strategic plan, the SPR benefits the nation by providing an insurance policy against actual and potential interruptions in crude oil or petroleum product supplies caused by international turmoil, hurricanes, accidents, or terrorist activities.⁴ Releasing SPR crude oil during a supply disruption is intended to mitigate damage to the economy by replacing disrupted crude oil supplies, thereby reducing price increases that can result in economic damage.

In addition to helping the United States meet its domestic energy security needs, the SPR also helps the United States meet its obligations as a member of the International Energy Agency (IEA)—an international energy forum of 30 member countries established in 1974 to help

³GAO, *Strategic Petroleum Reserve: Preliminary Observations on the Emergency Oil Stockpile*, [GAO-18-209T](#) (Washington, D.C.: Nov. 2, 2017).

⁴U.S. Department of Energy, *U.S. Department of Energy Strategic Plan 2014-2018*, March 2014.

members respond collectively to major energy supply disruptions.⁵ Crude oil and petroleum product markets are global. Therefore, while a release of crude oil or petroleum products from any country during a supply disruption can have global benefits, the ability of any individual country to significantly affect these global markets is limited. To become a member of the IEA, a country must have, among other things, crude oil or petroleum product reserves equivalent to 90 days of the previous year's net imports and measures in place to ensure it is able to contribute its share of a collective action initiated in response to a significant global oil supply disruption. The IEA first established this 90-day minimum reserve obligation in 1974. The IEA counts both public and private reserves towards meeting the 90-day reserve obligation, although the United States has recently met this obligation solely through publicly owned reserves in the SPR.⁶

Since 2015, six laws required sales of crude oil from the SPR to fund the modernization of SPR facilities and other national priorities.⁷ Total

⁵The 30 member countries are Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Republic of Korea, Luxembourg, Mexico, The Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States.

⁶Public reserves are owned by the government or an independent organization set up by the government, known as an agency. Private reserves, also called industry reserves, are oil or petroleum products held by industry for commercial and operational purposes as well as oil or petroleum products held by industry to meet minimum national reserve requirements.

⁷Specifically, the Bipartisan Budget Act of 2015 provided for the drawdown and sale of a total of 58 million barrels of crude oil from fiscal years 2018 through 2025 and authorized the sale of up to \$2 billion worth of oil, with the proceeds to be deposited in an Energy Security and Infrastructure Modernization Fund, the purpose of which is to provide for the construction, maintenance, repair, and replacement of SPR facilities. Pub. L. No. 114-74, §§ 403, 404, 129 Stat. 584, 589 (2015). The Fixing America's Surface Transportation Act provided for the drawdown and sale of a total of 66 million barrels of crude oil from fiscal years 2023 through 2025. Pub. L. No. 114-94, § 32204, 129 Stat. 1311, 1740 (2015). The 21st Century Cures Act provided for the drawdown and sale of a total of 25 million barrels from fiscal years 2017 through 2019. Pub. L. No. 114-255, § 5010, 130 Stat. 1033, 1197 (2015). The Tax Cuts and Jobs Act provided for the drawdown and sale of 7 million barrels of crude oil from fiscal years 2026 through 2027. Pub. L. No. 115-97, § 20003 (2017). The Bipartisan Budget Act of 2018 provided for the drawdown and sale of a total of 100 million barrels of crude oil from fiscal years 2022 through 2027. Pub. L. No. 115-123, § 30204 (2018). The Consolidated Appropriations Act of 2018 provided for the drawdown and sale of 10 million barrels of crude oil from fiscal years 2020 through 2021. Pub. L. No. 115-141, Div. O, § 501 (2018). The mandated drawdowns are not to be conducted if they would limit the authority to sell petroleum products for emergency protection in the full authorized quantity. See 42 U.S.C. § 6241(h).

planned sales are projected to reduce the SPR from 665.5 million barrels of crude oil in March 2018 to 405 million barrels by the end of fiscal year 2027.⁸ These sales have an estimated value of almost \$16 billion, according to Congressional Budget Office documents. Of this estimated value, sales of up to \$2 billion were specifically authorized for the SPR's modernization program. The SPR's infrastructure of facilities, pipelines, pumps, and other equipment is aging and much of it needs replacement, according to DOE documents. Since 2014, DOE has developed plans for modernizing the SPR to address these needs, among other things.

You asked us to examine the SPR's ability to meet U.S. energy security needs and IEA obligations. This report examines (1) how the United States and other IEA members meet their IEA 90-day reserve obligation and their obligation to release those reserves in response to a supply disruption, (2) the extent to which DOE has identified the optimal size and the potential need for additional petroleum product reserves for the SPR to meet the United States' international obligations and energy security needs, and (3) the extent to which DOE's plans for modernizing the SPR take into account the effects of current and potential future congressionally mandated oil sales.

To conduct this work, we reviewed reports and studies that we identified through DOE officials, recommendations by experts and stakeholders, and sources referenced in DOE publications. We also identified studies through searching literature databases, including ProQuest, Web of Science, and SciSearch. Our review included studies by DOE, the U.S. Energy Information Administration (EIA),⁹ and IEA. We interviewed DOE

⁸According to the U.S. Energy Information Administration, volumes of oil sold under the Bipartisan Budget Act of 2015, worth up to the \$2 billion authorized for an SPR modernization program are estimated. The estimated volume of oil is derived from oil sold in fiscal years 2017 and 2018 and forthcoming sales in fiscal years 2019 and 2020, according to DOE.

⁹EIA is a statistical agency within DOE that collects, analyzes, and disseminates independent information on energy issues.

officials and reviewed our prior work on the SPR.¹⁰ We also interviewed nine experts and four stakeholders.¹¹ We identified potential experts and stakeholders through related GAO reports, recommendations from government agency officials and other experts, and a literature review. We selected experts who represent sectors and areas of expertise including academia, government, energy economics, energy security, and energy policy. We selected stakeholders who represent a for-profit oil company, energy consulting groups, and a state agency. Generally, we asked experts and stakeholders for opinions on the size and configuration of the SPR, the SPR's mission, and other options to provide U.S. energy security. We conducted an analysis to identify areas of agreement and disagreement. Results are not generalizable but provide examples of a range of views.

To compare how the United States and other countries meet their IEA obligations, we interviewed IEA officials about reserve systems and IEA obligations. To provide examples, we examined reserve structures in six countries—Czech Republic, France, Germany, Ireland, Japan, and the United Kingdom. We selected these countries to ensure representation of

¹⁰GAO, *Strategic Petroleum Reserve: Available Oil Can Provide Significant Benefits, but Many Factors Should Influence Future Decisions about Fill, Use, and Expansion*, [GAO-06-872](#) (Washington, D.C.: Aug. 24, 2006); *Strategic Petroleum Reserve: Improving the Cost-Effectiveness of Filling the Reserve*, [GAO-08-726T](#) (Washington, D.C.: Apr. 24, 2008); *Strategic Petroleum Reserve: Issues Regarding the Inclusion of Refined Petroleum Products as Part of the Strategic Petroleum Reserve*, [GAO-09-695T](#) (Washington, D.C.: May 12, 2009); *Changing Crude Oil Markets: Allowing Exports Could Reduce Consumer Fuel Prices, and the Size of the Strategic Reserves Should Be Reexamined*, [GAO-14-807](#) (Washington, D.C.: Sept. 30, 2014); *Climate Change: Energy Infrastructure Risks and Adaptation Efforts*, [GAO-14-74](#) (Washington, D.C.: Jan. 31, 2014); [GAO-18-209T](#).

¹¹We conducted both semi-structured and exploratory interviews with: Severin Borenstein, University of California, Berkeley; Stephen Brown, University of Nevada, Las Vegas; Adam Sieminski, Center for Strategic and International Studies; Amy Meyers Jaffe, Council on Foreign Relations; Jason Bordoff, Columbia University; and Joseph Aldy, Harvard University. We conducted semi-structured interviews only with: Robert McNally, The Rapidan Group; James Stock, Harvard University; and jointly with Michael Leahy and Rob Schwiens, Chevron Corporation. We conducted exploratory interviews only with: David Goldwyn, Goldwyn Global Strategies; Sarah Ladislav, Center for Strategic and International Studies; Lorne Stockman, Oil Change International; and Gordon Schremp, California Energy Commission.

the different types of reserve structures used by IEA members.¹² We reviewed documents from each country and interviewed officials involved with the administration of their countries' reserves.¹³ Findings from these countries are not generalizable to those we did not review. To examine how the United States historically has met its IEA 90-day reserve obligation, we analyzed EIA data.

To examine the extent to which DOE has identified the optimal size and potential need for additional petroleum product reserves for the SPR, we reviewed DOE studies and interviewed some of the authors of these studies. Specifically, we reviewed DOE's 2016 long-term strategic review of the SPR, as well as studies and analyses conducted as part of the 2016 review.¹⁴ We also estimated days of U.S. net import protection for 2017 and 2027 using DOE's estimates of the SPR's size, IEA data on days of net import protection, and EIA's 2017 Annual Energy Outlook

¹²Based on our review of IEA documentation and interviews with relevant officials, the Czech Republic uses a reserve structure similar to the United States, in which oil reserves are government-owned; France uses a privately run reserve agency to hold reserves, and requires its domestic oil industry to delegate a specific portion of their holdings to this agency; Germany and Ireland each established a separate organization known as an agency to hold reserves; Japan uses a combination of state-owned reserves and obligations on the private industry; and the United Kingdom meets all of its reserve requirements by obligating industry companies to hold reserves.

¹³We interviewed officials from the Czech Republic's Administration of State Material Reserves; the French Ministry of Ecology, Sustainable Development, and Energy; the French stockholding agency, Comité Professionnel des Stocks Stratégiques Pétroliers; the French Association of Petroleum Industry; Germany's Mineralölwirtschaftsverband e.V. (Mineral Oil Economy Association); Ireland's Department of Communications, Climate Action, and Environment; Ireland's National Oil Reserves Agency; the Irish Petroleum Industry Association; Japan Ministry of Economy, Trade, and Industry; Japan Oil, Gas and Metals National Corporation; the United Kingdom's Department of Energy and Climate Change; and the United Kingdom Petroleum Industry Association. We obtained written responses from Germany's stockholding agency, Erdölbevorratungsverband.

¹⁴U.S. Department of Energy, *Long-Term Strategic Review of the U.S. Strategic Petroleum Reserve: Report to Congress (2016 Long-Term Strategic Review)*, (Washington, D.C.: August 2016); U.S. Department of Energy, *Quadrennial Energy Review: Energy Transmission, Storage, and Distribution Infrastructure (Quadrennial Energy Review of 2015)*, April 2015; Leiby, P.N., D.C. Bowman, G.A. Oladosu, R. Uria-Martinez, and M. Johnson, *Economic Benefits of Alternative Configurations of the U.S. Strategic Petroleum Reserve*, Oak Ridge National Laboratory (Oak Ridge, TN: July 2016). Beccue, Phillip, and Hillard Huntington, *An Updated Assessment of Oil Market Disruption Risks – Final Report* (Stanford, CA: Feb. 5, 2016). Stanford's Energy Modeling Forum is a structured forum for studying important energy and environmental issues. Participants are leading energy experts and advisors from government, industry, universities, and other research organizations. DOE sponsored an expert panel study by the Stanford Energy Modeling Forum to quantify oil disruption risk.

forecast data on net oil imports. We compared those estimates to the IEA 90-day reserve obligation. To assess the reliability of these data, we reviewed relevant documentation, interviewed officials, and compared the data with similar data published in other sources. We determined these data to be sufficiently reliable for the purposes of our reporting objectives.

To examine the extent to which DOE's modernization plans for the SPR have taken into account the effects of congressionally mandated oil sales, we reviewed documentation on the SPR's modernization, including plans and analysis of alternatives. We also reviewed our best practices for analysis of alternatives,¹⁵ when we examined DOE's analysis of alternatives for the SPR's modernization. We reviewed the Energy Policy and Conservation Act that authorizes the SPR,¹⁶ DOE annual reports on SPR activities, and DOE budget justifications for fiscal years 2017, 2018, and 2019. We interviewed DOE's contractor that maintains SPR sites to obtain views on any challenges in moving forward with modernization plans and meeting congressionally mandated sales. We also interviewed representatives from a private salt cavern company, government officials from two IEA member countries, and a representative from a private company that leases oil (an oil broker) to identify potential alternatives, and views on these alternatives, for using potential excess SPR assets after congressionally mandated sales.¹⁷ We compared DOE's plans for the SPR, including supporting documentation, to the agency's real property asset management order.¹⁸

¹⁵These best practices were published in GAO, *Amphibious Combat Vehicle: Some Acquisition Activities Demonstrate Best Practices; Attainment of Amphibious Capability to Be Determined*, [GAO-16-22](#) (Washington, D.C.: Oct. 28, 2015), and more recently in *Joint Intelligence Analysis Complex: DOD Partially Used Best Practices for Analyzing Alternatives and Should Do So Fully for Future Military Construction Decisions*, [GAO-16-853](#) (Washington, D.C.: Sept. 30, 2016). An earlier version of the best practices was published in GAO, *DOE and NNSA Project Management: Analysis of Alternatives Could Be Improved by Incorporating Best Practices*, [GAO-15-37](#) (Washington, DC: Dec. 11, 2014).

¹⁶Pub. L. No. 94-163, § 154(a), 89 Stat. 871, 882 (1975) (codified as amended at 42 U.S.C. § 6234(a)).

¹⁷The government officials we interviewed were from the Australian Department of the Environment and Energy and the New Zealand Ministry of Business, Innovation, and Employment.

¹⁸U.S. Department of Energy, Real Property Asset Management, DOE Order 430.1C (Washington, D.C.: August 2016).

We conducted this performance audit from February 2017 to May 2018 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Changing Petroleum Markets

Oil and petroleum products markets have changed substantially in the years since the establishment of the SPR. Specifically, U.S. domestic crude oil production has generally been increasing, consumption has been relatively stable, and crude oil and petroleum products markets have become increasingly global. Additionally, U.S. crude oil production is projected to rise further in the future, according to EIA and IEA projections, further reversing a decades-long decline. Recent technological improvements have made onshore production from shale formations economically viable, and domestic crude oil production began to rise in about 2008. The combination of increasing production and relatively stable consumption has resulted in declining net crude oil and petroleum products imports, from a high of about 12 million barrels per day in 2005 to fewer than 4 million barrels per day in 2017.

Since these trends are expected to continue, the IEA and EIA both project net U.S. crude oil and petroleum products imports will decline to zero sometime in the late 2020s and the United States will become a net exporter shortly thereafter. Since the IEA 90-day reserve obligation is based on a country's net imports, there is no such obligation for net exporters; therefore, the United States would have no 90-day reserve obligation as long as it is a net exporter, though it would still be obligated to release reserves in response to supply disruptions. Over the longer term, EIA's projections show U.S. net exports peaking in 2037 and the United States again becoming a net importer between 2040 and 2050.

At the time of the Arab oil embargo, price controls in the United States prevented the prices of oil and petroleum products from increasing as much as they otherwise might have, contributing to a physical oil shortage that caused long lines at gasoline stations throughout the United States. In addition, in the 1970s, oil prices were often set in long-term contracts, which meant that prices would not automatically rise in the face of greater

scarcity. This generally reduced incentives for producers to expand production and sales as well as for consumers to reduce consumption in the face of greater scarcity caused by a supply disruption. Now that crude oil and petroleum product markets are global, the prices of these commodities are determined in the world market, primarily on the basis of supply and demand. In the absence of long-term contracted prices or price controls, scarcity from a supply disruption is generally expressed in the form of higher prices, as purchasers are free to bid as high as they are willing to pay to secure oil supply. In a global market, a large enough supply disruption anywhere in the world raises prices everywhere. This creates incentives for producers unaffected by the disruption to increase their production and release existing inventories and for consumers everywhere to reduce consumption in the ways they find most efficient and least disruptive. While it can take time for some of these actions to affect crude oil and petroleum product markets—according to DOE officials, it can take approximately 6 months from when a producer drills an oil well until oil production comes on line—all these actions tend to mitigate the effects of supply disruptions.

Strategic Petroleum Reserve

The Energy Policy and Conservation Act of 1975 authorized the creation of the SPR, partly in response to the Arab oil embargo of 1973-1974 that caused a shortfall in the international oil market.¹⁹ The purposes of the SPR are, among other things, to reduce the impact of disruptions in supplies of petroleum products and to carry out obligations of the United States under the international energy program. Specifically, the 1974 International Energy Program Agreement, a joint strategy and treaty, established the IEA to address oil security issues on an international scale.²⁰ The SPR is owned by the federal government, managed by DOE's Office of Petroleum Reserves, and maintained by Fluor Federal Petroleum Operations LLC.²¹ The SPR stores crude oil in underground salt caverns along the Gulf Coast in Louisiana and Texas. The SPR currently maintains four storage sites—Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry—with a design capacity of 713.5 million barrels.

¹⁹Pub. L. No. 94-163, § 154(a), 89 Stat. 871, 882 (1975) (codified as amended at 42 U.S.C. § 6234(a)).

²⁰Agreement on an International Energy Program, Nov. 18, 1974, 27 U.S.T. 1685.

²¹Fluor Federal Petroleum Operations LLC is the current DOE Management and Operating Contractor for the SPR.

Under conditions prescribed by the Energy Policy and Conservation Act, as amended, the President has discretion to authorize the release of petroleum products from the SPR to minimize significant supply disruptions.²² When oil is released from the SPR, it is distributed through commercial pipelines or on waterborne vessels to refineries, where it is converted into gasoline and other petroleum products, and then transported to distribution centers for sale to the public.

According to DOE documents, well-functioning infrastructure is fundamental to the SPR's ability to maintain operational readiness and meet mission requirements. However, most of the critical infrastructure for moving SPR oil has exceeded its serviceable life, which has led to increasing maintenance costs and decreasing system reliability.²³ Specifically, the reserve relies on a complex system of salt caverns, pipelines, wells, and pumps, with other infrastructure and equipment. Any failures, such as ruptured pipelines, could affect the readiness of a site for an oil release. According to DOE officials, a growing backlog of major maintenance needs raises concerns about the ability of the system to operate as designed. In addition, there have been equipment failures that have rendered parts of the system temporarily inoperable.²⁴ For example, the SPR has experienced at least five major equipment failures since fiscal year 2013, including the Big Hill site pipe failure shown in figure 1.

²²Pub. L. No. 94-163, § 161, 89 Stat. 871, 888 (1975) (codified as amended at 42 U.S.C. § 6241). The statute provides for a drawdown of the reserve upon a finding by the President that drawdown and sale are required by a "severe energy supply interruption," as defined by statute, or by obligations under the international energy program. 42 U.S.C. § 6241(d). Limited drawdowns may be conducted if the President finds that a circumstance is, or is likely to become, a domestic energy supply shortage of significant scope or duration, action taken would assist directly and significantly in preventing or reducing the adverse impact of such shortage, the Secretary of Energy has found that action taken will not impair the ability of the United States to carry out its obligations under the international energy program, and the Secretary of Defense has found that action taken will not impair national security. 42 U.S.C. § 6241(h)(1). Petroleum products may not be drawn down under this authority if there are fewer than 340,000,000 barrels of petroleum product stored in the Reserve, and may not be drawn down below the level of an aggregate of 340,000,000 barrels of petroleum product stored in the Reserve. 42 U.S.C. § 6241(h)(2).

²³According to DOE officials, the SPR has been able to fulfill all of its drawdown requirements and perform its mission in spite of aging infrastructure and equipment failures that have occurred to date.

²⁴According to DOE officials, for pipeline outages, the contractor operating the reserve is required to mitigate outages within 13 days.

Figure 1: Strategic Petroleum Reserve, Big Hill Site – Raw Water Pipe Failure in April 2016



Click [here](#) to activate a video of this pipe failure at the Big Hill site that resulted in water spillage and needed site repairs.

Source: Department of Energy. | GAO-18-477

Regional Petroleum Product Reserves

The United States has two regional petroleum product reserves—the Northeast Home Heating Oil Reserve and the Northeast Gasoline Supply Reserve.

- The Northeast Home Heating Oil Reserve, which is not part of the SPR,²⁵ holds 1 million barrels of ultra low sulfur distillate, a petroleum product essentially equivalent to diesel fuel but that is also used for heating oil. The Northeast United States is heavily dependent on the use of heating oil in winter months.²⁶ The distillate is stored in leased

²⁵The Energy Act of 2000 authorized the establishment of the Northeast Home Heating Oil Reserve, and specifically provided that such a reserve is not a component of the SPR. Pub. L. No. 106-469, § 201(a)(3), 114 Stat. 2029, 2034 (2000) (codified as amended at 42 U.S.C. § 6250(a)).

²⁶The term Northeast, for purposes of the Northeast Home Heating Oil Reserve, is defined as the states of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, Pennsylvania, and New Jersey. 42 U.S.C. § 6250(b)(1).

commercial tank storage in terminals in Connecticut, Massachusetts, and New Jersey. In 2000, the President directed the creation of the reserve to hold approximately 10 days of inventory, the time required for ships to carry additional heating oil from the Gulf of Mexico to New York Harbor.²⁷

- The Northeast Gasoline Supply Reserve, a part of the SPR, holds 1 million barrels of gasoline for consumers in the northeastern United States. According to DOE's website, this region is particularly vulnerable to gasoline disruptions as a result of hurricanes and other natural events. For example, Hurricane Sandy caused widespread gasoline shortages in the region in 2012. DOE conducted a test sale of the SPR in 2014 and used a portion of the proceeds from the sale to create the reserve. The gasoline is stored in leased commercial tank storage in terminals in Maine, Massachusetts, and New Jersey.

IEA Obligations

The SPR helps the United States meet its IEA obligation to hold the equivalent of 90 days of net imports of crude oil and petroleum products. In order to meet the IEA 90-day reserve obligation, countries, including the United States, can count existing private reserves of crude oil and petroleum products in addition to public reserves (in the United States, the SPR). In most years, the United States has met its 90-day reserve obligation with a combination of SPR and private reserves.²⁸ The days of import protection may vary based on actual net U.S. crude oil and petroleum products imports as well as the inventory levels of the SPR and private reserves. As discussed previously, because the IEA 90-day reserve obligation is based on a country's net imports, there is no such reserve obligation for countries that are net exporters of crude oil and petroleum products.

The United States also relies on the SPR to meet its IEA obligation to release reserves in the event of a collective action to respond to a supply disruption. Countries contribute to an IEA collective action based on their share of IEA oil consumption, and they can meet their obligation by whatever measure they choose, including release of public or private

²⁷Initially, the Northeast Home Heating Oil Reserve held 2 million barrels of high sulfur heating oil. In 2011, the 2 million barrels of high sulfur heating oil was sold and replaced with 1 million barrels of ultra low sulfur distillate.

²⁸In this report, unless otherwise noted, we have calculated the number of days of import protection for the United States by dividing the SPR's inventory level by the EIA's reported net petroleum imports per day for the preceding year.

reserves, or demand restraint. IEA collective actions are designed to mitigate the negative effects of sudden supply shortages by making additional crude oil and petroleum products available to the global market through a combination of emergency response measures, which include increasing supply and reducing demand. In the event of a global market disruption, IEA member countries can call for a collective action after reaching consensus on whether a response is needed. DOE stated that the collective action IEA obligation is more relevant to the SPR's mission of protecting the U.S. economy from severe petroleum supply interruptions than the 90-day reserve obligation. The United States has participated in each of the three IEA collective actions. In 1991, with the commencement of Operation Desert Storm, DOE released 17.3 million barrels of SPR crude oil. After Hurricane Katrina in 2005, DOE released 11 million barrels of SPR crude oil. Most recently, in June 2011, in response to crude oil supply disruptions driven by hostilities in Libya, DOE released 30.6 million barrels of crude oil from the SPR. The Libya collective action is an example of how, in practice, member countries participate according to national circumstances. After consultations with IEA member countries, all IEA member countries agreed to the Libya collective action, under which 12 of the 28 members at that time contributed to the action.²⁹ In addition to the three IEA collective actions, the SPR has been used 10 times in response to U.S. domestic supply disturbances that were not IEA collective actions, most notably in response to severe weather events.³⁰

²⁹At the time of the Libya collective action, there were 28 IEA member countries. Mexico and Estonia have since joined the IEA, which now has 30 members.

³⁰In addition to these releases in response to supply disruptions, the SPR has released oil in relatively small amounts at other times for reasons that include test sales to ensure the system is working.

In Contrast with the United States, Most IEA Members Rely on Private Reserves to Meet Reserve Obligations and Hold Significant Proportions of Their Reserves as Petroleum Products

In terms of how they meet their IEA obligations, most other IEA members differ from the United States in two basic ways. Specifically, as of December 2017, most IEA members rely at least in part on private rather than public reserves to meet their obligations, and most hold significant proportions of these reserves as petroleum products rather than as crude oil.

In December 2017, before Mexico joined the IEA in early 2018, there were 29 member countries. Of these 29 countries, 25 IEA members had two common attributes: (1) as net importers, they had a 90-day reserve obligation and met that obligation,³¹ and (2) they had formal processes for holding and releasing these reserves. As of December 2017, 18 of these 25 members relied entirely or in part on private reserves to meet their reserve obligations.³² Specifically, based on IEA data as of December 2017, these 18 countries met their 90-day reserve obligation through private reserves and either had no public reserves or had public reserves of less than 90 days. According to a 2014 IEA report, some of these countries require industry to hold reserves and, when needed, release them. For example, according to a 2014 IEA report and documentation provided by government officials, the United Kingdom meets its entire obligation by requiring private industry to hold reserves.³³ In contrast, New Zealand had publicly held reserves amounting to 26 days of net imports, according to IEA data as of December 2017. According to a 2014 IEA report, New Zealand relied on industry reserves held for commercial purposes to meet the rest of its 90-day reserve obligation, although New Zealand does not formally require industry to hold reserves specifically for this purpose.

Unlike the 18 countries that rely at least in part on private reserves, as of December 2017, the United States and 6 other IEA members met the 90-day reserve obligation exclusively through public reserves. Specifically, according to IEA data on member reserves, Estonia, Finland, Germany,

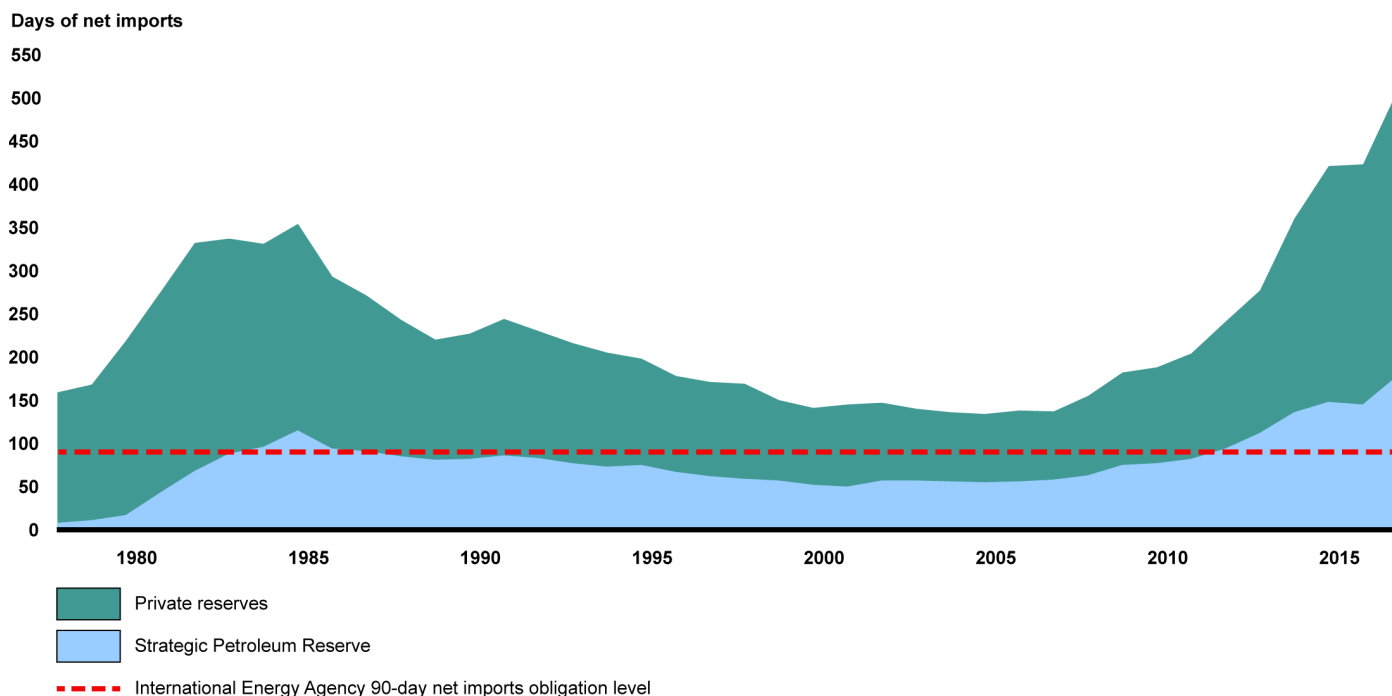
³¹According to IEA documents, as of December 2017, 3 member countries were net exporters and so did not have a 90-day obligation. In addition, according to IEA officials, Australia did not hold the equivalent of 90 days of net imports in December 2017.

³²The 18 member countries are Austria, Belgium, Czech Republic, France, Greece, Italy, Korea, Luxembourg, New Zealand, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, The Netherlands, Turkey, and the United Kingdom.

³³International Energy Agency, *Energy Supply Security, Emergency Response of IEA Countries* (Paris, France: 2014).

Hungary, Ireland, Japan, and the United States held public reserves equal to 90 days or more of net imports.³⁴ Although the United States currently meets its IEA 90-day reserve obligation solely with public reserves, for most of the SPR's existence, public reserves were insufficient to meet this obligation, so the United States also had to rely on private reserves. Specifically, according to EIA data, the United States has relied, at least in part, on private reserves together with the SPR to meet the 90-day reserve obligation with the exception of two time periods (1984-1987 and 2012-present), when the United States has relied solely on the SPR. The United States does not require industry to hold reserves for the purposes of meeting IEA obligations. Figure 2 compares the United States' reserves in days of net imports to the IEA's 90-day reserve obligation.

Figure 2: U.S. Holdings in the Strategic Petroleum Reserve and Private Reserves, 1977-2017



Source: GAO analysis of U.S. Energy Information Administration (EIA) data. | GAO-18-477

³⁴In addition to meeting their 90-day reserve obligation with public reserves, according to country and IEA documentation, Japan and Finland also place requirements on industry to hold some level of reserves.

Crude Oil and Petroleum Product Tickets

Tickets are contingent contracts under which a seller of a ticket agrees to deliver to the buyer an amount of oil or petroleum products if a specific event occurs, such as an IEA collective action, in return for an agreed upon fee. The agreement specifies the quantity, quality, and location of the oil or product, the duration, and how the price of the physical oil or product will be determined. For example, according to an oil broker, in the event of a disruption, when a buyer executes a ticket contract, the buyer may purchase the oil or petroleum products and pay a price tied to a market index for the oil or product received. Alternatively, according to an oil broker, with the agreement of the seller, the buyer can request that the contracted volumes of crude oil or petroleum products be made available for sale to any willing buyer.

For buyers, tickets provide an alternative to directly acquiring crude oil and petroleum products and building or renting necessary storage capacity. The fees from tickets also create an incentive for sellers to hold additional volumes of oil and product in reserve.

Sources: International Energy Agency and an oil broker. | GAO-18-477

According to a 2014 IEA report, most IEA members hold at least a third of their reserves as petroleum products, such as gasoline and diesel fuel, rather than as crude oil.³⁵ Holding petroleum products can be advantageous during certain disruptions because such reserves can be directly distributed to consumers, whereas crude oil must first be refined and turned into products, adding response time. According to the IEA's 2014 report, Germany's stockholding agency holds 55 percent of its reserve as petroleum products. Similarly, France holds only petroleum products that are distributed geographically across the country so that the reserves can be used quickly in the event of a supply disruption. In contrast, more than 99 percent of the SPR (665.5 million barrels as of March 2018) is held as crude oil, all of which is stored at the four storage sites in Louisiana and Texas. The exception is the Northeast Gasoline Supply Reserve, which, as mentioned previously, is a 1 million barrel gasoline reserve in terminals in Maine, Massachusetts, and New Jersey that was established in 2014 after Hurricane Sandy and that is considered part of the SPR. According to DOE officials, there are several reasons the SPR holds predominantly crude oil, including that it is more costly to store petroleum products than crude oil and that the United States has the largest refining capacity of any IEA member country. Because of the large U.S. refining sector, crude oil from the SPR can be domestically refined into petroleum products to meet demand.

Some IEA member countries store some of their reserves abroad, though the United States does not. According to a 2014 IEA report, some IEA member countries allow part of their reserves to be stored abroad to leverage spare storage capacity or more cost-effective storage by utilizing available storage space or excess private reserves in other countries.³⁶ For example, approximately 30 percent of Ireland's reserves are held in other European Union countries. In some of these cases, countries use short-term contracts, also known as tickets, instead of directly acquiring and storing oil and petroleum products. For example, according to documents provided by government officials, since 1995 the United Kingdom has increased its reserves held under ticket agreements outside of the country from around 10 percent of its total reserves to more than 25 percent.

³⁵International Energy Agency, *Energy Supply Security, Emergency Response of IEA Countries* (Paris, France: 2014).

³⁶International Energy Agency, *Energy Supply Security, Emergency Response of IEA Countries* (Paris, France: 2014).

In addition, unlike the United States, some IEA countries specify the size of their public or private reserves in terms of net imports or consumption, rather than a specific volume. In the United States, the total volume of crude oil and petroleum products held in the SPR is the result of amounts historically purchased to fill the reserve and subsequent sales as mandated by Congress or released in response to a supply disruption. According to DOE, it cannot otherwise reduce or increase volumes held in reserve without congressional action—either through requirements to purchase additional oil or laws authorizing or mandating sales. On the other hand, some IEA countries have tied their reserves' volumes of crude oil and petroleum products to a metric such as days of net imports or a percent of consumption. For example, according to documentation provided by government officials, in 2015 Japan changed how it specifies its target reserves from a specified amount to days of net imports.³⁷ In specifying the size of reserves in this way, the amount held is adjusted as market conditions change—for example, if net imports change and require more or fewer reserves to meet the IEA 90-day reserve obligation, or when other underlying factors affecting a nation's energy security needs change.

DOE Has Not Identified the Optimal Size for the SPR or the Potential Need for Regional Product Reserves

While DOE has examined a range of sizes for the SPR, it has not identified the optimal size for the SPR to meet U.S. energy security needs and IEA obligations, and DOE's analysis of SPR sizes was limited in three ways. DOE also has not identified whether additional regional petroleum product reserves should be part of the SPR in U.S. regions identified as vulnerable to fuel supply disruptions.

³⁷In another example, according to a 2014 IEA report, the United Kingdom and France require industry to hold levels of reserves in days of net imports based on consumption levels.

DOE Examined a Range of Sizes for the SPR but Has Not Identified the Optimal Size for SPR and the Agency's Analysis Was Limited in Three Ways

DOE has not identified the optimal size for the SPR and though the agency examined a range of SPR sizes, its analysis was limited in at least three ways. In response to direction from Congress and recommendations from GAO and the DOE Inspector General, DOE developed and published a long-term strategic review of the SPR in August 2016.³⁸ In DOE's 2016 review, the agency examined the expected economic benefits of SPR sizes ranging from 430 million to 695 million barrels of oil over a 25-year time horizon (2016 through 2040), but it did not recommend an optimal size for the reserve.

DOE's review did not identify the optimal size for the SPR because of three limitations:

- **DOE did not fully evaluate implications of market fluctuations and estimate needs.** DOE did not fully evaluate the implications of falling net imports of crude oil and petroleum products with respect to meeting IEA obligations to hold the equivalent of 90 days of net imports and to respond to collective actions. As mentioned previously, the United States is expected to become a net exporter of crude oil and petroleum products by the late 2020s. Since the IEA 90-day reserve obligation is based on a country's net imports, this means that at that point the United States would not have a 90-day reserve obligation. However, even as a net exporter, the United States would still have to meet the IEA obligation to respond to a collective action. Yet, DOE's analysis did not evaluate the SPR's configuration as it relates to projected fluctuations in net imports or estimate the minimal amount of reserves needed to meet potential future collective actions. Without considering projected fluctuations in net imports or providing

³⁸U.S. Department of Energy, *Long-Term Strategic Review of the U.S. Strategic Petroleum Reserve: Report to Congress*, (Washington, D.C.: August 2016). The Bipartisan Budget Act of 2015 directed the Secretary of Energy to develop and submit to Congress a proposed action plan that, among other things, identifies the configuration and performance capabilities of the SPR and recommends an action plan to achieve the optimal capacity, location, and composition of petroleum products in the SPR. Pub. L. No. 114-74, § 402, 129 Stat. 584, 589 (2015). In September 2014, we reported that changing market conditions have implications for the size, location, and composition of the SPR. We recommended that DOE reexamine the SPR's size. DOE concurred with our recommendation. [GAO-14-807](#). In July 2014, DOE's Office of Inspector General recommended that DOE's Office of Fossil Energy perform a long-range strategic review of the SPR to ensure it is best configured to respond to the current and future needs of the United States and DOE concurred with the recommendation. U.S. Department of Energy, Office of Inspector General, Office of Audits and Inspections. *The Strategic Petroleum Reserve's Drawdown Readiness. DOE/IG-0916* (Washington, D.C.: July 2014).

an analysis of how much oil is estimated to be needed to meet IEA collective actions, DOE cannot fully advise Congress on the optimal size of the SPR.

- **DOE did not consider private-sector response.** DOE's analyses in its 2016 review focused on the publicly held reserves in the SPR as the only means to respond to oil supply disruptions and did not consider a response from the private sector or through consumers reducing demand. According to DOE's 2016 review, the underlying analysis for the benefits of the SPR did not consider a response from the private sector for three reasons: (1) while U.S. commercial stocks could conceivably address part of a supply disruption, private industry could also hold oil inventories in a crisis instead of releasing them; (2) unlike most other IEA member countries, the United States does not require private-sector response; and (3) research on the exact nature of private-sector response during a disruption is needed. DOE officials told us the agency has not studied the extent to which SPR releases of crude oil displace what would otherwise have been private releases of inventories.³⁹

As we reported in September 2014, changing market conditions—most importantly the significant increase in domestic production of oil—have implications for the SPR's size because increased production has led to increasing private reserves.⁴⁰ According to IEA data as of December 2017, U.S. private reserves held the equivalent of 194 days of net import protection coverage, up from about 59 days in 2006. Further, private reserves in the United States consist of both crude oil and petroleum products with more than half in the latter category. For example, as of January 2018, total private reserves of crude oil and petroleum products were about 1.215 billion barrels, of which about 420 million barrels were in the form of crude oil and 795 million barrels were petroleum products, according to the EIA. As of 2013, these private reserves were distributed across the entire country in more than 1,400 terminals, according to the EIA.

As we reported in December 2007, international trade in oil and petroleum products has expanded significantly over the past 2 decades, making markets for gasoline and other petroleum products

³⁹According to DOE officials, the agency adjusted its oil market model to account for the response of U.S. oil production to price changes; the literature is unclear about private-sector behavior, such as whether the private sector would hoard or sell oil inventory when prices rise and as a result, DOE left the role of private sector neutral in its analyses.

⁴⁰[GAO-14-807](#).

increasingly global in nature.⁴¹ In such a global oil market, higher levels of private reserves can benefit the United States and the rest of the world by helping mitigate a supply disruption. Most experts and stakeholders we interviewed generally agreed that the private sector is in a better position to respond to supply disruptions than they were when the SPR was created. With regard to demand response, DOE officials told us they do not consider this because there is no mechanism to require industry to respond to supply disruptions or consumers to reduce demand in response to a supply disruption. However, DOE has not studied how voluntary response to changes in petroleum product prices affects the need for or efficacy of strategic releases. Without conducting an analysis of how private parties respond to supply disruptions, DOE cannot advise Congress on the optimal size of the SPR because it cannot know how effective such private responses could be in mitigating supply disruptions.

- **DOE did not fully examine costs of differently sized reserves.** DOE's review of the expected economic benefits of differently sized reserves did not fully examine the corresponding costs of those sizes. According to DOE officials, there was no requirement or need to conduct a formal cost benefit analysis of the SPR because the SPR's oil acquisition and initial capital costs to create the reserve are sunk costs and the ongoing operational costs to maintain the reserve are minimal in comparison. However, this does not take into account the opportunity cost to the government that holding reserves represents; as Congress has mandated several times recently, crude oil from the reserve can be sold to fund other federal priorities. Without additional analysis, such as of the costs and benefits of SPR's size, DOE cannot fully advise Congress on the optimal size of the SPR.

When we reviewed the SPR in 2006 and 2014, we found that DOE had not periodically re-examined the strategic reserves. In 2006, we recommended that the Secretary of Energy reexamine the appropriate size of the SPR. In its response to our recommendation, DOE stated that its reexamination had taken the form of more "actionable items," including not requesting expansion funding in its 2011 budget and canceling and redirecting the prior year's expansion funding to general operations of the SPR, based on the Administration's decision that the SPR's current size

⁴¹GAO, *Energy Markets: Increasing Globalization of Petroleum Products Markets, Tightening Refining Demand and Supply Balance, and Other Trends Have Implications for U.S. Energy Supply, Prices, and Price Volatility*, [GAO-08-14](#) (Washington, D.C.: Dec. 20, 2007).

at the time was adequate. Similarly, as previously mentioned, in 2014 we found that changing market conditions have implications for the size, location, and composition of the SPR, but DOE had not reexamined the SPR's size since 2005. Accordingly, we recommended that the Secretary of Energy undertake a comprehensive reexamination of the appropriate size of the SPR. In response to our recommendation, the 2014 DOE Inspector General recommendation mentioned previously, and the Bipartisan Budget Act of 2015, DOE published its 2016 review.

As previously mentioned and reported, crude oil and petroleum markets are constantly changing, but DOE conducted its full evaluations of the SPR more than a decade apart. According to DOE officials, there is no formal policy to periodically reevaluate the SPR. We previously found that federal programs should be reexamined if there have been significant changes in the country or the world that relate to the reason for initiating the program.⁴² In that report, we found that many federal programs and policies were designed decades ago to respond to trends and challenges that existed at the time of their creation. Moreover, the Office of Management and Budget Circular A-94 for benefit-cost analysis of federal programs includes guidelines that apply to any analysis used to support government decisions to initiate, renew, or expand programs or projects that would result in a series of measurable benefits or costs extending for 3 or more years into the future.⁴³ Given changing market conditions and future projections, without conducting additional analysis to supplement its 2016 review and thereafter periodically reexamining the SPR to take into account changes in market conditions and include a thorough consideration of the costs and benefits of a wide range of SPR sizes, DOE cannot provide information to Congress to inform decisions about the appropriate size of the SPR and risks holding too much or too little in the SPR to meet the United States' evolving energy security needs and IEA obligations.

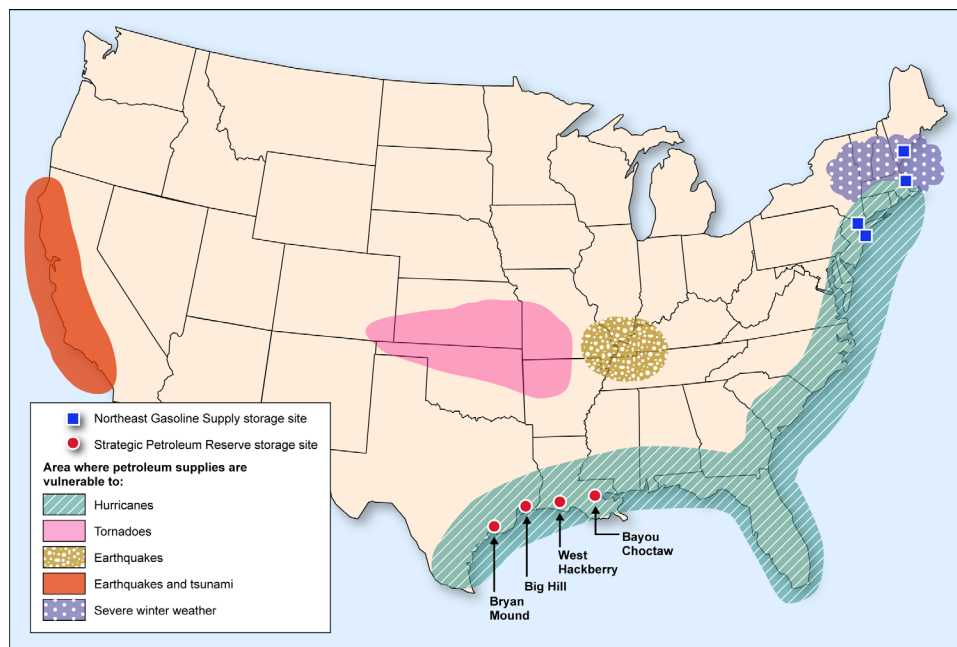
⁴²GAO, *21st Century Challenges: Reexamining the Base of the Federal Government*, [GAO-05-325SP](#) (Washington, D.C.: Feb. 1, 2005).

⁴³Office of Management and Budget Circular No. A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, (Oct. 29, 1992).

DOE Has Not Identified Whether Additional Regional Petroleum Product Reserves Should Be Part of the SPR

DOE has also not fully identified whether additional regional petroleum product reserves should be part of the SPR. Because the SPR stores oil nearly exclusively along the Gulf Coast, the SPR is configured primarily to respond to global oil supply disruptions. However, as we reported in November 2017, the SPR has primarily been used in response to domestic disruptions. The SPR is limited in its ability to respond to domestic disruptions because reserves are almost entirely composed of crude oil and not refined petroleum products, which may not be effective in responding to disruptions that affect the refining sector.⁴⁴ For example, as we reported in November 2017, Hurricanes Harvey, Irma, and Maria damaged infrastructure and property, caused the loss of life, and disrupted the operations of refineries representing at least 15 percent of the nation’s refining capacity.⁴⁵ DOE has identified regions subject to product supply vulnerabilities as shown in Figure 3.

Figure 3: U.S. Strategic Petroleum Reserve Locations and Regional Petroleum Product Supply Vulnerabilities Identified by the Department of Energy in 2014



Sources: Department of Energy, Map Resources (map). | GAO-18-477

⁴⁴GAO-18-209T.

⁴⁵GAO-18-209T.

The Quadrennial Energy Review of 2015 recommended that the agency analyze the need for additional or expanded regional product reserves by undertaking updated cost-benefit analyses for all of the regions of the United States that have been identified as vulnerable to fuel supply disruptions.⁴⁶ In response to this recommendation, DOE studied the costs and benefits of regional petroleum product reserves in the West Coast and Southeast Coast. According to DOE officials, weather events in the Southeast Coast are of higher probability but lower consequence, and events in the West Coast are of lower probability but higher consequence. DOE did not finalize its 2015 studies on regional petroleum product reserves and make them publicly available. However, the draft 2015 studies concluded that a product reserve in the Southeast would provide significant net economic benefits to the region and the United States, particularly in the event of a major hurricane, while further analyses are needed to determine the potential benefits of a reserve on the West Coast.⁴⁷ A prior DOE study also suggests that petroleum product reserves merit consideration—in 2011, DOE carried out a cost-benefit study of the establishment of a refined product reserve in the Southeast and estimated that such a reserve would reduce the average gasoline price rise by 50 percent to 70 percent in the weeks immediately after a hurricane landfall, resulting in consumer cost savings, according to the Quadrennial Energy Review of 2015.⁴⁸ According to DOE officials, the agency has no plans to conduct additional studies. DOE's 2016 review of the SPR did not fully assess whether there is a need for additional regional product reserves in other U.S. regions identified as vulnerable to fuel supply disruptions, as recommended by DOE's studies and the 2015

⁴⁶U.S. Department of Energy, *Quadrennial Energy Review: Energy Transmission, Storage, and Distribution Infrastructure*, April 2015. A 2014 Presidential memorandum created a Quadrennial Energy Review Task Force, co-chaired by the Directors of the Domestic Policy Council and the Office of Science and Technology Policy, with support from the Secretary of Energy. The Quadrennial Energy Review Report, to be submitted to the President every 4 years, is to, among other things, provide an integrated view of, and recommendations for, federal energy policy in the context of economic, environmental, occupational, security, and health and safety priorities, with attention in the first report given to the challenges facing the nation's energy infrastructures. The first report was issued in April 2015.

⁴⁷While this finding of the draft 2015 studies is pre-decisional and was not approved by DOE, we report it here because DOE has relied on related findings from the draft 2015 studies in its response to our report and recommendations (see appendix I).

⁴⁸Although this finding was reported in the 2015 Quadrennial Energy Review, according to DOE officials, all aspects of the 2011 study remain draft and pre-decisional since DOE did not officially approve the study.

Quadrennial Energy Review. Without completing studies on the costs and benefits of regional petroleum product reserves for all the vulnerable U.S. regions and publicly releasing the results, DOE cannot ensure that it and Congress have the information they need to make decisions about whether additional regional product reserves are needed.

DOE Has Taken Steps to Update Its Modernization Plans, But Is Hindered by Uncertainty Regarding the SPR's Long-term Size

DOE Has Taken Steps to Update Its Modernization Plans for Currently Mandated Sales

DOE has taken steps to take into account the effects of congressionally mandated oil sales in its plans for modernizing the SPR, though DOE's current plans are based on information largely developed prior to the most recent congressionally mandated oil sales. According to DOE, the SPR modernization program is focused on a life extension project to modernize aging infrastructure to ensure the SPR will be able to meet its mission requirements for the next several decades. The project's scope of work has undergone several revisions since its inception in response to changing conditions and requirements, according to the agency.⁴⁹ DOE has estimated the total cost for the SPR's modernization at up to \$1.4 billion. DOE raised about \$323 million for modernization through the sale of SPR oil in fiscal year 2017, and the Consolidated Appropriations Act of 2018 provided that DOE is to draw down and sell an amount of crude oil not to exceed \$350 million for modernization in fiscal year 2018.⁵⁰ As of the end of February 2018, DOE has spent \$22 million on modernization efforts and the additional funds will allow DOE to continue moving forward with the project, according to agency officials. According to DOE's modernization plans, the first major construction is scheduled for fiscal year 2019. However, these plans are largely based on information DOE analyzed before recent congressionally mandated sales of an additional 117 million barrels of oil.

⁴⁹Since 2016, DOE conducted additional supplemental analysis of alternatives to update its modernization plans which resulted in additions and deletions of tasks from the project's original scope of work, according to the agency.

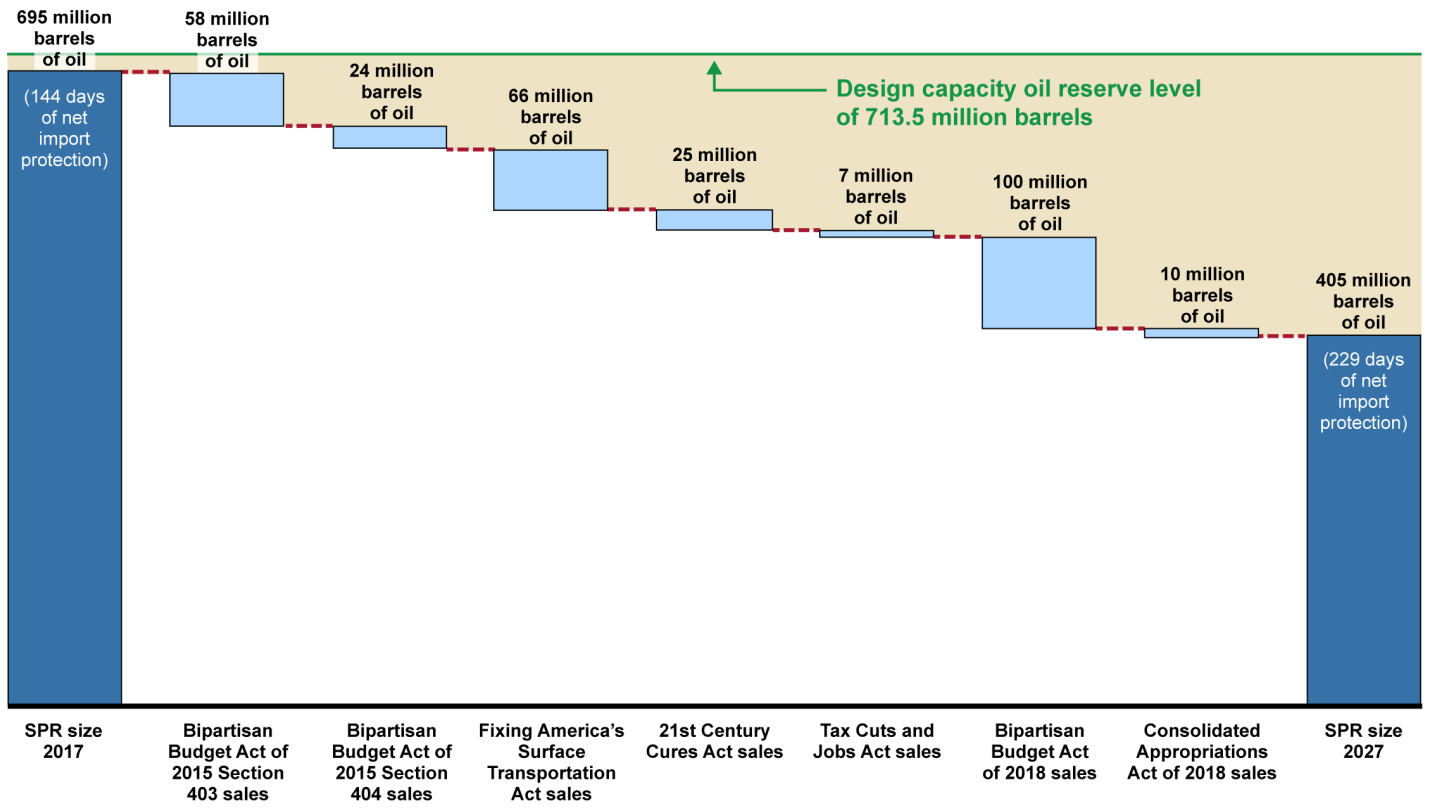
⁵⁰Pub. L. No. 115-141, Div. D, Tit. III (2018). The act further provides that, as authorized by section 404 of the Bipartisan Budget Act of 2015, the proceeds from such drawdown and sale shall be deposited into the Energy Security and Infrastructure Modernization Fund.

Since the most recent mandated sales, DOE has taken steps to update its modernization plans and has changed its assumptions for SPR's modernization. For example, DOE now assumes that the reserve will hold about 405 million barrels of oil and that one of the four SPR sites may close after congressionally mandated sales are completed at the end of fiscal year 2027, according to agency officials. However, DOE has not fully updated the SPR's modernization plans based on these assumptions. According to DOE officials, in March 2018, DOE commenced a study—the SPR post-sale configuration study—to examine potential future reserve configurations. This study is to take into account the effects of congressionally mandated sales on the reserve and its modernization, and is targeted for completion in October 2018, according to agency officials. Information from the study will inform DOE's updates to the SPR's modernization plans, according to DOE officials.

As part of its post-sale configuration study, DOE plans to examine how the agency may handle the potentially excess SPR facilities created by the mandated sales. In January 2017, the SPR had a design capacity to hold 713.5 million barrels of oil and actually held 695 million barrels. As shown in figure 4, without action by DOE to reduce the SPR's design capacity or otherwise use SPR facilities, congressionally mandated sales will cause excess storage capacity to grow to 308 million barrels or more by the end of fiscal year 2027—meaning that about 43 percent of the SPR's total design capacity to store oil would be unused.⁵¹

⁵¹According to DOE officials, as part of contingency planning, spare capacity is required in the event that oil must be removed from a cavern and the cavern is rendered unsuitable for oil storage. Moreover, natural creep on storage caverns reduces the amount of storage capacity across the SPR with the reserve losing about 1.2 million barrels per year across the SPR to natural cavern creep and another 1 million barrels per year are lost due to depressurizing caverns, according to DOE officials.

Figure 4: Oil Inventory Held in the Strategic Petroleum Reserve in 2017 and Projected Oil Inventory in 2027 Compared to the Reserve's Design Capacity in 2017



Size of Strategic Petroleum Reserve (SPR) Amount of congressionally mandated sale

Sources: GAO analysis of U.S. Department of Energy and U.S. Energy Information Administration data. | GAO-18-477

Note: Volumes of oil to be sold under section 404 of the Bipartisan Budget Act of 2015 (sales to fund SPR modernization) are U.S. Department of Energy estimates.

DOE plans to explore some options to use these potentially excess SPR assets in its ongoing post-sale configuration study. In withdrawing oil to meet congressionally mandated oil sales currently in place (290 million barrels through fiscal year 2027), DOE could close at least one SPR site based on our analysis of projected excess storage capacity. For example, if DOE were to close the smallest SPR site, Bayou Choctaw, the agency could also explore selling the connected pipeline and marine terminal, which are currently being leased to a private company. DOE could also consider leasing excess storage capacity to other countries so that they

could store oil at the SPR.⁵² DOE has not entered into any such leases with other countries and has not considered such leases because, according to DOE, the SPR has historically lacked capacity to store additional oil. DOE has not proposed any of these options or explored the revenue the agency could generate by selling or leasing these assets. According to DOE officials, the agency will examine the feasibility of such options in the ongoing SPR post-sale configuration study.

Uncertainty Has Hampered DOE's Efforts to Account for Potential Future Mandated Sales

As DOE takes steps to plan for the SPR's modernization, ongoing uncertainty regarding the SPR's long-term size and configuration have complicated DOE's efforts. According to DOE officials, this uncertainty makes it extremely difficult to effectively perform any mid-to long-range planning efforts for the SPR's modernization project, including the execution of major maintenance projects. Congress has generally set the SPR's size by mandating purchases or sales of oil, and has established and amended the minimum size of the SPR as it pertains to the release of oil for emergency protection. Since 2015, Congress has, across six pieces of legislation, mandated 290 million barrels in additional oil sales. However, DOE developed its modernization plans in 2016. DOE officials told us they do not know whether additional sales will be mandated over the next 10 years or whether other changes may be required to the configuration of the reserve. Any additional congressionally mandated sales or direction to pursue additional petroleum product reserves would require DOE to again revisit its modernization plans and assessments of the potential uses of any excess SPR assets. Oil market projections also have implications for the future of the SPR. Under current projections, the United States may fluctuate between being a net importer and net exporter over the next several decades. Specifically, the United States is projected to become a net exporter by the late 2020s and would then no longer have a 90-day reserve obligation, but it is projected to return to being a net importer between 2040 and 2050. These projected fluctuations could affect the desired size of the SPR in the future. This uncertainty creates risks for DOE's modernization plans, as DOE may end up spending funds on facilities that later turn out to be unnecessary should Congress ultimately decide on a larger- or smaller-sized SPR than DOE anticipates.

⁵²The Energy Policy and Conservation Act provides that the Secretary of Energy, by lease or otherwise, may store in underutilized SPR facilities petroleum product owned by a foreign government or its representative. 42 U.S.C. § 6247a(a).

Having a long-term target for the size and configuration of reserves helps other IEA member countries manage their reserves. For example, as previously discussed, unlike the United States, some other IEA members have specified in dynamic terms the amount of reserves to be held, such as days of net import protection or days of consumption, rather than specifying a specific static volume amount. Under such approaches, the amount held varies over time as entities managing the reserve acquire or sell reserves in order to meet the target. Setting a long-term target for the size and configuration of the SPR—taking into account projections for oil production, consumption, and IEA obligations—could better position DOE to ensure that funds spent on the SPR’s modernization do not modernize a system that is no longer needed and that DOE is able to adequately plan for potentially excess SPR assets.

In the course of our work, we also identified other options for handling potentially excess SPR assets that DOE is not planning on examining, largely because DOE does not currently have the authority to pursue them, according to agency officials. First, DOE could explore leasing storage capacity to private industry. U.S. oil production has generally increased over the last decade. As a result, the private sector may want to lease excess SPR capacity, which may be cheaper than above-ground storage, according to a representative of a private company we spoke with. Fees for doing so could help defray public reserve storage costs. However, officials told us that the Energy Policy and Conservation Act gives DOE authority to lease underutilized storage to other countries, but not to the private sector. Second, if Congress determines that the SPR holds oil in excess of that needed domestically, DOE could explore selling contracts or tickets for the excess oil rather than selling the oil outright. Australian and New Zealand officials told us that if DOE were to sell tickets for SPR oil, tickets would help these countries meet their IEA 90-day reserve obligations. Australian officials told us they have discussed this option with DOE. Currently the United States and Australia have agreed, through an arrangement, to allow Australia to contract for petroleum stocks located in the United States and controlled by commercial entities. According to DOE officials, the arrangement would permit Australia to receive credit from the IEA for tickets it purchases from the U.S. private sector. While the arrangement does not cover government-owned oil in the SPR, if it did, based on our analysis, DOE could generate up to approximately \$15 million annually if Australia purchased the maximum allowable amount of oil specified in an

arrangement through tickets for excess SPR oil.⁵³ However, although the Energy Policy and Conservation Act allows DOE to lease underutilized storage to other countries, DOE lacks the authority to sell tickets and does not plan to seek this authority, according to DOE officials. DOE officials told us that they do not plan to examine these options.

According to DOE's real property asset management order, the agency is to identify real property assets that are no longer needed to meet the program's mission needs and that may be candidates for reuse or disposal.⁵⁴ Once identified, the agency is to undertake certain actions, including determining whether to dispose of these assets by sale or lease. As part of its SPR post-sale configuration study, DOE plans to determine whether it is appropriate to close SPR facilities, and the relative benefit of any closures would be informed by potential lease revenues from maintaining sites so they could be leased, according to officials. However, without examining a full range of options in the post-sale configuration study, DOE risks missing beneficial ways to modernize the SPR while saving taxpayer resources.

Conclusions

Given changing crude oil and petroleum product market conditions and the constrained budget environment, it is important that DOE ensures the SPR is effective at meeting U.S. energy security needs and IEA obligations while being managed and maintained in an efficient manner. In response to congressional direction and recommendations from GAO and DOE Inspector General, DOE conducted a long-term strategic review of the SPR in 2016 after its last comprehensive examination in 2005. In its review, DOE did not determine an optimal size for the SPR, and its analysis was limited in several ways. In particular, DOE did not fully consider recent and expected future changes in crude oil and petroleum market conditions such as the implications of projected fluctuations in U.S. net imports or the role that increased levels of private reserves could play in responding to supply disruptions. DOE also did not perform a full cost-benefit analysis of holding different volumes of reserves. Without supplementing its 2016 strategic review by conducting additional analysis,

⁵³The estimated amount is based on average monthly projected ticket prices in 2018 for crude oil and an arrangement between the United States and Australia that outlines the maximum amount of oil that Australia can purchase in the form of tickets from commercial entities located in the United States.

⁵⁴U.S. Department of Energy, Real Property Asset Management, DOE Order 430.1C (Washington, D.C.: August 2016).

and periodically conducting such analyses going forward, DOE cannot provide information to Congress to inform decisions about the appropriate amounts of crude oil and petroleum products to hold in the SPR and risks holding too much or too little in the SPR to meet the United States' energy security needs and international obligations. Such information is needed on a timely basis, to reflect the pace of change in oil and petroleum markets and other relevant factors that affect the optimal size of the SPR.

Though the SPR has primarily been used in response to domestic supply disruptions, such as hurricanes, the reserve is limited in this role because it is almost entirely composed of crude oil, and not petroleum products. In this regard, the Quadrennial Energy Review of 2015 recommended that DOE analyze the need for additional regional product reserves for U.S. regions that have been identified as vulnerable to fuel supply disruptions. DOE has not identified whether additional regional product reserves should be part of the SPR or completed studies of all vulnerable U.S. regions, and it has no plans to do so, according to DOE officials. Without conducting or completing studies for all the vulnerable U.S. regions and releasing the results, DOE cannot ensure it and Congress have the information they need to make decisions about potential additional regional product reserves.

In the face of declining net U.S. imports, Congress has taken repeated steps to reduce the size of the reserve. Given that net imports are projected to continue to decline through the late 2020s and fluctuate in the future, there may be additional congressionally mandated SPR oil sales. This has created long-term uncertainty regarding the future size and configuration of the SPR. Congress could address this uncertainty by identifying a long-term target for the size of the SPR—either by volume or in terms tied to factors, such as consumption or net import protection, that affect the country's energy security needs and IEA obligations. Setting such a long-term target could better position DOE to ensure the efficiency and efficacy of federal funds spent on the reserve.

DOE has recently begun to study the potential effects of congressionally mandated sales on its modernization plans. As part of its SPR post-sale configuration study, DOE plans to determine whether it is appropriate to close SPR facilities, and the relative benefit of any closures would be informed by potential lease revenues from maintaining sites so they could be leased, according to officials. However, we identified other options for handling potentially excess SPR assets that DOE is not planning to examine in its study, inconsistent with the agency's order on real property asset management. Although DOE does not currently have the authority

to implement these options, according to officials, examining their potential use, including possible revenue enhancement, could inform Congress as it examines whether it should grant such authority. Without examining a full range of options in the post-sale configuration study for handling potentially excess SPR assets, DOE risks missing beneficial ways to modernize the SPR while saving taxpayer resources.

Matter for Congressional Consideration

We are making the following matter for congressional consideration:

Congress may wish to consider setting a long-range target for the size and configuration of the SPR that takes into account projections for future oil production, oil consumption, the efficacy of the existing SPR to respond to domestic supply disruptions, and U.S. IEA obligations. (Matter 1)

Recommendations for Executive Action

We are making four recommendations to DOE:

The Secretary of Energy should supplement the agency's 2016 long-term strategic review by conducting an additional analysis that takes into account private-sector response, oil market projections, and costs and benefits of a wide range of different SPR sizes. (Recommendation 1)

The Secretary of Energy should take actions to ensure that the agency periodically conducts and provides to Congress a strategic review of the SPR that, among other things, takes into account changes in crude oil and petroleum product market conditions and contains additional analysis, such as the costs and benefits of a wide range of different SPR sizes. (Recommendation 2)

The Secretary of Energy should conduct or complete studies on the costs and benefits of regional petroleum product reserves for all U.S. regions that have been identified as vulnerable to fuel supply disruptions, and the Secretary should report the results to Congress. (Recommendation 3)

The Secretary of Energy, in completing DOE's ongoing study on the effects of congressionally mandated sales, should consider a full range of options for handling potentially excess assets and, if needed, request congressional authority for the disposition of these assets. (Recommendation 4)

Agency Comments and Our Evaluation

We provided a draft of this report to DOE for review and comment. DOE provided written comments, which are reproduced in appendix I. Of the four recommendations, DOE agreed with two, partially agreed with one, and disagreed with one.

- Regarding our recommendation that DOE supplement its 2016 long-term strategic review with an additional analysis that takes into account private sector response, oil market projections, and costs and benefits of a wide range of different SPR sizes, the agency partially agreed with the recommendation. DOE agreed to conduct an additional analysis to assess the purpose, goals, and objectives of the SPR, taking into account private sector response, oil market projections, and any other relevant factors, that will lead to an evaluation of possible optimal sizes of the SPR in the future. In response to taking into account the costs and benefits of a wide range of different SPR sizes, DOE stated that the agency determined the projected benefits of a wide range of different SPR sizes ranging from 430 million barrels of oil to 695 million barrels of oil in its 2016 review. However, the minimum SPR size considered by DOE is greater than the projected SPR size after congressionally mandated sales have occurred. Further, the SPR size after congressionally mandated sales is projected to be far in excess of the IEA obligation to hold a minimum of 90 days of net imports. DOE must also consider the minimum size needed to meet its IEA obligations in the event of a collective action. In conducting additional analysis, DOE should consider a smaller lower bound, in line with congressionally mandated sales, for the size of the SPR, and more fully consider the size needed to meet the IEA 90-day net import and collective action obligations.
- Regarding our recommendation that DOE conduct periodic reviews of the SPR, the agency agreed with the recommendation. DOE stated that a 5-year time interval between reviews would strike an appropriate balance between the need to periodically conduct a strategic assessment and evaluation of the SPR and the limitations on resources to plan and conduct such a review.
- Regarding our recommendation that DOE conduct or complete studies on the costs and benefits of regional petroleum product reserves, the agency disagreed. DOE stated that it is the agency's position that government owned and operated regional petroleum product reserves are an inefficient and expensive solution to respond

to regional fuel supply disruptions. DOE further stated, based on studies done in 2015 that DOE officials told us were pre-decisional and therefore could not be reported, that there are additional concerns associated with government-owned and operated regional refined petroleum product reserves, including little to no storage capacity for lease in commercial terminals and high costs for government owned and operated regional product reserves. However, these same studies took these concerns into account, and concluded that a product reserve in the Southeast would provide significant net economic benefits (benefits minus costs) to the region and the United States in the event of a major hurricane. These studies also concluded that additional analyses are required to inform decisions regarding the potential benefits of a similar reserve on the West Coast. Further, the Quadrennial Energy Review of 2015 recommended that similar analyses be completed for other areas deemed by DOE to be vulnerable to fuel supply disruptions. Therefore, we continue to believe that conducting these analyses, as recommended in the Quadrennial Energy Review of 2015, will provide Congress with information needed to make decisions about regional product reserves.

- Regarding our recommendation that DOE consider a full range of options for handling potentially excess assets, DOE agreed with the recommendation. DOE stated that in its ongoing study, the agency will include an assessment of disposition options for any potential excess or underutilized SPR assets, to include the need for new legislative authority, as necessary, for the disposition of assets. DOE expects this study to be completed in October 2018.

DOE also provided technical comments, which we incorporated, as appropriate.

As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies to the appropriate congressional committees, the Secretary of Energy, and other interested parties. In addition, the report will be available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff members have any questions about this report, please contact me at (202) 512-3841 or ruscof@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix II.

A handwritten signature in black ink that reads "Frank Rusco". The signature is written in a cursive style with a long, sweeping horizontal line extending to the right from the end of the name.

Frank Rusco
Director, Natural Resources and Environment

Appendix I: Comments from the Department of Energy



Department of Energy
Washington, DC 20585

May 11, 2018

Mr. Franklin Rusco
Director
Natural Resources and Environment
U.S. Government Accountability Office
441 G Street, N.W.
Washington, D.C. 20548

Dear Mr. Rusco:

Thank you for providing a copy of the Government Accountability Office (GAO) draft report titled: *Strategic Petroleum Reserve: DOE Needs to Strengthen Its Approach to Planning the Future of the Emergency Stockpile* (GAO-18-477). The enclosed comments are submitted by the Department of Energy in response to this draft report.

If you have any questions, please contact me, or Douglas Macintyre, Acting Deputy Assistant Secretary for the Office of Petroleum Reserves, at 202-586-1831.

Sincerely,

A handwritten signature in black ink, appearing to read "Steven E. Winberg".

Steven E. Winberg
Assistant Secretary for Fossil Energy

Enclosure



Response to Report Recommendations

***Recommendation 1:** The Secretary of Energy should supplement the agency's 2016 long-term strategic review by conducting an additional analysis that takes into account private sector response, oil market projections, and costs and benefits of a wide range of different SPR sizes.*

DOEs Response:

DOE **partially concurs** with this recommendation. DOE's 2016 long-term strategic review (LTSR) of the SPR utilized modeling to determine the projected benefits of a wide range of different SPR crude oil inventory sizes ranging from 430 million barrels to 695 million barrels, and DOE's entire modeling effort was built around the oil market projections contained in the Energy Information Administration's 2015 Annual Energy Outlook. It should be noted the tasking from Congress that motivated the LTSR did not request a full cost-benefit analysis of the SPR itself. Such an endeavor would not yield much insight, given that the vast majority of the major lifecycle costs of the SPR are sunk costs since the infrastructure is built and the crude oil inventory has already been acquired.

However, DOE does agree to conduct additional analysis to assess the purpose, goals, and objectives of the SPR, taking into account private sector response, oil market projections, and any other relevant factors, that will lead to an evaluation of possible optimal sizes of the SPR in the future. In doing this analysis, DOE will address Sec. 161(d)(2) of the Energy Policy and Conservation Act that states that the President will direct a drawdown and sale of the SPR upon determination of a "severe energy supply interruption or by obligations of the United States under the international energy program." This analysis will be an input into policy discussions about the size of the SPR. Until such time, we would refer policymakers to the Quadrennial Energy Review which suggests a range of optimal sizes. DOE expects to begin this analysis after completion of an SPR Post-Sale Configuration Study analysis that is due to be completed in October 2018. The additional analysis recommended would use the results of the SPR Post-Sale Configuration and DOE expects the additional analysis would be completed in FY 2019.

***Recommendation 2:** The Secretary of Energy should take actions to ensure that the agency periodically conducts and provides to Congress a strategic review of the SPR that, among other*

things, takes into account crude oil and petroleum product market conditions, and contains additional analysis, such as the costs and benefits of a wide range of different SPR sizes.

DOEs Response:

DOE **concur**s with this recommendation. A five-year time interval between reviews strikes an appropriate balance between the need to periodically conduct a strategic assessment and evaluation of the SPR against resource limitations required to plan and conduct a strategic review.

***Recommendation 3:** The Secretary of Energy should conduct or complete studies on the costs and benefits of regional petroleum product reserves for all of the regions of the United States that had been identified as vulnerable to fuel supply disruptions and report the results to Congress.*

DOEs Response:

DOE **does not concur** with this recommendation. It is DOE's position that Government-owned and/or operated regional reserves of refined petroleum products are an inefficient and expensive solution to respond to regional fuel supply disruptions. The operating cost of the SPR is less than \$0.25 per barrel of authorized crude oil storage capacity per year. Results of international benchmarking studies of petroleum stockholding countries performed by the benchmarking group of the Annual Coordinating Meeting of Entity Stockholders (ACOMES) have consistently shown SPR crude oil storage and operating costs to be the most economic operating system in the world. By comparison, results from these same studies have shown the storage and operating costs associated with refined petroleum product reserves in the United States to be the most expensive in the world, with U.S. gasoline storage and operating costs 86% higher than the storage and operating costs of the next highest country. Given that the United States has the most robust refining capability in the world, it is much more economic for the SPR to supply additional crude oil to refineries to help resupply refined petroleum product markets through existing distribution systems.

There are additional concerns associated with government-owned and/or operated regional refined petroleum product reserves. The West Coast (PADD V) and Southeast U.S. studies conducted in 2015 indicated there was little to no spare storage capacity for lease in commercial terminals in these regions. This lack of storage capacity would preclude DOE from employing a model similar to that utilized for the Northeast Gasoline Supply Reserve and the Northeast Home Heating Oil Reserve, in which the U.S. government owned the refined petroleum product and leased commercial storage at private sector facilities, extremely high costs of storage

notwithstanding. In addition to high storage costs, the U.S. government would be responsible for acquisition costs of any refined petroleum product purchased. As of mid-April 2018, market prices of \$2.03 per gallon for gasoline (\$85.26 per barrel) and \$2.08 per gallon for ultra-low sulfur distillate (ULSD) (\$87.36 per barrel), the acquisition costs for a 5 million barrel reserve for these refined petroleum products would be \$426.1 million dollars for gasoline and \$436.8 million dollars for ULSD. For government-owned and operated regional refined petroleum product reserves, there would be significant initial capital expenditures required to plan, design, and construct any new storage and distribution facilities. Lifecycle costs would also be extremely high, since funding would be required to staff, maintain, and operate the facilities. As noted above, there would also be significant acquisition costs for the refined petroleum products. Additionally, there are operational challenges associated with this model. Unlike stored crude oil, refined petroleum products in storage must be periodically rotated to maintain product quality and usefulness in an emergency. This would require the U.S. government to completely turnover the existing inventory multiple times a year, resulting in an almost constant cycle of selling existing inventory and buying new inventory. This would result in the U.S. government being in direct competition with the private sector, and would distort local markets.

The GAO report notes that as of December 2017, 18 IEA member countries either fully or partially utilized an industry stockholding model consisting of both crude oil and refined petroleum products to meet their oil stockholding obligations. This model places a requirement on certain companies in the petroleum industry, such as importers, refiners, product suppliers or wholesalers, to hold a minimum inventory level of stocks to be made available upon government direction. While the United States currently employs a government stockholding model through which stockholding obligations are met by the SPR, an industry stockholding model could be considered as an alternative to any government-owned and/or operated regional refined petroleum product reserve to address regional fuel supply disruptions. This would, however, place stockholding mandates and additional costs on the U.S. petroleum industry and require new legislation and regulations in order to implement mandated private industry drawdowns. Furthermore, taxpayers could ultimately be charged for the premiums industry would need to pay for additional storage and increased product inventory requirements through price increases at the pump.

Industry stockholding requirements have been evaluated since the SPR was first legislated into existence in 1975. The original text of EPCA gave DOE (at the time the Federal Energy Administration, or FEA) discretionary authority to require importers to hold stocks equivalent to up to three percent of the previous year's imports and directed FEA to analyze the potential efficacy of an Industrial Petroleum Reserve (similar to today's industry stockholding model) in the initial SPR plan. This evaluation concluded that such a system would be difficult to administer in practice, that it would place an undue burden on the oil industry, and that it would ultimately serve as a less effective energy security tool. DOE re-evaluated the government-owned model again in the 1980s in response to the SPR's growing pains (which were chronicled in a 1977 GAO report), but determined that the administrative and financial challenges of

changing the oil stockholding model would be too difficult to overcome given that it would require new legislation.

Recommendation 4: The Secretary of Energy, in completing its ongoing study on the effects of congressionally-mandated sales, should consider a full range of options for handling potentially excess assets, and if needed, request congressional authority for the disposition of these assets.

DOEs Response:

DOE **concurs** with this recommendation. DOE's Office of Petroleum Reserves commenced a SPR Post-Sale Configuration Study in March 2018 to evaluate options for the long-term configuration of the SPR as a result of recently enacted congressionally-mandated SPR crude oil sales legislation. This study will include an assessment of disposition options for any potential excess or underutilized SPR assets, to include the need for new legislative authority, as necessary, for the disposition of these assets. DOE expects this study to be completed in October 2018.

Appendix II: GAO Contact and Staff Acknowledgments

GAO Contact

Frank Rusco, (202) 512-3841 or ruscof@gao.gov

Staff Acknowledgments

In addition to the individual named above, Quindi Franco (Assistant Director), Nkenge Gibson (Analyst-in-Charge), Philip Farah, Ellen Fried, Cindy Gilbert, Greg Marchand, Celia Mendive, Patricia Moye, Camille Pease, Oliver Richard, Dan Royer, Rachel Stoiko, and Marie Suding made key contributions to this report.

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