



U.S. DEPARTMENT OF
ENERGY

Strategic Petroleum Reserve Annual Report for Calendar Year 2017

Report to Congress
December 2018

United States Department of Energy
Washington, D.C. 20585

Message from the Secretary

The Secretary of Energy is required¹ to report annually to the President and Congress on the activities of the Strategic Petroleum Reserve. Highlights of the Department's accomplishments are included in the Executive Summary of this report, the *Strategic Petroleum Reserve Annual Report for Calendar Year 2017*.

This report also includes details concerning the physical capacity, type, and quantity of petroleum in the Strategic Petroleum Reserve in 2017, as well as plans for upgrades and major maintenance. The Energy Policy and Conservation Act requires the Secretary to report information on the current withdrawal and distribution rates and capabilities of the Strategic Petroleum Reserve; the history and costs of petroleum acquisitions for the Strategic Petroleum Reserve; and the costs associated with operations, maintenance, management, and planned projects for the Strategic Petroleum Reserve.

This report is being provided to the President and the following members of Congress:

- **The Honorable Michael R. Pence**
President of the Senate
- **The Honorable Paul Ryan**
Speaker of the House of Representatives
- **The Honorable Richard C. Shelby**
Chairman, Senate Committee on Appropriations
- **The Honorable Patrick Leahy**
Vice Chairman, Senate Committee on Appropriations
- **The Honorable Michael B. Enzi**
Chairman, Senate Committee on Budget
- **The Honorable Bernard Sanders**
Ranking Member, Senate Committee on Budget
- **The Honorable Lamar Alexander**
Chairman, Subcommittee on Energy and Water Development
Senate Committee on Appropriations

¹ Section 165 of the Energy Policy and Conservation Act (42 U.S.C. 6245), as amended

- **The Honorable Dianne Feinstein**
Ranking Member, Subcommittee on Energy and Water Development
Senate Committee on Appropriations
- **The Honorable Lisa Murkowski**
Chairwoman, Senate Committee on Energy and Natural Resources
- **The Honorable Maria Cantwell**
Ranking Member, Senate Committee on Energy and Natural Resources
- **The Honorable Rodney P. Frelinghuysen**
Chairman, House Committee on Appropriations
- **The Honorable Nita M. Lowey**
Ranking Member, House Committee on Appropriations
- **The Honorable Mike Simpson**
Chairman, Subcommittee on Energy and Water Development
House Committee on Appropriations
- **The Honorable Marcy Kaptur**
Ranking Member, Subcommittee on Energy and Water Development
House Committee on Appropriations
- **The Honorable Steve Womack**
Chairman, House Committee on the Budget
- **The Honorable John Yarmuth**
Ranking Member, House Committee on the Budget
- **The Honorable Greg Walden**
Chairman, House Committee on Energy and Commerce
- **The Honorable Frank Pallone, Jr.**
Ranking Member, House Committee on Energy and Commerce
- **The Honorable Fred Upton**
Chairman, Subcommittee on Energy
House Committee on Energy and Commerce
- **The Honorable Bobby L. Rush**
Ranking Member, Subcommittee on Energy
House Committee on Energy and Commerce

If you have any questions or need additional information, please contact, Mr. Dwayne Bolton, Principal Deputy Assistant Secretary or Mr. Shawn Affolter, Deputy Assistant Secretary for Senate Affairs, Office of Congressional and Intergovernmental Affairs, at (202) 586-5450; or Ms. Bridgette Forcier, Director, Office of Budget, (202) 586-0176.

Sincerely,

A handwritten signature in black ink that reads "Rick Perry". The signature is written in a cursive, slightly stylized font.

Rick Perry

Executive Summary

Program Highlights and Status

The Strategic Petroleum Reserve (SPR) provides the United States with energy and economic security through its emergency stockpile of crude oil and refined petroleum products. Crude oil stocks are located at four storage-site facilities: Bryan Mound and Big Hill in Texas, and Bayou Choctaw and West Hackberry in Louisiana.

The SPR entered calendar year (CY) 2017 with 695.1 million barrels (MMbbl) of crude oil, and at the end of CY 2017 (as of December 31, 2017), the SPR held 662.8 MMbbl, an amount equivalent to approximately 178 days of net U.S. petroleum imports. The SPR's crude oil inventory decreased by 32.3 MMbbl from the previous year, and the net decrease resulted primarily from Congressionally-mandated sales and emergency exchange deliveries that were not returned to the SPR storages until January and February of 2018. Additionally, the inventory was also decreased due to the degasification losses of crude oil, as a result of the removal of high vapor pressure gasses from the crude oil, which processed 42.6 MMbbl of crude oil in CY 2017. The degasification started in August 2014, at the West Hackberry storage site and will continue until October 2018. Degasification was completed on 15 of 22 caverns at the West Hackberry storage site by the end of CY 2017.

In 2017, the SPR successfully carried out three congressionally mandated crude oil sales. In February 2017, the SPR began crude oil sales in accordance with Section 404 of the Bipartisan Budget Act of 2015 (Public Law 114-74). Section 404 authorizes the Secretary of Energy to draw down and sell SPR crude oil to generate revenue to fund an SPR modernization program. Over the course of four years, commencing in fiscal year (FY) 2017 and continuing through FY 2020, the Secretary of Energy can generate up to \$2 billion in revenue needed for the SPR modernization program, based on authorized annual appropriations. Subsequently, Section 101 of the Further Continuing and Security Assistance Appropriations Act, 2017 (Public Law 114-254) provided the appropriation authorization for the Secretary to draw down and sell an amount of crude oil not to exceed \$375.4 million from the SPR in FY 2017 as provided for in Section 404 of the Bipartisan Budget Act of 2015. The FY 2017 SPR Modernization Program Crude Oil Sales concluded in April 2017 with 6,282,694 bbl delivered over 37 deliveries. The SPR deposited \$323,195,827 of revenue into the Energy Security and Infrastructure Modernization Fund.

In May 2017, the SPR began crude oil sales in accordance with Section 5010 of the 21st Century Cures Act of 2015 (Public Law 114-255) which directs the Secretary of Energy to draw down and sell a total of 25 MMbbl of crude oil from the SPR over three consecutive years commencing in FY 2017. The FY 2017 Cures Act Sale concluded in July 2017 with 9,893,710 bbl delivered, over 49 deliveries. The SPR deposited \$449,185,955 of revenue into the general fund of the Treasury.

In October 2017, the SPR began crude oil sales in accordance with Section 403 of the Bipartisan Budget Act of 2015 (Public Law 114-74) and Section 5010 of the 21st Century Cures Act of 2015 (Public Law 114-255) to meet requirements for FY 2018. The combined FY 2018 sales concluded in November 2017 with 13,717,304 bbl delivered over 53 deliveries. The SPR deposited \$790,823,567 of revenue into the general fund of the Treasury.

The SPR successfully executed six emergency exchange agreements, in response to impacts from Hurricane Harvey and subsequent oil shortages, with deliveries from August 30, 2017, through September 28, 2017, to four companies—Marathon, Phillips 66, Placid, and Valero—for a total of approximately 5.0 MMbbl. Of the total exchange barrels 2,684,826 barrels of crude oil, including premium barrels were paid back in CY2017. The remaining 2,550,183 barrels were returned in CY2018.

Through the Consolidated Appropriations Act, 2017 (Public Law 115-31) the budget authority for the SPR was \$223 million. Over the history of the SPR, a total amount of \$24.6 billion, net of sales and transfers, was appropriated for the SPR, through FY 2017. Obligations for the SPR in FY 2017 totaled approximately \$220.8 million. From this amount, \$22.2 million was obligated for Federal program management. The remaining \$198.6 million was obligated for contractual goods and services to operate and maintain the SPR and to conduct an emergency drawdown and sale, if required.

Changes to Performance Capabilities

Vapor Pressure Mitigation Program

The Vapor Pressure Mitigation Program continued in CY 2017. The use of deep underground solution-mined salt caverns for long-term storage of crude oil subjects the oil to geothermal heating and gas intrusion from the surrounding salt. That exposure tends to increase the crude oil vapor pressure. During a drawdown, oil that is delivered to storage tanks at terminals may contain toxic and flammable gases at levels that can present environmental and health risks to terminal personnel and the public. The SPR mitigates these risks by using a customized, portable degasification unit that reduces the crude oil vapor pressure in the caverns for safe crude oil delivery. The unit moves among the SPR sites every 2–5 years, as necessary, to degas caverns that show high levels of vapor pressure.

The degassing unit, which began in August 2014, continued its 5-year program at the West Hackberry, Louisiana site. The total volume processed was 147.3 MMbbl as of December 31, 2017. Processing of oil through the degas unit at West Hackberry should conclude at the beginning of FY 2019.

Environment, Safety, and Health

The SPR had another successful year with regard to safety—continuing to improve safety and health systems throughout the complex during CY 2017. The SPR succeeded in maintaining the lowest SPR accident rate on record with a Total Recordable Case Rate of 0.45 and a Days Away/Restricted/Transferred rate of 0.23 for CY 2017. Additionally, the SPR storage sites received several awards for management quality, environmental stewardship, and safety management systems.

In 2017, the SPR received four awards from the Occupational Safety and Health Administration's (OSHA) Voluntary Protection Program (VPP) Region VI. The Big Hill, Bryan Mound, and West Hackberry sites each received a Star of Excellence award, and the Bayou Choctaw site was recognized as a "Star Among Stars." A Star of Excellence award requires the site to have an incident rate at least 90 percent below the national average, and the "Star Among Stars" distinction recognizes Region VI sites that have incident rates at least 50 percent below the national average. Fluor Federal Petroleum Operations (FFPO), the management and operations (M&O) contractor, also received Fluor Government Group's 2017 Health, Safety, and Environment Excellence Award. Additionally, a third-party auditor found the SPR's Environmental Management System to be in compliance with the 2004 version of the International Organization for Standardization's (ISO's) 14001 standards.



STRATEGIC PETROLEUM RESERVE ANNUAL REPORT FOR CALENDAR YEAR 2017

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I. Legislative Language

The SPR was authorized by the Energy Policy and Conservation Act (EPCA), (42 U.S.C. 6201 *et seq.*), enacted on December 22, 1975 (Public Law 94-163). Since then, the SPR has operated in order to reduce the impact of disruptions in oil supplies and to carry out obligations under the International Energy Program.

Section 165 of EPCA, as amended, requires the Secretary of Energy to submit an annual report to the President and Congress on the activities of the SPR. Consistent with this statutory provision, this *Strategic Petroleum Reserve Annual Report for Calendar Year 2017* includes information on:

- The status of the physical capacity of the SPR and the type and quantity of petroleum products stored in the SPR
- An estimate of the schedule and cost to complete planned equipment upgrades or capital investments in the SPR, including upgrades and investments carried out as part of operational maintenance or life extension activities
- Identification of any life-limiting conditions or operational problems at any SPR facility, and proposed remedial actions including an estimate of the schedule and cost of implementing those remedial actions
- A description of current withdrawal and distribution rates and capabilities, and an identification of any operational or other limitations on those rates and capabilities
- A listing of petroleum product acquisitions made in the preceding year and planned in the following year, including quantity, price, and type of petroleum
- A summary of the actions taken to develop, operate, and maintain the SPR
- A summary of the financial status and financial transactions of the SPR and the SPR Petroleum Accounts for the year
- A summary of expenses for the year, and the number of federal and contractor employees
- The status of contracts for development, operation, maintenance, distribution, and other activities of the SPR
- A summary of foreign oil storage agreements and their implementation status
- Any recommendations for supplemental legislation or policy or operational changes the Secretary considers necessary to implement EPCA as it pertains to the SPR.

II. Program Mission

Introduction

The SPR operates pursuant to the authority of EPCA (42 U.S.C. 6201 et seq.), as amended. Congress enacted EPCA in recognition of the vulnerability of the United States to disruptions in the world oil market. One of the purposes of EPCA was to create an SPR capable of reducing the impact of severe energy supply interruptions.

At the end of CY 2017 (as of December 31, 2017), the SPR contained 662.8 MMbbl of crude oil. That inventory provides the equivalent of approximately 178 days of net petroleum imports, based on 2017 average net U.S. imports of 3.7 million barrels per day (MMbbl/D). The United States relies on the SPR to fulfill its obligations under the International Energy Program.

Legislative Activity

The following laws enacted by the end of CY 2017 directly impact the SPR program over the next decade and beyond:

Section 403 of the Bipartisan Budget Act of 2015, enacted on November 2, 2015, requires the Secretary of Energy (hereinafter “the Secretary”) to draw down and sell a total of 58 MMbbl of crude oil from the SPR over eight consecutive years, commencing in FY 2018 and continuing through FY 2025.

Section 404 of the Bipartisan Budget Act of 2015 (Public Law 114-74), authorized the Secretary to sell crude in an amount up to \$2 billion for the period encompassing FYs 2017–2020. The sales were for the purposes of carrying out an SPR modernization program, to the extent provided in advance in Appropriations Acts. In FY 2017, Section 101 of the Further Continuing and Security Assistance Appropriations Act, 2017 (Public Law 114-254) requires the Secretary to draw down and sell amounts not exceeding \$375.4 million of crude oil from the SPR.

Section 32204 of the Fixing America’s Surface Transportation Act (the FAST Act) (Public Law 114-94), enacted on December 4, 2015, requires the Secretary to draw down and sell a total of 66 MMbbl of crude oil from the SPR over three consecutive years, commencing in FY 2023 and continuing through FY 2025.

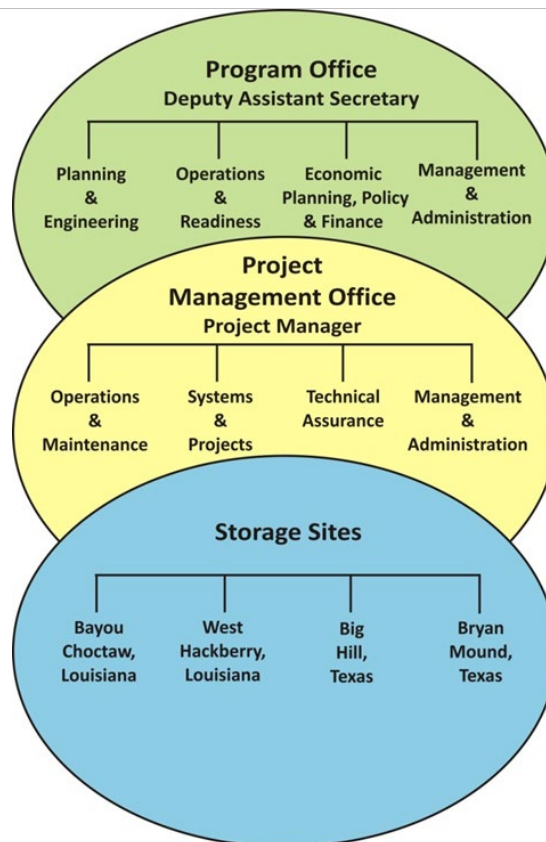
Section 5010 of the 21st Century Cures Act of 2015 (Public Law 114-255), requires the Secretary of Energy to draw down and sell a total of 25 MMbbl of crude oil from the SPR over three consecutive years commencing in FY 2017 through 2019. The first portion of these sales was executed in spring 2017.

III. Program Management

Organization

The Assistant Secretary for Fossil Energy at the Department of Energy (DOE) in Washington, D.C., has overall program responsibility for carrying out the mission of the SPR, and for monitoring the SPR's operational readiness capability. This responsibility is delegated to the Deputy Assistant Secretary for Petroleum Reserves, and is exercised through the Program Office in Washington, D.C., and the SPR Project Management Office (PMO) in New Orleans, Louisiana. As of December 31, 2017, the Program Office staffing was 25 Federal employees and 10 contractor employees, while SPR PMO staffing was 84 Federal employees and 550 contractor employees. Figure 1 depicts the SPR's organizational structure.

Figure 1
Strategic Petroleum Reserve Organizational Structure



Contractual Support

The PMO is responsible for the design, development, operation, and maintenance of the SPR. FFPO serves as the M&O contractor, providing management and personnel to operate and maintain the SPR facilities and related systems. The period of performance for this contract is five years. It began on April 1, 2014, with one 5-year option.

Vali Cooper International, a Service-Disabled Veteran-Owned Small Business architectural and engineering (A&E) firm, is under contract to provide design services for the four storage facilities. The period of performance is three years, which commenced August 15, 2014.

DOE's Sandia National Laboratory provided geotechnical support that included analysis of the salt domes, cavern integrity, vapor pressure, crude oil quality, and new cavern development.

Several support services contracts exist for management, technical, and computer support. The largest support service contractor was Performance Excellence Partners, a certified 8(a) Small Disadvantaged Business that provided management and technical support through October 31, 2016. On November 1, 2016, the SPR entered into a new contract with Infinity Technology. This contract has a 2-year base period with three 1-year option periods.

Other support contractors that provided support to the Program Office in Washington, DC, in 2017, included Core Laboratories, L.P., AOC Petroleum Support Services, LLC, and Cyborg, Inc.

The SPR purchased power for the four storage sites from Engie Resources and Entergy Louisiana, LLC.

During CY 2017, the SPR held contracts with two commercial facilities that provided terminal services for fill, drawdown, and storage of crude oil. SPR's contract with Sunoco Partners Marketing & Terminals, L.P. is in its final 5-year option period that runs through May 2018. SPR's contract with Phillips 66, which originally ran through August 2017, was extended to November 2017 to allow for use during the congressionally mandated sale that delivered oil in October and November 2017. The SPR's M&O contractor also continued its agreement with Seaway Crude Pipeline Company for terminal services. The agreement with Seaway commenced on December 2, 2016, and will conclude on November 30, 2021.

IV. Crude Oil Storage Program

Strategic Petroleum Reserve Storage Facilities

The SPR currently operates and maintains four major oil storage facilities in the Gulf Coast region of the United States. All oil stored in the SPR's facilities is in large underground caverns that have been created in salt dome formations. Salt dome storage technology provides maximum security and safety for the Nation's stockpile of crude oil and is also the lowest-cost technology for large-scale petroleum storage projects. The average operations cost for the FY 2017 was \$0.248 per barrel for management, staffing, operations and maintenance, and security of the SPR. This cost is substantially less than industry storage costs and all foreign petroleum oil reserves.

The SPR has two sites in Texas (Bryan Mound and Big Hill), and two sites in Louisiana (West Hackberry and Bayou Choctaw). The four SPR sites have a combined storage capacity of 714 MMbbl and a maximum sustained drawdown capability of 4.415 MMbbl/D.² Shown in Table 1 is the authorized storage capacity and sustained drawdown capability of each SPR site as of December 31, 2017.

The SPR's oil storage facilities are grouped into three geographical pipeline distribution systems in the Gulf Coast: Seaway, Texoma, and Capline. Each of these pipelines systems has access to one or more major refining centers, interstate crude oil pipelines, and marine terminals for crude oil distribution. The locations of the SPR storage sites and their respective distribution systems are shown in Figure 2.

**Table 1: Authorized Storage Capacity and Sustained Drawdown Capability
(As of December 31, 2017)**

CURRENT SITE CAPABILITY			
Storage Facility	Authorized Storage Capacity (MMbbl)	Crude Mix Sweet/Sour (MMbbl)	Sustained Drawdown Capability (MMbbl/D)
Bryan Mound	247.0	71/176	1.5*
West Hackberry	221.0	108/113	1.3
Big Hill	170.0	72/98	1.1
Bayou Choctaw	76.0	24/52	.515
Total Program	714.0	275/439 (39%/61%)	4.415²

Sweet = Sulfur content not exceeding 0.5 percent

MMbbl = Million Barrels

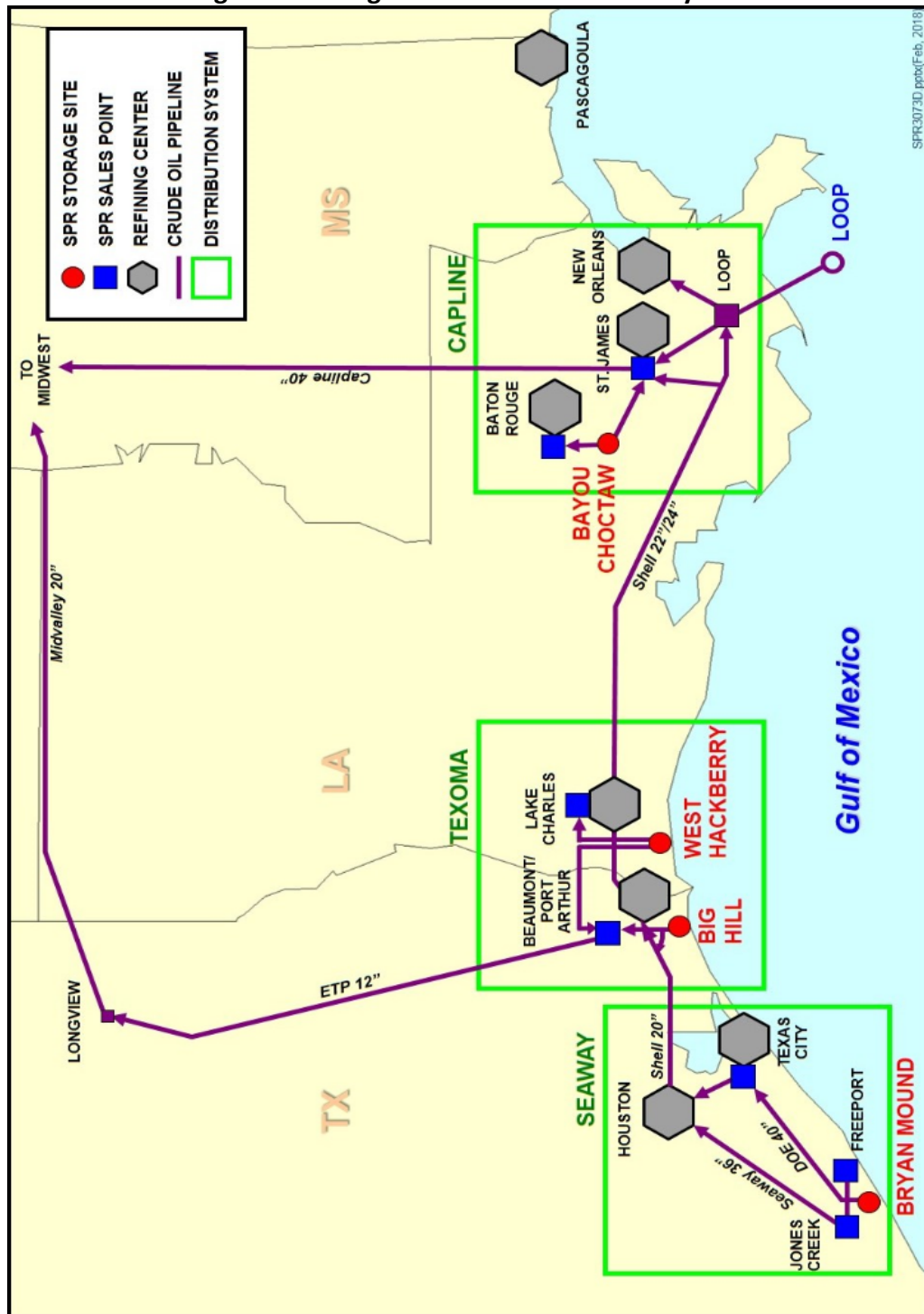
Sour = Sulfur content greater than 0.5 percent

Mbbl/D = Thousand Barrels Per Day

* Current Bryan Mound maximum sustained drawdown capability is reduced to 1.350 MMbbl/D due to needed repair to above ground storage tank.

² Current SPR maximum drawdown capability is reduced to 4.25 MMbbl/D due to a damaged floating pan in Tank 2 at Bryan Mound.

Figure 2: Storage Sites and Distribution System



Cavern Maintenance

During 2017, a total of 11 well workovers were performed at the four SPR sites. These workovers included nine diagnostic workovers, and two remediation workovers to install a cemented protective steel liner inside the existing wellbore. Two workover rigs were used to perform this work, including one leased rig and one DOE-owned rig. A dedicated safety professional was assigned to each rig.

Bryan Mound Site Status

The Bryan Mound storage site is in Brazoria County, Texas, approximately 3 miles southwest of Freeport, Texas. As of December 31, 2017, the site had 19 operational storage caverns with a total authorized storage capacity of 247.0 MMbbl, and a cavern inventory of 234.8 MMbbl. During 2017, the site drawdown rate was reduced by 150,000 bbl per day pending conversion of a crude oil storage tank used for drawdown, from an internal floating roof to an external floating roof tank. A second crude oil storage tank, which also requires conversion to an external floating roof tank, was out of service for 2017. It will undergo the conversion during the upcoming SPR Modernization Program - Life Extension 2 Project.

Big Hill Site Status

The Big Hill storage site is located in Jefferson County, Texas, approximately 26 miles southwest of Beaumont, Texas. As of December 31, 2017, the site had 14 operational storage caverns, with a combined authorized storage capacity of 170.0 MMbbl, and a cavern inventory of 155.4 MMbbl.

West Hackberry Site Status

The West Hackberry storage site is located in Cameron Parish, Louisiana, approximately 25 miles southwest of Lake Charles, Louisiana. As of December 31, 2017, the site had 21 operational storage caverns with a combined authorized storage capacity of 221.0 MMbbl, and a cavern inventory of 200.6 MMbbl.

Bayou Choctaw Site Status

The Bayou Choctaw storage site is located in Iberville Parish, Louisiana, approximately 12 miles northwest of Baton Rouge, Louisiana. As of December 31, 2017, the site had six storage caverns, an authorized storage capacity of 76.0 MMbbl, and a cavern inventory of 70.8 MMbbl.

The SPR annually performs several major maintenance projects each year to maintain the site's operational capabilities.

St. James Marine Terminal Status

The SPR owns a marine terminal on the Mississippi River in St. James, Louisiana. The facility was constructed in the late 1970s and began operations in early 1980. The facility was designed to support fill and drawdown of the Weeks Island and Bayou Choctaw SPR sites. The St. James marine terminal has six aboveground storage tanks with a total storage capacity of approximately 2 MMbbl. The SPR has a lease agreement for the St. James marine terminal with Shell Oil Products U.S., which will expire on December 31, 2019. Under the lease agreement, Shell provides all normal operations and maintenance of the terminal and is required to support the SPR as a sales and distribution point in the event of an SPR drawdown.

The St. James marine terminal, in addition to its ability to support marine transfer operations, has pipeline connections that allow crude oil to be distributed to local area markets for further distribution. Direct connections to the Louisiana Capline and Plains facilities enhance the SPR's emergency distribution capabilities by enabling unencumbered crude oil distribution.

V. West Hackberry Cavern 6 Transfer Project

In 2012, West Hackberry oil storage Cavern 6 was identified with a well stability issue that could potentially result in future oil accessibility issues. Consequently, the SPR developed and instituted a plan to remove oil from the cavern. As of December 31, 2017, all of the readily accessible oil had been transferred out of West Hackberry Cavern 6 and into other available caverns on site. Operations will continue to transfer low volumes of residual crude migrating to the wellhead. Once this phase is complete, long-term decommissioning activities will commence.

VI. Bryan Mound Cavern 2 Transfer Project

In 2014, access to the sweet crude oil inventory in Bryan Mound Cavern 2 was considered at risk. Cavern 2 is a two-well configuration cavern. Both Well 2 and 2A failed a Mechanical Integrity Test in 2013.

Because of this well history and the associated risk, the decision was made to empty Cavern 2 of crude oil. After the cavern is empty, geotechnical analysis and well stabilization will occur. Crude oil removal out of Cavern 2 began March 1, 2015, as a single closed-loop, cavern-to-cavern movement. Oil was transferred from Cavern 2 to additional receiving caverns within the site. Regulatory requirements will continue to be met during this inventory withdrawal period.

As of December 31, 2017, all pumpable inventory had been removed from the cavern. Operations will continue to transfer low volumes of any residual crude migrating to the wellhead. Once this phase is complete, longer-term decommissioning activities will commence.

VII. SPR Modernization Program – Life Extension 2 Project

In 2015, the SPR commenced a program that will replace or upgrade site equipment and facilities that are approaching or have exceeded their 25-year life span with the signing of Critical Decision-0 Mission Need, in accordance with DOE Order 413.3C, Acquisition of Capital Assets. Critical Decision 1 Analysis of Alternatives was approved in December 2016, with a cost range of \$750 million to \$1.4 billion. In 2017, Life Extension Phase 2 (LE2) efforts continued with the award of the A&E contract by the M&O contractor. The LE2 Project will upgrade the four SPR storage sites.

In 2017, the SPR's major accomplishments included: Procuring an A&E contractor who will be responsible for designing LE2; performing a supplemental Analysis of Alternatives; commencing long lead procurement for three sites; completing the plan and schedule for implementation of

Earned Value Management System; completing project management, planning, and control documentation; initiating environmental assessments required under the National Environmental Policy Act; and completing the FY 2017 SPR Modernization crude oil sale, with \$323.2 million sales revenue deposited to the Energy Security and Infrastructure Modernization Fund.

VIII. Petroleum Acquisition and Exchange

Oil Acquisition Market Assessments

The *Procedures for the Acquisition of Petroleum for the SPR* (10 CFR Part 626) establish the rules and processes for acquiring SPR crude oil. These procedures require that a comprehensive market assessment be performed prior to initiation or continuation of any oil fill activities to ensure that SPR acquisition activities will not unduly affect the current market conditions.

Crude Oil Exchanges

Hurricane Harvey's effects on the Gulf of Mexico resulted in a 20 percent reduction in offshore oil production. Onshore crude oil production was also impacted for areas of Louisiana and Texas affected by coastal flooding and hurricane conditions. Additionally, the major commercial crude oil pipelines bringing oil into the Gulf Coast were offline because the major crude oil import ports were closed to vessel traffic. Ten major refineries in the region were completely offline, and other refiners in the Gulf Coast had significantly reduced capacity. In fact, estimates suggest more than 2 MMbbl/D of capacity were offline at one point. Total reduction in fuel refining capacity was also estimated at approximately 20 percent of U.S. capacity.

Sections 159 and 160 of EPCA authorized the Secretary of Energy to exchange SPR petroleum products and to acquire petroleum products by exchange for storage in the SPR. The Secretary of Energy has previously exercised this legal authority to conduct emergency exchanges in response to natural disasters, including Hurricane Isaac in 2012 (1 MMbbl), Hurricanes Gustav and Ike in 2008 (5.4 MMbbl), Hurricane Katrina in 2005 (9.8 MMbbl), and Hurricane Ivan in 2004 (5.4 MMbbl). In response to national impacts from Hurricane Harvey, the Secretary of Energy authorized the SPR to negotiate and execute an emergency oil exchange with four companies that had significant market supply shortages—Marathon, Phillips 66, Placid, and Valero. The SPR negotiated multiple exchange agreements with each of the companies totaling approximately 5.0 MMbbl of oil to be delivered from the SPR. The SPR provided crude oil in more than 30 deliveries made to various delivery points. Both the Bayou Choctaw and West Hackberry sites participated in this activity, which began on August 30, 2017, and ended on September 28, 2017.

Historically, DOE elected to build SPR storage locations along the Gulf Coast because these locations provide great flexibility in connecting the SPR to the Nation's commercial oil transport network. This flexibility means that oil from the SPR can be distributed through interstate pipelines to over half of the Nation's oil refineries or loaded into ships or barges for transport to other area refineries.

The SPR's chosen site locations also provide multiple connection capabilities. The Big Hill and West Hackberry sites are both able to deliver oil to the Texoma pipeline market/ and some unique connection points such as the Bayou Choctaw site being the only SPR facility that can distribute oil to the Capline pipeline system. This strategic configuration allows movement of crude oil to meet specific market demands throughout the United States. This particular emergency crude oil exchange validated the importance of having four geographically diverse site locations.

Crude Oil Inventory Status

As of December 31, 2017, the SPR's crude oil inventory was 662.8 MMbbl, a decrease of 32.3 MMbbl from the previous year. The net decrease resulted primarily from Congressionally-mandated sales and emergency exchange deliveries that were not returned to the SPR storages until January and February 2018, as well as the degassing of crude oil in CY 2017, resulting in the removal of impurities from the degassed crude oil.

Fill of Reserve

Detailed information about the SPR's fill program since 1977 can be found in the following:

- Table 2 lists year-end inventories and average daily fill rates for the years 1977–2017 (by FY and CY).
- Table 3 lists crude oil receipts by country of origin since 1977.
- Table 4 identifies the location of the inventory by storage site, and Figure 3 illustrates the cumulative oil fill by year.

Table 2: Year-End Inventories and Oil Fill History

	FISCAL YEAR		CALENDAR YEAR	
	Year-End Inventory (MMbbl)	Average Daily Fill Rate ¹ (Mbb/D)	Year-End Inventory (MMbbl)	Average Daily Fill Rate ¹ (Mbb/D)
1977	1.1	3	7.2	20
1978	49.1	131	68.5	168
1979	91.2	115	91.7	64
1980	92.8	4	107.8	44
1981	199.2	292	230.3	336
1982	277.9	215	293.8	174
1983	361.0	228	379.1	234
1984	431.1	191	450.5	195
1985	489.3	159	493.3	119
1986	506.4	47	511.6	51
1987	533.9	75	540.6	80
1988	554.7	57	559.5	52
1989	577.1	62	579.9	56
1990	589.6	34	585.7	27
1991	568.5	(58)	568.5	(47)
1992	571.4	8	574.7	17
1993	585.7	39	587.1	34
1994	591.7	16	591.7	13
1995	591.7	*2	591.6	*2
1996	573.6	(49)	565.8	(70)
1997	563.4	(28)	563.4	(7)
1998	563.4	*2	561.1	(6) ³
1999	564.9	4	567.0	16
2000	570.3	15	540.7	(72) ⁴
2001	544.8	(70) ⁴	550.2	26
2002	587.2	116	599.1	134
2003	624.4	102	638.4	108
2004	670.3	126 ⁵	675.6	102 ⁵
2005	693.7	64 ⁶	684.5	25 ⁶
2006	687.8	(16) ⁷	688.6	11 ⁷
2007	692.8	14	696.9	23
2008	702.4	26 ⁸	701.8	13 ⁸
2009	725.1	62.2	726.6	67.9
2010	726.5	3.8	726.5	(0.2) ⁹
2011	695.9	(84) ¹⁰	695.9	(84) ¹⁰
2012	694.9	(3) ¹¹	695.3	(2) ¹¹
2013	696.0	3	696.0	2
2014	691.0	(13.6) ¹²	691.0	(13.6) ¹²
2015	695.1	11.2	695.1	11.2
2016	695.1	0	695.1	0
2017	673.8	(58.4) ¹³	662.8	(88.5) ¹⁴

MMbbl = Million Barrels

Mbb/D = Thousand Barrels per Day

() = Denotes a Reduction

1. Fill rates adjusted for oil sales

2. Fill suspended during this period

3. Decrease due to Maya exchange

4. Net decrease due to Exchange 2000

5. Net Hurricane Ivan deliveries and receipts

6. Net Hurricane Ivan receipts & Katrina deliveries and receipts

13. FY17 21st Century Cures, FY17 SPR Modernization, Hurricane Harvey Exchange

14. FY18 Mandatory Sale, Harvey Exchange

7. Net Hurricane Katrina exchange and drawdown sales

8. Net Hurricanes Gustav & Ike deliveries

9. West Hackberry/Bayou Choctaw Exchange oil costs and degas loss

10. Drawdown 2011

11. Hurricane Isaac Exchange

12. Test Sale 2014

Table 3: Crude Oil Receipts (As of December 31, 2017)

Source Country	Cumulative (MMbbl)	Percent of Total (%)
Mexico	266.3	30.9
United Kingdom	193.9	22.5
United States*	113.4	13.2
Saudi Arabia	28.3	3.3
Libya	27.5	3.2
Venezuela	25.3	2.9
Angola	25.1	2.9
Russia	25.1	2.9
Iran****	20.0	2.3
United Arab Emirates	19.3	2.2
Nigeria	16.3	1.9
Algeria	15.7	1.8
Cameroon	15.1	1.8
Equatorial Guinea	15.1	1.8
Norway	14.0	1.6
Oman	12.9	1.5
Egypt	8.9	1.0
Ecuador	6.2	0.7
Iraq	3.4	0.4
Gabon	2.4	0.3
Qatar	2.3	0.3
Azerbaijan	2.1	0.2
Columbia	1.2	0.1
Argentina	0.4	0.0
Ivory Coast	0.4	0.0
Peru	0.4	0.0
Total**	861.0***	100.0

MMbbl = Million Barrels

* Included receipts from offshore Gulf of Mexico.

** Totals do not add due to rounding.

*** Cumulative total receipts unadjusted for sales and operational gains and losses.

**** Prior to 1995

Table 4: Crude Oil Inventory (As of December 31, 2017)

Storage Site	Inventory (MMbbl)		
	Sweet*	Sour**	Total***
Bryan Mound, Brazoria County, Texas	67.3	167.5	234.8
Big Hill, Jefferson County, Texas	65.8	89.6	155.4
West Hackberry, Cameron Parish, Louisiana	104.5	96.1	200.6
Bayou Choctaw, Iberville Parish, Louisiana	18.9	51.8	70.8
Subtotal Underground Inventory	256.5	405.1	661.6
Tanks and Pipelines	1.0	0.3	1.2
Total Inventory	257.4	405.4	662.8
Total Accounts Receivable	2.6	0.0	2.6
Total SPR Book Inventory	260.0	405.4	665.4

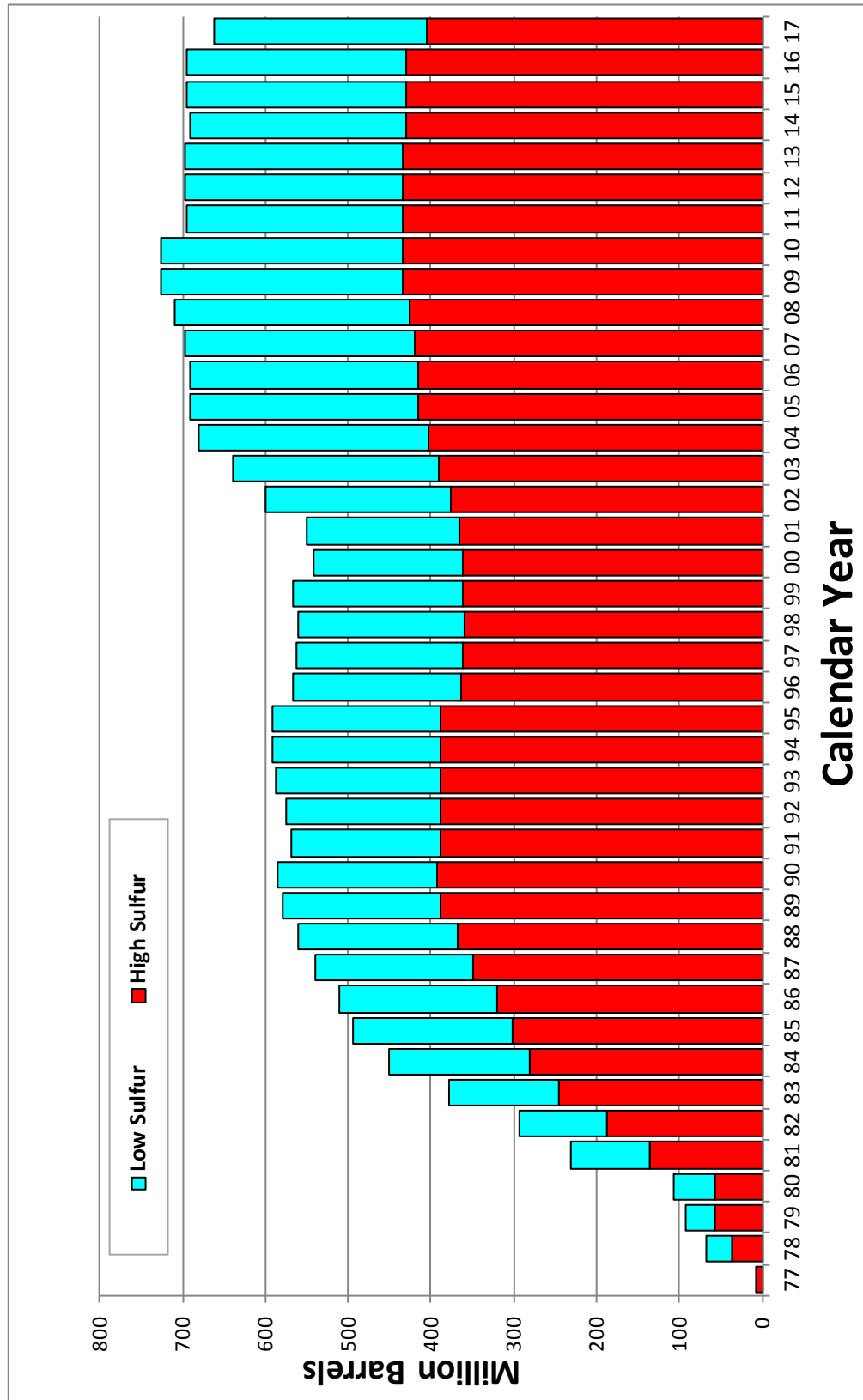
MMbbl = Million Barrels

* Sulfur content not exceeding 0.5 percent

** Sulfur content greater than 0.5 percent

*** Totals do not add due to rounding

Figure 3: Cumulative Oil Fill



IX. Emergency Response Capabilities

Sale of Oil

Section 161 of the EPCA gives authority to the President under specified conditions to direct the Secretary of Energy to conduct a public sale of oil from the SPR. Contracts are awarded to the highest qualified offerors.

Competitive Sales Procedures

DOE regulations in Title 10 of the Code of Federal Regulations Part 625 govern the process for price-competitive sales from the SPR, including the establishment of Standard Sales Provisions that contain provisions to be utilized in contracts for the sale of SPR crude oil. The first step in the process is to issue a Notice of Sale identifying the volume, characteristics, and location of the petroleum for sale. The Notice of Sale also provides delivery dates and the requirements to successfully submit offers. Measures required for assuring performance and financial responsibilities are also described in the Notice of Sale.

During a drawdown, multiple Notices of Sale may be issued using a web-based automated oil sales and evaluation system, which provides a triple-redundant backup system. Each Notice of Sale covers a sales period of one to two months. Offerors may have five days or less from the date a Notice of Sale is issued until offers are due. Delivery of oil could commence as soon as 13 days after the President calls for a drawdown of the SPR. Subsequent sale periods, if necessary, will correlate with standard industry delivery periods. Because of the possible short initial lead-time, DOE maintains a registry of prospective offerors who will receive electronic notification of all Notices of Sale.

The second step in the sales process is for prospective purchasers to submit offers, as specified in the Notice of Sale. Offerors must unconditionally accept all terms and conditions in the Notice of Sale and submit an offer guarantee of 5 percent of the maximum potential contract amount, or \$10 million—whichever is less. The offer evaluation process is structured so that the offerors bidding the highest prices will determine the transportation methods, up to the limits of the distribution system. Specific delivery arrangements are negotiated later in the process.

Within five business days of being notified, all "apparently successful offerors" are required to provide a Letter of Credit equal to 100 percent of the contract amount as a guarantee of performance and payment of amounts due under the contract. Upon timely receipt of the financial guarantees, and a final determination by the Contracting Officer that offers are responsive and selected offerors are financially responsible, the SPR will issue Notices of Award. Deliveries to the purchasers then begin, consistent with the purchasers' arrangements for commercial pipeline or marine vessel transportation.

Following delivery, the purchaser is invoiced for actual barrels received at a price that reflects the market indexed contract award price, plus any adjustments for quality differentials, delivery mode, or location changes. Payment is due in the month following the delivery.

Drawdown Capabilities³

The crude oil acquired for the SPR is commingled in caverns at the storage sites, creating various distinct crude oil streams available for release. Table 5 identifies these crude oil streams, delivery modes, and locations.

Based on its sustained drawdown rate, the SPR can draw down crude oil at an initial sustainable rate of 4.415 MMbbl/D ⁴ for a period of 90 days. After this period, the drawdown rate gradually decreases as site inventories are depleted and the declining number of caverns containing crude oil becomes a constraint.

Table 5: Crude Oil Streams (As of December 31, 2017)

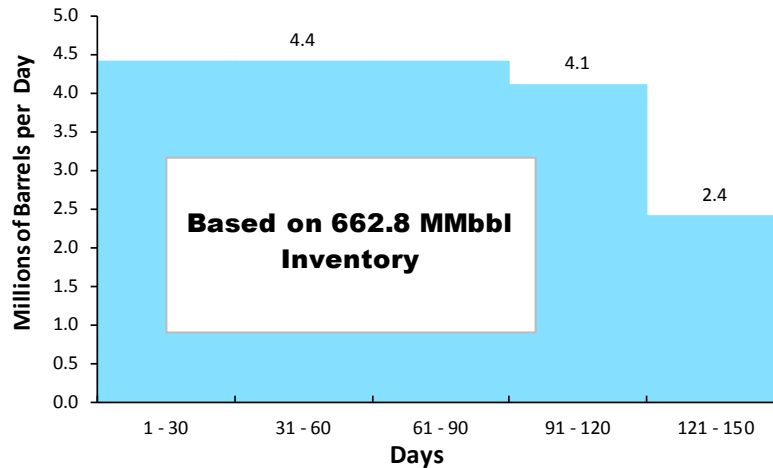
Crude Oil Stream	Gravity (°API)	Sulfur Content (Mass %)	Delivery Mode and Location
Seaway System			
Bryan Mound (Sweet)	36.4	0.38	Pipeline at Jones Creek Tank Farm, Jones Creek, Texas; Tankship at Seaway (Enterprise Products) Terminals, Freeport and Texas City, Texas; Genesis Terminal, Texas City, Texas
Bryan Mound (Sour)	33.3	1.401	
Texoma System			
West Hackberry (Sweet)	36.7	0.34	Pipeline, tankship, or barge at Sun Partners Marketing & Terminals LP, Nederland, Texas; Pipeline at Zydeco-22"/DOE connection, Lake Charles, Louisiana
West Hackberry (Sour)	33.0	1.52	
Big Hill (Sweet)	35.6	0.41	Pipeline, tankship, or barge at Sun Partners Marketing & Terminals LP, Nederland, Texas; Pipeline or tankship at Phillips 66 Terminal, Nederland, Texas; Pipeline at Zydeco-20"/DOE connection, Winnie, Texas
Big Hill (Sour)	30.8	1.43	
Capline System			
Bayou Choctaw (Sweet)	35.4	0.42	Pipeline at Capline, Plains Marketing, or Louisiana Capline Terminals, St. James, Louisiana; Tankship at Sugarland St. James Terminal, St. James, Louisiana; 24-inch site connection to Red Stick Pipeline, Iberville Parish, Louisiana
Bayou Choctaw (Sour)	31.9	1.46	

³ This refers to the ability to displace oil out of the SPR caverns without considering whether the downstream distribution of the oil to SPR customers would accommodate that much oil being pumped out of the SPR caverns.

⁴ Current sustained drawdown capability is reduced to 4.25 MMbbl/D due to unavailability of Bryan Mound Tank 2 pending repairs.

Figure 4 illustrates the SPR's sustained drawdown capabilities during 2017, with an inventory of 662.8 MMbbl.

**Figure 4: Sustained Drawdown Capability
(As of December 31, 2017)***



* Sustained drawdown capability is temporarily reduced to 4.25 MMbbl/D due to unavailability of a storage tank at Bryan Mound that is used during drawdown.

Drawdown Readiness Activities

The SPR performed the following drawdown readiness assurance activities during CY 2017:

- The Drawdown Readiness Review Program requires and monitors quarterly drawdown readiness. Four reviews were conducted in 2017, confirming that all sites and systems were prepared for an SPR crude oil drawdown or exchange.
- As a part of the Drawdown Readiness Review Program, Readiness and Capability (RECAP) and SPR Exchange Readiness and Capability (SPREX-RECAP) Reports are published quarterly, along with an update to Drawdown Configuration charts.
- The Systems Test Exercise program determines the drawdown readiness of an SPR site's equipment, procedures, systems, and personnel, and it collects data to further ensure readiness status. The Systems Test Exercise program involves a tabletop exercise at each site every year and a dynamic site test performed when directed. In 2017, tabletop exercises were conducted at the Big Hill and Bayou Choctaw sites. Dynamic oil movement exercises were performed at the Bryan Mound and West Hackberry sites. These exercises are further explained below in the following three bullets:

- An administrative Modified Recovery Program Tabletop Exercise was conducted at Big Hill on February 15, 2017. This exercise simulated a drawdown to demonstrate the SPR Recovery Program's ability to restore all drawdown critical systems to above 85 percent of the site's full drawdown capability within 15 calendar days. The simulated scenario started on February 5, 2017, and continued for 30 days at a rate of 850 Mbbl/D.
- DOE approved using a single oil sale movement as a dynamic exercise for the Bryan Mound and West Hackberry 2017 STE requirement. This provided a realistic exercise for the demonstration of capability to meet a 13-day notice for emergency drawdown. The oil sale that was used for the Bryan Mound exercise delivered 288 thousand barrels (Mbbl) of crude oil sold to BP and delivered to Freeport Dock II to load the American Phoenix vessel. The oil sale used for the West Hackberry exercise delivered 175 Mbbl of crude oil to the Lake Charles Meter Station for sale to British Petroleum.
- An administrative tabletop exercise was conducted at Bayou Choctaw on April 26, 2017. This exercise simulated a drawdown with the following two delivery groups: 1.5 MMbbl of sour crude oil delivered to Placid in 300 Mbbl batches at a rate of 192 Mbbl/d during 15 days, April 26–May 12; and 3 MMbbl of sour crude oil delivered to St. James marine terminal in 500 Mbbl batches at a rate of 480 Mbbl/d during 15 days, May 13–May 28.

Distribution Capabilities

The substantial increase in both Canadian and U.S. domestic production has had a significant impact on both the magnitude and spatial disposition of crude oil supply over the past decade. Though several other regions of the country have emerged as significant supply centers, the Gulf Coast remains a major refining and trans-shipment destination for crude oil. As a result, there have been significant changes in the use of oil distribution infrastructure. Through 2011, most major pipelines originated in the Gulf Coast region and provided crude oil to local refineries and Midwest refiners. Since then, several major pipelines have reversed direction and are now flowing crude to the U.S. Gulf Coast refining centers, thereby reducing imports.

Consequently, in 2012, the SPR lost connectivity to 10 refineries in the central part of the United States when the Seaway Pipeline's flow direction reversed. The Seaway Pipeline now flows from Cushing, Oklahoma, to Freeport, Texas. In December 2013, Shell reversed a section of one of its pipeline systems, now referred to as the Zydeco Pipeline, to flow eastbound from Houston, Texas, to the Louisiana Offshore Oil Port's terminal in Clovelly, Louisiana. As a result, the SPR's Big Hill site lost connectivity to Houston area refineries, reducing the number of potential buyers that can receive SPR oil by pipeline. However, the flow of oil eastward now allows the SPR to connect to refineries previously unable to receive pipeline deliveries from the

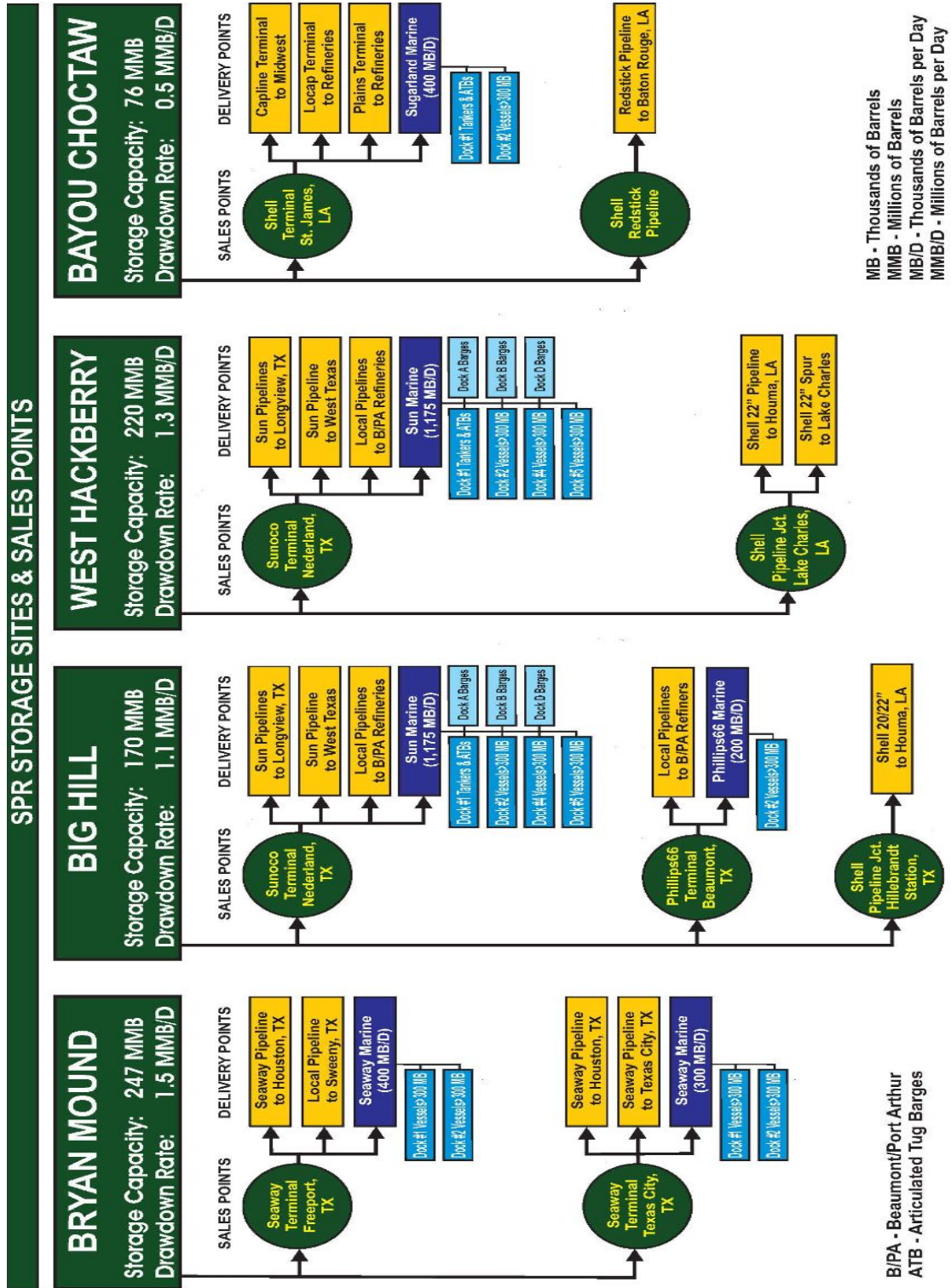
SPR. Refineries along the Mississippi River, such as Valero Meraux, Shell Norco, and P66 Alliance can now receive pipeline deliveries from the SPR.

As of the beginning of CY 2017, the SPR was connected by commercial pipeline systems to about 56 percent of the refining capacity in the United States. That connection covers 45 refineries, which processed approximately 58 percent of crude oil imports to the United States during 2016 (final 2017 data will not be available until the summer of 2018). Remarkably, SPR connections to refineries have not changed much despite the reversal of the pipelines. Prior to the pipeline reversals in 2012, the SPR had connection to 49 refineries, which processed 58 percent of the crude oil imports.

The SPR is also connected to four marine terminals that have a combined contracted marine distribution capacity of 2.075 MMbbl/D, and it owns one marine terminal (currently leased to Shell) with a distribution capacity of 0.400 MMbbl/D. These marine terminals are: Seaway Terminal (Enterprise Products), Freeport, Texas; Seaway Terminal (Enterprise Products), Texas City, Texas; Sunoco Logistics Terminal, Nederland, Texas; Phillips 66 Beaumont Terminal, Nederland, Texas; and Shell Sugarland, St. James Terminal, St. James, Louisiana, respectively. Figure 5 illustrates the SPR's pipeline and marine distribution capabilities.

The crude oil pipeline from Bryan Mound to Seaway Terminal (Jones Creek) is out of commission due to undermining that occurred at the Brazos River crossing during Hurricane Harvey in August–September 2017. Repairs to replace the river crossing is expected to be completed by FY 2020.

Figure 5: Pipeline and Marine Design Distribution Capabilities



Distribution Assessment

The SPR performs an annual assessment based on its established technical and performance criteria. The assessment evaluates the SPR's crude oil distribution system capabilities to: a) ensure that there are adequate connections to the commercial distribution systems and b) identify the need for any remedial plans. The 2017 distribution assessment evaluated the SPR's theoretical capability at its sustained drawdown rate, in order to replace oil imported in the base year (2017) and, for future years (2020, 2025, 2030, 2035, and 2040). This report does not intend to model distribution capability during an actual emergency oil disruption event.

Established Level I Technical and Performance Criteria for the SPR's distribution capabilities require that the physical distribution system infrastructure—both DOE-owned and commercial—are capable of meeting distribution rates exceeding 120 percent of the combined site drawdown rates to provide sufficient allowances for terminal operational delays and commercial demand variances.

The distribution assessment and the results summarized below are based on a study of the physical distribution capacity, which is the total capacity of all physical connections from SPR storage sites to commercial pipelines and marine terminals, including the DOE-owned St. James marine terminal. It assumes that during a commercial supply disruption, the SPR is capable of utilizing 100 percent of its contractual terminal services to move oil from the DOE pipeline to vessels loading at the St. James marine terminal's dock or to third-party pipelines or tankage via the contractor's existing connections. As stated previously, such an assumption is unlikely to reflect actual distribution capability during an emergency oil disruption event.

Base-Year Assessment

The base-year assessment indicates that only one of the three SPR crude oil distribution systems (the Capline System) was compliant with Level I Performance Criteria. The Level I Performance criteria for the Texoma System has remained below 120 percent for five years in a row, as a result of petroleum infrastructure additions, pipeline reversals, and the resulting marine terminal and pipeline congestions.

Table 6 provides the performance measures for the base and previous year.

Table 6: Base-Year Distribution Assessment

System	Sustained Drawdown Rate (Mbbl/D)	Physical Distribution Capability (Mbbl/D)	Performance Measure As of 12/31/2016	Performance Measure As of 12/31/2015
Seaway	1,500	1,547	103%	100%
Texoma	2,400	2,205	92%	95%
Capline	515	838	163%	161%
Total	4,415	4,590	104%	105%

Mbbl/d = Thousand Barrels per Day

Future Year Assessments

For future years 2020, 2025, 2030, 2035, and 2040, the SPR performed an assessment from the 2017 perspective using the U.S. petroleum refining supply and demand projections from the Energy Information Administration's *Annual Energy Outlook 2017*. The future-year assessment assumes the design drawdown rate does not change from base-year levels and assumes no infrastructure changes to the SPR. Based on the *Annual Energy Outlook 2017* projections for U.S. petroleum imports, the Distribution Assessment concluded that the distribution capability of the SPR falls below Level I Performance Criteria during the outer years with the current infrastructure in place, for the Seaway and Texoma systems. Table 7 provides the performance measures by the system for each forecast period.

Table 7: Base and Future Years Performance Measures

System	2020	2025	2030	2035	2040
Seaway	108%	100%	83%	95%	93%
Texoma	87%	89%	88%	89%	90%
Capline	147%	154%	167%	172%	176%
Total	101%	100%	96%	101%	101%

Physical Distribution Capability

The assessment discussed above focuses exclusively on the SPR's physical distribution capability, which is distinct from the SPR's distribution capability. The former focuses on the actual connections that the SPR maintains to physical assets. Meanwhile, the distribution capability is the rate that SPR crude oil can be incrementally added to the market and is dependent upon oil market activity; the utilization of commercial pipelines and commercial terminals at the time of drawdown; and the magnitude and geographic location of the oil supply disruption.

At this time, the ability of the SPR to distribute incremental oil without disrupting domestic and Canadian crude flows has been diminished due to congestion of commercial facilities in the SPR's Gulf Coast distribution region. In recent years, the changing geography of U.S. oil production has led to major changes in the domestic oil refining and distribution systems. New patterns of oil supply and demand among U.S. oil producers and refineries, along with associated changes in the U.S. midstream, have significantly reduced the ability of the SPR to distribute *incremental* volumes of oil during possible future oil supply interruptions. Moving SPR oil to Midwest refineries—a historical pattern—would be of no value during a petroleum supply disruption, as non-Canadian imports and Gulf Coast supplies into this refining complex have essentially disappeared. The U.S. pipeline distribution system, along with other modes of oil transport, are instead moving large volumes of oil to the Gulf Coast, especially from U.S. tight oil plays and Canada. This new geography of U.S. oil production and energy exports has also increased commercial traffic at U.S. Gulf Coast marine loading facilities.

While the SPR has throughput contracts for dock space utilization at five marine terminals within the SPR distribution system, the use of these docks for the distribution of SPR crude oil could cause displacement of domestically produced oil and/or Canadian-imported oil. The changing patterns of U.S. oil imports mean that the magnitude and geographic location of an international oil supply disruption can affect a) the capacity of the SPR to deliver oil to its customers and b) the ability of the United States to meet its international energy program (IEP) obligations in the event of an International Energy Agency (IEA) collective action in response to a global supply disruption. If the SPR cannot load oil onto barges and tankers without disrupting commercial shipments, SPR sales could be offset by a corresponding decrease in domestic crude oil shipments or exports of domestically produced petroleum products. For these reasons—the evolution of global oil markets, the participation of the United States in those markets, the changed geography and volume of U.S. oil supplies, reduced oil imports, and congestion of commercial facilities in the SPR's distribution region—an effective SPR release will increasingly depend on the ability to load *incremental* SPR oil onto marine vessels.

In 2016, the Office of Petroleum Reserves completed a scenario-based crude supply disruption analysis of SPR's distribution capability. The project quantified the SPR's distribution capabilities in terms of incremental barrels that can be added to the market without disrupting commercial flows. The SPR distribution capability analysis results were included in the

published Report to Congress: *Long-Term Strategic Review of the U.S. Strategic Petroleum Reserve*, August 2016.

International Energy Program Requirements

The United States, as a member of the International Energy Agency (IEA), is obligated to maintain stocks of crude oil and products in reserves that are equivalent to 90 days of net oil imports. Computations of member nations' stockpile requirements are based on both publicly and privately held stocks, and net imports are defined as the average daily level in the previous year.

In the event of a severe petroleum supply interruption, the IEA Governing Board may choose to collectively release oil stocks to respond to the crisis. In a coordinated IEA response, each member country is responsible for a share of the total release that is proportionate to their share of total IEA oil consumption. For the United States, this share was 42.9 percent in 2017.

X. Commercial Activities

Commercial Leases

The SPR has commercialized its under-utilized crude oil distribution facilities to be more cost-effective, and it currently has leased three crude oil pipelines and a marine terminal to private industry. The contracts for these leases require that the facilities be maintained in good condition, and, in the event of a Presidentially-ordered emergency drawdown, use of the leased facilities will be returned to DOE within five days' notice. Receipts from the leases are deposited to the U.S. Treasury.

Bayou Choctaw Pipeline: In the early 1990s, the SPR determined that leasing the Bayou Choctaw pipeline would be advantageous to the U.S. Government and in the public's interest because it would eliminate operating costs for the government and provide a means to generate revenue. Through a competitive bid process, the SPR leased the pipeline to Shell Pipeline Company LP on May 1, 1997, on a revenue-sharing basis. The lease payments were based on a percentage of Shell's gross revenue with a minimum of \$11,000 a month. Revenue earned from May 1997 through December 2017 totaled \$5.2 million, with a maintenance cost avoidance of \$500,000 per year. The initial term of the lease was through April 13, 1998, with automatic annual lease renewals thereafter until December 2017. In May 2017, a 2-year lease extension was negotiated to allow for modernizing the St. James Marine Terminal in anticipation that the Bayou Choctaw Pipeline and St. James Marine Terminal may revert back to maintenance and operations by the government. The current lease period will expire on December 31, 2019.

Bryan Mound Pipelines: In 2017, lease revenues totaled \$2,564,390. Two of the three Bryan Mound pipelines were leased to ExxonMobil Pipeline Company on January 14, 1999. ExxonMobil began using the pipelines in June 2000 as part of its onshore distribution system for the Diana-Hoover production in the Gulf of Mexico. The first 5-year option of the lease agreement was executed and began in June 2010. The second and final 5-year option of the lease agreement was executed on February 12, 2014, for the period of June 1, 2015–May 31, 2020.

St. James Marine Terminal: In 2017, St. James Marine Terminal lease revenues were \$2 million. The terminal was leased to Shell Pipeline Corporation (now Equilon Enterprises LLC, “doing business as” Shell Oil Products U.S.) on January 31, 1997, on a revenue-sharing basis. In 2017, the contract was renegotiated for a period of two years in the amount of \$2 million per year through December 31, 2019, to allow for modernizing of the terminal in anticipation of possible terminal maintenance and operation by the Government.

Commercial Revenues

During CY 2017, receipts to the General Fund of the U.S. Treasury from the commercial leases of the SPR’s distribution facilities and pipelines totaled \$5,026,915. Table 8 summarizes commercial revenues from 1996–2017.

Table 8: Summary of Commercial Revenues
(December 31, 2017)

Calendar Year	Bryan Mound Pipelines (Actual \$)	Big Hill Pipeline (Actual \$)	Bayou Choctaw Pipeline (Actual \$)	St. James Terminal Lease (Actual \$)	Total Revenue Generated (Actual \$)
1996	102,606	472,809	0	0	575,415
1997	0	429,824	0	133,300	563,124
1998	12,500	402,525	0	481,010	896,035
1999	679,393	400,000	163,030	546,125	1,788,548
2000	652,146	493,359	217,573	748,986	2,112,064
2001	1,054,297	33,104	212,738	1,227,021	2,527,160
2002	1,468,613	0	249,708	1,285,183	3,003,504
2003	1,647,828	0	168,718	1,863,060	3,679,606
2004	1,546,121	0	174,338	1,700,000	3,420,459
2005	1,132,668	0	730,542	1,700,000	3,563,210
2006	1,091,799	0	337,949	1,700,000	3,129,748
2007	1,128,340	0	218,912	1,700,000	3,047,252
2008	1,211,171	0	321,799	1,700,000	3,232,970
2009	1,141,228	0	232,374	1,700,000	3,073,602
2010	1,091,494	0	169,541	1,700,000	2,961,035
2011	2,124,218	0	318,183	1,700,000	4,142,401
2012	5,838,356	0	312,481	1,700,000	7,850,837
2013	17,270,421	0	274,481	1,975,000	19,519,902
2014	6,513,476	0	188,695	2,000,000	8,703,171
2015	11,243,574	0	236,583	2,000,000	13,480,157
2016	3,902,442	0	360,500	2,000,000	6,262,942
2017	2,564,390	0	462,525	2,000,000	5,026,915

XI. Budget and Finance

With enactment of the Consolidated Appropriations Act, 2017 (Public Law 115-31), Congress appropriated \$223 million for the SPR.

Appropriations through Fiscal Year 2017

Over the history of the SPR, a total amount of \$24.6 billion, net of sales and transfers, has been appropriated for the SPR through FY 2017. The distribution of this annual appropriation is described in Table 9.

Strategic Petroleum Reserve Account

The SPR Account funds the development, operation, and maintenance of facilities; the salaries and expenses necessary to plan and manage the program, including the operation of the SPR PMO in New Orleans, Louisiana; and the activities pertinent to major issues concerning the development and use of the SPR.

Obligations for the SPR in FY 2017 totaled approximately \$220.8 million. From this amount, \$22.2 million was obligated for federal program management. Another \$198.6 million was obligated for contractual goods and services to operate and maintain the SPR and to conduct an emergency drawdown and sale, if required.

Table 9: Appropriations for Storage Facilities
Operations and Management and Petroleum Account* (As of December 31, 2017)

Fiscal Year	Oil Account (\$000)	Facilities (\$000)	Management	Expansion (\$000)	Total (\$000)	Defense SPR (\$000)
1976	0	300,000	13,975		313,975	
1977	440,000	0	7,824		447,824	
1978	2,703,469	463,933	14,704		3,182,106	
Total 1979 Appropriations*	2,356,456	632,504	18,111		3,007,071	
Total 1980 Appropriations*	(2,022,272)	0	22,272		(2,000,000)	
Total 1981 Appropriations*	3,205,094	108,168	19,391		3,332,653	
Total 1982 Appropriations*	3,679,700	175,656	20,076		3,875,432	
1983	2,074,060	222,528	19,590		2,316,178	
1984	650,000	142,357	16,413		808,770	
1985	2,049,550	441,300	17,890		2,508,740	
Total 1986*	(12,964)	106,979	13,518		107,533	
1987	0	134,021	13,412		147,433	
1988	438,744	151,886	12,276		602,906	
1989	242,000	160,021	13,400		415,421	
1990	371,916	179,530	12,953		564,399	
1991	566,318	187,728	12,846		766,892	
1992	88,413	171,678	13,384		273,475	
1993	(125,625)	161,940	14,227		50,542	
DOD Transfer (non-add)	124,925	700	0		125,625	125,625
1994	0	191,035	15,775		206,810	
1995	(107,764)	226,938	16,780		135,954	
1996 transfer from SPR Petro Acct	(187,000)	170,173	16,827		0	
1996 Weeks Island Oil Sale	(97,114)	97,114	0		0	
1996 deficit reduction oil sale	(227,000)	0	0		(227,000)	
1996 Total	(511,114)	267,287	16,827		(227,000)	
1997 Total*	(220,000)	193,000	16,000		(11,000)	
1998	0	191,500	16,000		207,500	
1999	0	145,120	14,805		159,925	
2000	0	144,000	15,000		159,000	
2001	0	140,672			156,637	
2002	0	154,009			170,880	
2003	1,955	157,823			173,687	
2004	0	155,044			170,948	
2005*	43,000	109,946	16,764		169,710	
2006*	(43,000)	190,510**	16,830		207,340	
2007	0	146,950	17,491		164,441	
2008		143,980	18,004	24,773	186,757	
2009	(21,586)	176,255***	18,824	31,507	226,586	
2010	0	199,732	19,091	25,000	243,823	
2011	0	186,873	22,568	0	209,441	
2012*	0	172,914	19,790	0	192,704	
2013*	0	162,975	19,650	0	182,625	
2014*	0	167,514	21,846		189,360	
2015		174,999	25,001		200,000	
2016	0	186,870	25,130		212,000	
2017	0	195,646	27,354	0	233,000	

Note: FY 1991 SPR Petroleum Account of \$566,318 includes proceeds of \$122,681 from the Test Sale recorded as additional budget authority, rather than reductions to obligations, costs, and outlays. It also includes \$315,425 in Desert Storm Drawdown proceeds from January 1991, and \$19,755, from FY 1991 Naval Petroleum Reserve excess receipts. Thus, the cumulative budget authority is "gross" and not related directly to the inventory of oil on hand. * Includes reprogramming, rescission and transfer actions. ** Includes the return of \$43,000,000 from the SPR Petroleum Account. *** Includes \$21,586 from the SPR Petroleum Account for site maintenance activities.

Strategic Petroleum Reserve Petroleum Account

The SPR Petroleum Account funds the acquisition and withdrawal of oil for the SPR; the associated costs for transportation and terminal expenses, U.S. customs duties, Superfund and Oil Spill Liabilities Trust Fund taxes; and other miscellaneous costs.

During an emergency drawdown and sale, as well as congressionally mandated sales, the SPR Petroleum Account is the source of funding for the incremental costs of withdrawing oil from the storage caverns and transporting it to the point where purchasers take title. Receipts from the sale of oil are deposited to the U.S. Treasury (except for crude oil sales in accordance with Section 404 of the Bipartisan Budget Act of 2015, which are deposited in the Energy Security and Infrastructure Modernization Fund as mandated by law), and an equal amount of mandatory budget authority is created in the SPR Petroleum Account.

On April 15, 2014, the Secretary of Energy authorized establishment of the Northeastern Regional Refined Petroleum Product Reserve, now identified as Northeast Gasoline Supply Reserve (NGSR), as a component of the SPR. The purpose of the NGSR is to mitigate market disruptions in the Mid-Atlantic and New England coastal areas caused by natural disasters. The Congressional Control level was established, and the Office of Management and Budget apportioned \$235.6 million in late June 2014, from receipts from an SPR test sale, to establish the NGSR. Oversight and administration of the product acquisition and commercial storage activities will occur for 4.5 years.

For FY 2017, the capitalized cost of the crude oil in the SPR was \$20.8 billion, with an average cost per barrel of approximately \$29.89 (excluding storage costs).

Through use of a Royalty-in-Kind (RIK) program, established by the Department of the Interior from April 1999 through December 2009, the cumulative dollar value of the exchange barrels provided to the SPR by contractors who received royalty oil from the Department of Interior (DOI) totaled \$6.1 billion. The value of the RIK oil transferred from DOI to DOE through 2009, the last year of the program, is shown by FY in Table 10.

Table 10: Value of Royalty-in-Kind Transferred by the Department of the Interior

Fiscal Year	Royalty-in-Kind Transfer * Total Barrels (Source: DOE)	Reconciled Royalty-in-Kind Transfer Total Barrels* (Source: DOE)	Department of the Interior** Forgone Receipts - (\$000) (Source: DOI)
1999	11,928,981	8,135,603	***
2000	15,105,558	18,898,937	560,521
2001	1,568,220	1,568,220	61,654
2002	10,575,379	10,575,378	262,752
2003	34,742,046	34,852,185	1,044,350
2004	35,506,135	35,599,310	1,191,284
2005	25,185,527	25,184,519	1,194,618
2006	0	0	0
2007	8,742,829	4,425,911	306,191
2008	15,943,421	15,943,421	1,600,027
2009	4,493,099	6,798,713	268,537
Total	163,791,195	161,982,197	6,489,934

* In coordination with Minerals Management Service, DOE completed a total DOE-RIK program reconciliation (1999–2009) in CY 2009, requiring net figure adjustments to prior years.

** Net figures that include DOI preliminary volumes and adjustments to prior years.

*** DOI data not available.

Performance Measurement

In FY 2017, the SPR tracked 19 measures that are indicative of how the strategic goals and objectives for the SPR were pursued. They are consistent with the SPR Strategic Plan, which provides a framework for implementing the program’s mission by setting a course for the program and guiding decisions about the effective use of resources. Of the tracked measures, 16 met or exceeded the performance measure, while three measures did not meet the performance measure target during this period. Specifically, the measures that missed the target were:

- “Distribution Capability as a Percentage of Drawdown Rate”— This target was missed due to a reduction in locally connected refinery imports and interstate pipeline imports.
- “90 Day Sustainable Drawdown Rate”— The 12-month average fell below the target due to a September actual of 2.85 MMbbl/D primarily due to a transformer issue at Bryan Mound, which resulted in the site not being drawdown ready for more than half of the month.
- “Well integrity Compliance with State Regulations”—The Louisiana Department of Natural Resources did not receive notification of a failed Mechanical Integrity Test on West Hackberry-107 within the required timeframe. The contractor made restitution and paid the required fine.

The financial measure of “Operating Cost per Barrel of Storage Capacity” was \$0.246 versus a target of \$0.300. This is a measure of operational cost-effectiveness and indicates the responsible use of financial resources. This measure is used to promote the efficient use of taxpayer resources provided to operate the SPR.

In FY 2017, the critical few performance measures were again incorporated into the SPR Annual Operating Plan, in accordance with the Under Secretary of Energy’s direction. This ensures integration of these critical few performance measures into the planning process and enables tracking of their performance. A complete accounting of the Office of Petroleum Reserves’ performance measures is reflected in Table 11.

Table 11: Performance Measures

Performance Measures	FY 2016 Actual Performance	FY 2017 Target Output	FY 2017 Actual Performance
Oil Inventory, Drawdown Readiness, and Distribution			
90-day sustainable drawdown rate	4.25 MMbbl/D	4.22 MMbbl/D	4.10 MMbbl/D
Number of days to commence crude oil drawdown	13 days	13 days	13 days
Number of days to complete heating oil drawdown	13 days	13 days per drawdown	13 days
Distribution capability as a percentage of drawdown rate	105%	≥120% of drawdown rate	104%
Calculated site availability	97.3%	≥95%	97.75%
Calculated maintenance performance appraisal report rating	97.6%	≥95 out of a possible 100 points	98.1
Percent of site security survey Ratings that are satisfactory	100%	100%	100%
Number of barrels of crude oil degassed	44.02 MMbbl	37.00 MMbbl	42.00 MMbbl
Well integrity compliance with state regulations	100%	100%	<100%
Customer Knowledge and Focus			
Percentage of key customers visited	51%	N/A	N/A
Operational Effectiveness, Efficiency, and Knowledge Management/Fiscal Responsibility and Budgetary Control			
Information system availability	99.9%	≥97%	100%
Operating cost per barrel of storage capacity	\$0.233	≤\$0.30 per barrel	\$0.246
NEHHOR Operating Cost – Negotiate best possible commercial storage rates per the Federal Acquisition Regulation (FAR) System	\$7.15 operating cost per barrel	N/A	N/A
NSGR Operating Cost – Negotiate best possible commercial storage rates per the FAR System	\$21.38 operating cost per barrel N/A	N/A	\$N/A
Dynamic Teamwork: Continuous Improvement			
ISO 9001-2008 Certification	November 6, 2014	September 15, 2016	November 3 2015
Partnerships			
Number of partnerships arrangements with federal, state, and local agencies	NA	N/A	N/A
Memorandum of understanding/agreements (MOA) with federal, state, and local agencies to minimize life safety and environmental risks to the sites and community	13	13	13
Local Community Support/Environment, Safety, and Health			
Maintain or apply for OSHA VPP Star Status through completion of an annual self-evaluation or application for each SPR storage fixed site	February 15, 2016 ¹	September 30, 2017	February 15, 2017 ^{2,3}
Number of cited environmental violations received	0	0	0
Number of reportable releases to the environment annually	3	≤4	4
ISO 14001 Certification	March 25, 2016	Maintain SPR Emergency Management System certification with ISO 14001 by May 3, 2017	April 06, 2017
Site Sustainability Plan submittal	November 25, 2015	November 30, 2016	November 21, 2016
Employee Development and Quality of Life			
Employee Individual Development Plans	100%	95%	99%

¹February 15, 2016 is the application date for evaluation of performance in CY 2016²February 15, 2017 is the application date for evaluation of performance in CY 2016³December 2017 - Bayou Choctaw received a letter from OSHA confirming recertification in VPP

XII. Other Program Activities

Congressionally Mandated SPR Crude Oil Sales

The SPR successfully carried out three sales in 2017 as provided for by various congressional mandates. While all three sales were conducted during CY 2017, two were for FY 2017 requirements and the third, which satisfied two distinct legislative mandates, was for FY 2018 requirements.

In February 2017, the SPR initiated crude oil deliveries in accordance with Section 404 of the Bipartisan Budget Act of 2015 (Public Law 114-74). Section 404 authorizes the Secretary of Energy to draw down and sell crude in an amount up to \$2 billion during FYs 2017–2020 to carry out an SPR modernization program, based on an authorized annual appropriation. Subsequently, in FY 2017, Section 101 of the Further Continuing and Security Assistance Appropriations Act, 2017 (Public Law 114-254) authorized the Secretary to draw down and sell an amount not to exceed \$375.4 million of crude oil from the SPR.

A Notice of Sale was issued for the FY 2017 SPR Modernization Program Crude Oil Sales on January 9, 2017 and resulted in 157 bids from 21 companies. After a thorough analysis of the bids, seven bids were accepted from two companies for a total volume of 6.4 MMbbl. Deliveries commenced on February 24, 2017, and were completed on April 29, 2017. The SPR provided a total of 6,282,694 bbl over 37 deliveries. The SPR deposited \$323,195,827 of revenue into the Energy Security and Infrastructure Modernization Fund.

In May 2017, the SPR initiated crude oil deliveries in accordance with Section 5010 of the 21st Century Cures Act of 2015 (Public Law 114-255), which directs the Secretary of Energy to draw down and sell a total of 25 MMbbl of crude oil from the SPR over three consecutive years commencing with 10 MMbbl in FY 2017. The proceeds from the sales are required to be deposited into the General Fund of the U.S. Treasury.

A Notice of Sale was issued for the 2017 Cures Act Sale on February 21, 2017 and resulted in 129 bids from 16 companies. After a thorough analysis of the bids, the SPR accepted 21 bids from seven companies for a total volume of 10 MMbbl. The SPR commenced deliveries on May 3, 2017 and completed them on July 1, 2017. A total of 9,893,710 bbl was provided over 49 deliveries. The SPR deposited \$449,185,955 of revenue into the General Fund of the Treasury.

In October 2017, the SPR initiated crude oil deliveries in accordance with the Bipartisan Budget Act of 2015 and Section 5010 of the 21st Century Cures Act of 2015 to satisfy requirements for FY 2018. Section 403 of the Bipartisan Budget Act of 2015 directs the Secretary of Energy to draw down and sell a total of 58 MMbbl of crude oil from the SPR over eight consecutive years commencing with 5 MMbbl in FY 2018. The 21st Century Cures Act directs the Secretary to

draw down and sell 9 MMbbl in FY 2018. The proceeds from each of these sales are required to be deposited into the General Fund of the U.S. Treasury.

A Notice of Sale was issued for the combined Bipartisan Budget Act of 2015 and 21st Century Cures Act requirements as the FY 2018 mandatory sales on August 22, 2017 and resulted in 102 bids from 18 companies. After a thorough analysis of the bids, the SPR accepted 27 bids from six companies for a total volume of 14 MMbbl. The SPR commenced deliveries on October 4, 2017 and completed them on November 29, 2017. A total of 13,717,304 bbl was provided in 53 deliveries. The SPR deposited \$790,823,567 of revenue into the General Fund of the Treasury. One delivery was cancelled, and the remaining volume of the combined requirement was included in a subsequent sale conducted in CY 2018.

Northeast Gasoline Supply Reserve

The NGSR consists of contracted storage at multiple facilities in the New York Harbor, greater Boston, Massachusetts, and greater Portland, Maine areas. The SPR does not own storage facilities suitable for the storage of refined petroleum products. It was determined that the benefits of contracting the storage of up to 1 MMbbl of refined petroleum products pursuant to the authority granted by Section 171 of EPCA are comparable to the benefits from a similar action undertaken under Title I, Part B of the statute. It was also determined that the availability of funds in the SPR Petroleum Account would enable the creation of a refined petroleum product reserve in time for the 2014 hurricane season. Placing the refined product reserve within the normal supply chain also ensured higher product quality, because unlike crude oil, refined products require periodic turnover to ensure that the products remain within strict quality specifications.

Four storage service contracts were executed to support the establishment of a regional product reserve in the Northeast. The Northeast region of the United States heavily depends on product supplies from the Gulf Coast, as well as local refining and imports. The crude oil stored in the SPR sites along the Gulf Coast are well suited to mitigating impacts of crude oil supply to refineries. However, vulnerabilities elsewhere in the supply chain could still result in significant regional disruptions. The establishment of a regional product reserve closer to the point of consumption can mitigate the impact of short-term disruptions, while issues with the larger supply chain (from crude oil refining through product distribution to consumers) are resolved.

DOE provides operational oversight of the NGSR, which includes managing the contracts, providing independent product quality and quantity assurance certifications; performing annual audits; establishing a sales procedure and platform; and coordinating with each of the storage contractors to ensure availability of and accessibility to the government-owned product.

The storage contractors are responsible for maintaining both the quantity and quality of the refined product, including any seasonal changeover of products to comply with EPA Clean Air

Act requirements. Additionally, the contractors are obligated to ensure that their specific facility is available in the event that a release is required, including the ability to meet the government's release requirements in the aftermath of an event without commercial electric power. In addition, the contractors are required to provide detailed information on inventories, activities, and distribution capabilities at the request of DOE if conditions exist for a potential release.

Quality and Performance Assurance

The SPR conducted oversight activities per DOE procedural requirements. These activities included on-site management appraisals, technical assessments, security surveys, and quarterly reviews of the M&O contractor's Contractor Assurance System (CAS).

The CAS covers four oversight areas mandated by DOE Order 226.1B, Implementation of DOE Oversight Policy. These categories are Environment, Safety, and Health; Safeguards and Security; Cyber Security; and Emergency Management. Additionally, CAS has been expanded to cover Finance, Human Resources, Property and Facilities, Procurement, Cavern Integrity, Data Systems, M&O, Engineering, and Internal Audit. The Quality and Performance Assurance Division (QPAD) conducted technical assessments on key areas within the M&O contractor's organization. The assessment of the Conduct of Operations (COPs) program evaluated the M&O contractor's effectiveness in executing COPs procedures at all the SPR facilities. These assessments were conducted to evaluate contractor compliance with the oversight requirements in DOE Order 414.1D, Quality Assurance and DOE Order 226.1B, Implementation of DOE Oversight Policy.

QPAD personnel performed 22 inspections or site surveillances in 2017 and were documented in Technical Assurance Surveillance Reports. These included inspections at the SPR sites and supplier/vendor facilities. These inspections were done to ensure all activities and procedures were conducted according to contractual requirements.

QPAD personnel coordinated the oversight management process for the SPR. Six elements including the Project Manager, General Counsel, Management and Administration, Maintenance and Operations, Systems and Projects, and Technical Assurance developed annual Oversight Management Plans for FY 2017. Each organization performed oversight activities in accordance with these plans. Oversight activities were reported quarterly, and QPAD personnel conducted an analysis and provided a roll-up status report to the Project Manager each quarter.

The oversight of the critical few performance measures included 10 objective processes. The assessment of each measure was conducted by a subject matter expert to ensure that the contractor's performance was measured against their objectives, appropriately monitored, documented, and verified. QPAD then performed an independent assessment to validate the subject matter expert's due diligence. Both positive and negative results were submitted to the

Performance Fee Board via the board secretary. Once the assessment results were completed and documented, a summary report was submitted to the Project Manager and the Performance Fee Board chairperson to determine the appropriate fee distribution.

Additionally, the SPR's Quality Council monitored the activities of five process improvement teams. The first team worked to identify methods to capture the unique knowledge and experiences of SPR personnel. The second team redesigned the methods by which performance evaluation tools are presented for use by SPR personnel. The third team was tasked to explore ways to enhance and improve DOE's on-site management appraisal process. The fourth team used results from a survey of PMO employees to identify the top challenges to employee satisfaction. The SPR as a whole worked together to address those challenges. Finally, a fifth team worked to improve the SPR's onboarding process.

Vapor Pressure Mitigation

Reassembly and commissioning of the portable degasification plant (that had been stored at the Bryan Mound facility since 2011) was completed at the West Hackberry site in 2014. Operation of the West Hackberry degas plant started August 27, 2014, and continued through December 2017. The degas plant is scheduled to remain at West Hackberry until October 2018 and will degas 15 of the 22 West Hackberry caverns during that time. A process total of 147.3 MMbbl of crude oil was degassed in CY 2017.

The need for a continuous vapor pressure-mitigation program was recognized in 1992 through routine oil sampling of the caverns. Long-term storage of crude oil in salt caverns results in gradual geothermal heating that raises the temperature of the oil in some caverns from approximately 80°F at the time of injection into the cavern, to a range between 110°F and 130°F over time. In addition, because of operational activities that include occasional injection of raw water into the cavern, gasses encapsulated in the salt are released and absorbed into the oil while stored. Naturally occurring methane gas may also migrate into the cavern through the salt matrix discontinuities. Under certain drawdown conditions, increased vapor pressure results in gas being released into the atmosphere in amounts that may pose environmental, safety, and health risks.

The degas plant removes excess gasses from the crude oil so that it can be sold and distributed to customers with a greatly reduced potential for emission of volatile organic compound (VOCs) ozone precursors, benzene, and hydrogen sulfide (H₂S). The degas plant reduces the VOCs in the vapors from the treated oil by 97 percent. Specifically, given life-cycle VOC emissions from the plant averaging about 2 tons per year, emissions from a single full-scale, end-of-life-cycle drawdown are reduced by 77,000 tons or 1,900 times the pollutants generated from operation of the plant over its entire 25-year life cycle.

International Organization for Standardization (ISO) 14001

In May 2000, the SPR became the first bulk petroleum storage organization, public or private, to receive an ISO 14001, Environmental Management System certification. In 2017, the SPR successfully maintained ISO 14001 certification by means of a third-party recertification audit. This certification is valid through May 2, 2018.

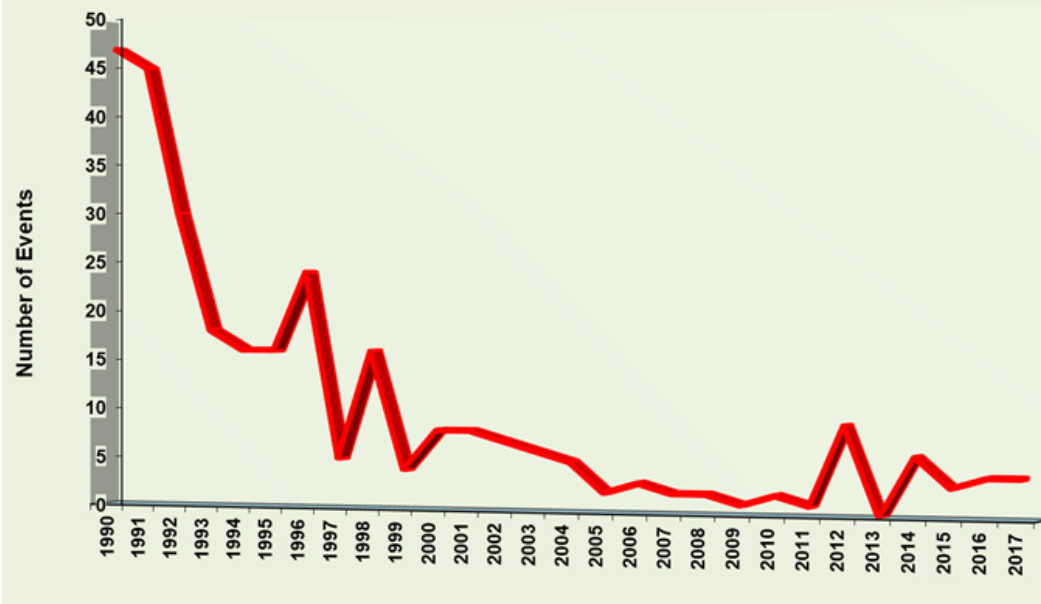
Environment, Safety, and Health

The SPR is accountable to the public for the safe delivery of crude oil during a national energy emergency and for being a good steward of the environment. During 2017, all SPR storage sites continued their participation in occupational safety and health programs, including OSHA's VPP as well as DOE's VPP. All four sites were recognized for their low accident rates by OSHA Region VI. Big Hill, Bryan Mound, and West Hackberry each received a Star of Excellence award, while Bayou Choctaw received a "Star Among Stars" Award. A Star of Excellence award requires the site to have an incident rate of at least 90 percent below the national average, and the "Star Among Stars" distinction recognizes Region VI sites that have accident rates at least 50 percent below the national average.

Figure 6 shows the SPR's performance for reportable environmental incidents from 1993–2017. During CY 2017, there were a total of four reportable project events at the SPR; four reportable releases to the environment. The CY 2017 reportable project events included:

- A 30-bbl brine release at Bayou Choctaw
- A 3–4-bbl release at Bayou Choctaw
- A sheen of diesel fuel at the Big Hill Raw Water Intake Structure
- A sheen of crude oil at West Hackberry Cavern 115. The release incidents were within the established performance targets of the FY 2017 contractual directives.

Figure 6: Environmental Reportable Events 1990–2017



Pollution Prevention

The SPR sets fiscal year goals for hazardous solid waste, non-hazardous solid waste, and C&D debris waste generated at its sites. Waste diversion is the prevention and reduction of generated waste. The SPR achieves waste diversion in several ways, including source reduction, recycling, and/or reuse.

Hazardous Waste

SPR met the FY 2017 goal to divert at least 50 percent of hazardous solid waste generated with a diversion rate of 99.7 percent.

Non-Hazardous Waste

The SPR continued its successful efforts to reduce municipal solid waste by diverting 62 percent of non-hazardous solid waste during FY 2017. The goal was to divert at least 50 percent of non-hazardous solid waste. *In FY 2017, the SPR continued its strategy to reduce municipal solid waste sent to landfills, which in turn helps achieve DOE GHG reduction targets.*

Construction and Demolition Debris

The FY 2017 goal was to divert at least 50 percent of C&D waste generated. The SPR exceeded that goal by diverting 62 percent.

Exploration and Production

Although there are no specific goals established for exploration and production (E&P) waste generation or diversion, the SPR continued with its effort to recycle this waste stream whenever possible. During FY 2017, 80 percent of E&P waste was diverted. The generated E&P waste included crude oil-contaminated plastic and absorbents, crude oil-contaminated solids, workover wastes, off-specification crude oil mixtures, and drill cutting wastes.

Environmental Improvement Measures

The SPR sites continued to maintain acreage for habitat enhancement for the benefit of both native wildlife and resident and migratory birds.

Throughout the year, educational papers and informative posters that highlight specific wildlife topics are developed and sent to the sites to be posted on their wildlife bulletin board. The sites perform periodic avian inventories, which are uploaded into the Cornell Laboratory of Ornithology database. A presentation of the best photographs taken of the wildlife that year is a highlight of the Environmental, Safety & Health Summit. The SPR recognized the 47th Anniversary of Earth Day in 2017 as an opportunity for employees to join together and make commitments to environmental sustainability and a global green economy. Activities included an Earth Day crossword puzzle, an Earth Day message from the FFPO Project Manager to employees at all of the sites, and an Earth Day-themed decorated cake for employees. The sites also held activities.

The SPR conducted a Climate Change Risk and Resiliency Assessment in 2017 in conjunction with National Renewable Energy Laboratory and Southern Climate Impacts Planning Program. The assessment presented SPR Senior Management with resiliency strategies to reduce emissions and increase energy efficiency in order to minimize contributions to climate change.

The SPR has continued to host Environmental Advisory Committee (EAC) meetings as part of community outreach efforts. The EAC comprises environmental experts and community representatives. EAC meetings were held at the Big Hill site January 9–10, 2017, and at the New Orleans Project Management Office on September 18–19, 2017.

Security and Emergency Operations

The SPR mitigated risk by ensuring the capability to effectively respond to any emergency during day-to-day operations and severe weather conditions. The Continuity of Operations Plan (COOP), Emergency Command Vehicle, communication vehicles, and Emergency Communications Network are the cornerstones for continuing essential work functions under catastrophic conditions. Emergency response team members are assisted by protection force personnel as “support responders” for emergency conditions.

The SPR built the infrastructure for applying and maintaining a robust Homeland Security Presidential Directive 12-credentialing program that includes training and maintenance. In 2017, the SPR completed and executed its Strategic Plan to secure drawdown capability, the protection of people, resources, and classified information.

During 2017, the SPR completed four announced and four unannounced oil spill response drills in support of the Oil Pollution Act of 1990. Each storage site successfully executed two oil boom containment deployments and exercised command and control response and recovery activities.

The SPR strengthens its protection strategy by building relationships with the local community law enforcement and emergency response agencies and personnel. The SPR conducts exercises with these local agencies and personnel, and it supports local community events.

Safety and Health Improvement Areas

Safety and Health Maintains Best Practice Performance

The SPR continued to enhance safety and health systems throughout the complex during 2017. The lockout/tag out process was completely revised by a performance improvement team to improve ease of use, ensure energy control, and maintain consistency between the sites. The Management in Action program focused initially on contacts between managers and employees. It was expanded in 2016 to include first-line supervisors in the process. As a result of the enhancement, 1,089 Management in Action observations were performed in FY 2017.

The SPR also continued to strengthen its involvement in the subcontracting selection process. The SPR's involvement in the subcontractor selection process is a proactive approach to ensure that adequate risk assessments are performed and hazard controls are implemented. This will be particularly important during the SPR's LE2 project. This level of oversight will continue through contract closeout and will be documented as lessons learned.

The automated Job Hazard Analysis (JHA) process initiated in 2016 continued to improve the quality and consistency of the JHAs. The automated JHA uses drop prompts that aid users in identifying hazards and controls for a specific task. This drives consistency across the SPR in identifying hazards and implementing controls for similar tasks.

During CY 2017, the Industrial Hygiene (IH) program initiated a complete overhaul of the IH program across the complex. Significant resources were invested in new IH equipment and the training of Site Safety Specialists to conduct IH monitoring at the technician level. A workforce of contracted industrial hygienists trained the Site Safety Specialists in the field. These contracted industrial hygienists gathered updated data for the Baseline Exposure Assessment for the SPR. They conducted monitoring for noise, heat stress, and air contaminants during normal operations and maintenance activities. They also collected data for infrequent, but

high-risk activities. Revisions to the Heat Stress Program were made more specific to the actual work location, reducing the number of “stop works” for heat stress without sacrificing personnel health and safety. The Ergonomic Program was improved by sending IH specialists and Safety Specialists to be trained as Certified Behavioral-Based Ergonomic Specialists. The new certification applies to both office and industrial ergonomic evaluations.

DOE and Occupational Safety & Health Administration’s Voluntary Protection Program

The SPR participates in the OSHA VPP and the DOE VPP. Each SPR site must submit a candid self-evaluation to OSHA and DOE each year demonstrating their continued improvement of the safety and health management system. The self-evaluation also includes 20 or more answers to very specific questions about their Process Safety Management System. Recommendations for improvements made during each of the OSHA on-site assessments must be replicated at all of the sites. In 2017, all four sites maintained their VPP certification, as did the security contractor at West Hackberry. Bayou Choctaw successfully hosted its on-site OSHA assessment for continued acceptance in the VPP program. The other sites will have on-site assessments in 2018.

Accident Rates for the SPR

The SPR continued to improve the safety and health systems throughout the complex during CY 2017. The SPR had another successful year with regards to safety in CY 2017. The SPR succeeded in maintaining the lowest SPR accident rate since rates have been recorded with a Total Recordable Case Rate of 0.45. The Days Away/Restricted or Job Transfer Rate was 0.23 for CY 2017. The SPR storage sites are recipients of several awards for management quality, environmental stewardship, and safety management systems.

Integrated Safety Management

The SPR completed its annual Integrated Safety Management (ISM) System validation and documented its performance in the *ISM System Annual Review and Update Report of 2017*. This report summarized the results of all audits and assessments conducted during the FY and provided senior management with qualitative and quantitative data verifying that the ISM System performed effectively. In 2017, improvements were made to the ISM System Description and Annual Report such as the addition of performance metrics and the inclusion of program information. Each ISM Core Function was analyzed to identify areas in which enhancements could be made to the system. The Annual Report was briefed to a joint audience of DOE and M&O contractor personnel.

Annual Safety Summit and Tripartite Safety Council

The SPR held their annual ES&H Summit in CY 2017. The ES&H Summit included briefings by the safety, health, and environmental departments of the M&O contractor, as well as the

security contractor. Current issues were briefed and discussed in the open forum.

The SPR also conducted two Tripartite Safety Council meetings in CY 2017. The purpose of these council meetings is to give all SPR contractors' representatives an opportunity to address safety issues directly with the SPR Project Manager that have not been resolved through normal channels. Each SPR site, the security contractor, and the A&E contractor had representatives at the meeting. Action items from these council meetings are tracked through closure.

In 2017, the M&O contractor continued the Health, Safety, and Environment Week that began in 2015, conducting events at each of the SPR sites during the first week of May. After a kick-off by senior management, which was televised from New Orleans, each of the sites conducted daily activities highlighting some environmental or safety topic with excellent employee participation. In New Orleans, there were lunch time topics and other presentations.

Business Process Re-Engineering

The SPR information technology function is a national leader in the execution and implementation of re-engineering business processes utilizing a combination of Microsoft SharePoint, InfoPath Forms, and K2 workflow engine. The SPR currently has developed and deployed more than 50 automated business processes that ensure that tasks are completed timely and consistently. In 2016, system changes included consolidation of several systems into one large data management SharePoint farm.

Data Security, Accessibility, and Resiliency

In 2017, the SPR's Alternate Data Center was expanded to include a security enhancement that requires a Personal Identification Verification badge, based on a two-factor authentication to access the SPR network environment. The enhanced recovery capabilities allow for remotely accessible infrastructure, a significant number of portable computers and Smartphones, and robust backup communications to provide reliable performance in an emergency so that essential work can be performed remotely. Comprehensive mobile device management for laptops, smartphones, and tablets is in place to improve user access to SPR data. Additionally, a secure extranet is in place to significantly improve collaboration with partners and external customers.

In addition, efforts continue in the deployment of a wireless network infrastructure at the SPR storage sites to allow site users to participate in SPR automated business processes and have untethered access to SPR data. The SPR implemented a strong cyber security program, using innovative approaches, tailored controls, and monitoring of the SPR operational environment. Per recommendation from the DOE Office of Enterprise Assessments' review, a Privileged Account Management solution was implemented in September 2016. This solution improves the security of privileged accounts on the SPR network by requiring usage of multifactor

authentication via a Personal Identity Verification card. A cloud computing study was completed to determine how to best, and most cost-effectively use cloud services to improve accessibility and resiliency. The SPR uses Microsoft Office 365 to leverage cloud services for email and Microsoft Office capabilities. The main objective is to increase the availability of email for SPR mobile users.

Awards and Certifications

The SPR received the following awards for performance during 2017:

- OSHA Region VI Star of Excellence – Big Hill, Bryan Mound, and West Hackberry
- OSHA Region VI Star Among Stars – Bayou Choctaw

International Organization for Standardization 9001 Quality Management System

During 2017, FFPO maintained their ISO 9001 and 14001 certifications and updated their Environmental Management System to be in compliance with the ISO 14001:2015 version.

Customer Service

The SPR's Customer Service Team met with several refiners, traders, pipeline companies, and other customers during the 2017 American Fuel and Petrochemical Manufacturers annual meeting in San Antonio, Texas, during the third week of March. Additional meetings were held at the SPR offices in Washington, D.C., and at some of the customers' corporate offices. Meetings with customers always have two primary functions: to gather customer information to improve the SPR's response capabilities and to update those customers on SPR activities. The customers provided valuable feedback and reported that the overall experience was excellent.

In order to maintain an accurate and current list of customer contacts, each customer was asked to review his or her contact information and to provide updates on refinery activities, such as expansion plans and any planned or actual changes to their crude oil inputs. Customers were also encouraged to discuss any operational or administrative issues they have encountered when dealing with the SPR so that those issues may be addressed.

The Customer Service Team provided updates to the customers regarding the status of the SPR and welcomed questions from the customers. Customers provided the team with updates on refinery closings, shutdowns, and hurricane upgrades.

Real Estate Actions

During 2017:

- Modification 92 to Interagency Agreement No. DE-AI96-78PO02816 was executed, to extend the agreement's period of performance through September 30, 2018.
- Occupancy Agreement ALA03906 between the General Service Administration and DOE commenced August 8, 2017 for the lease of 39,951 square feet of useable space located at 521 Elmwood Park Boulevard, Harahan, Louisiana. The space is being used as the general-purpose warehouse with eight permanent contract employees. The current agreement expires August 7, 2022, and has one 5-year option renewable option.
- Fluor Property Section and Office of Asset Management conducted Facilities Information Management System validations for buildings, trailers, and other structures & facilities; DOE-owned land; DOE-archived assets; and DOE leases were conducted in 2017. FLUOR scored GREEN on all four validation scorecards.

XIII. Conclusion

The SPR continues to protect the U.S. economy from severe petroleum supply disruptions through continued operation and management of this emergency stockpile of crude oil. The SPR maintained crude oil stocks at four site facilities: Bryan Mound and Big Hill in Texas, and Bayou Choctaw and West Hackberry in Louisiana. The SPR entered CY 2017 with 695.1 MMbbl of crude oil, equivalent to approximately 178 days of net U.S. petroleum imports.

At the end of CY 2017 (as of December 31, 2017), the SPR's crude oil inventory was 662.8 MMbbl, a decrease of 32.3 MMbbl from the previous year. The decline in 2017 was mostly due to three Congressionally-mandated sales in CY 2017. The SPR continued efforts for maintaining the SPR in accordance with EPCA (42 U.S.C. § 6201 *et seq.*).

Appendix: Strategic Petroleum Reserve Site Information

Bryan Mound

Location

Brazoria County, Texas (3 miles southwest of Freeport, Texas).

Site Description

Authorized 247 MMbbl storage facility with 19 active caverns.

24-inch diameter, 6-mile brine disposal pipeline extending 4 miles offshore in the Gulf of Mexico.

Oil, brine and raw water piping distribution system connecting caverns with central plant and water intake structure located on Brazos River. Twenty-one (21) pumps totaling approximately 45,000 horsepower.

System Parameters

Drawdown Rate:	(Sour)	1,500,000 bbl/D*
	(Sweet)	1,000,000 bbl/D
Raw Water Pumping Rate:		1,626,000 bbl/D
Oil Fill Rate:		225,000 bbl/D
Brine Disposal Rate:		260,000 bbl/D

*Bryan Mound has three storage tanks that are required for site drawdown and refill operations. Two tanks are currently unusable due to a damaged internal floating pan. The unavailability of the storage tank has reduced the site's actual drawdown capability from 1.5 MMbbl/D to 1.35 MMbbl/D.

Distribution Facilities

DOE-owned 3.9-mile, 30-inch pipeline to Seaway Freeport Marine Terminal; DOE-owned 4.0-mile, 30-inch pipeline to Seaway Jones Creek Tank Farm; and Pipeline and DOE-owned 46.3-mile, 40-inch pipeline to Seaway Texas City Terminal and Docks.

Acquisition

Acquired 499.47 acres fee simple, through eminent domain, in April 1977, from Freeport Mineral Company and other owners. Dow Chemical Company was the previous operator.

West Hackberry

Location

Cameron Parish, Louisiana (25 miles southwest of Lake Charles, Louisiana).

Site Description

Authorized 220 MMbbl storage facility with 21 active caverns.

Oil, brine, and raw water piping distribution system connecting caverns with central plant, water intake structure located on Intra-coastal waterway and nine brine disposal wells. Thirty-three (33) pumps totaling over 41,680 horsepower.

System Parameters

Drawdown Rate:	(Sour)	1,300,000 bbl/D*
	(Sweet)	1,300,000 bbl/D
Raw Water Pumping Rate:		1,400,000 bbl/D
Oil Fill Rate:		225,000 bbl/D
Brine Disposal Rate:		225,000 bbl/D

*The drawdown rate is affected due to increased vapor pressure in several of the site's caverns.

Distribution Facilities

DOE-owned 42.8-mile, 42-inch pipeline to Sunoco Nederland Terminal; DOE-owned 13.6-mile, 36-inch pipeline to Zydeco Pipeline common carrier pipeline system (Lake Charles Meter Station) at Carlyss.

Acquisition

Acquired 405.36 acres' fee simple through eminent domain, in April 1977, from numerous private landowners. Olin Corporation was the previous site operator. Acquired 160.0 additional acres fee simple by condemnation in two actions, first in July 1979 and then in March 1980.

Big Hill

Location

Jefferson County, Texas (26 miles southwest of Beaumont, Texas).

Site Description

Authorized 170 MMbbl storage facility with 14 active caverns.

Oil, brine, and raw water systems connecting caverns with central plant, water intake structure located on the Intracoastal Waterway, and a 48-inch diameter, 14-mile brine disposal pipeline extending four miles offshore in the Gulf of Mexico. Forty-eight (48) pumps totaling 46,000 horsepower.

System Parameters

Drawdown Rate:	(Sour)	1,100,000 bbl/D
	(Sweet)	1,000,000 bbl/D
Raw Water Pumping Rate:		1,192,000 bbl/D
Oil Fill Rate:		225,000 bbl/D
Brine Disposal Rate:		232,000 bbl/D

Distribution Facilities

DOE-owned 24.5-mile, 36-inch pipeline to Sunoco Nederland Terminal; Phillips 66 2-mile, 24-inch pipeline to Phillips 66 Docks; Zydeco 20-inch pipeline system to Houma, Louisiana.

Acquisition

Acquired 271 acres fee simple, through eminent domain, in November 1982 and July 1983, from three landowners, (i.e., 238.48 acres from Amoco, 27.06 acres from the Pipkin estate, and 5.46 acres from the Patrick Henry Phelan estate).

Bayou Choctaw

Location

Iberville Parish, Louisiana (12 miles southwest of Baton Rouge, Louisiana).

Site Description

Authorized 76 MMbbl storage facility with six active caverns.

Oil, brine, and raw water piping distribution system connecting caverns with central plant, a water intake structure, and 12 brine disposal wells). Eighteen (18) pumps totaling over 18,000 horsepower.

System Parameters

Drawdown Rate:	(Sour)	515,000 bbl/D
	(Sweet)	300,000 bbl/D
Raw Water Pumping Rate:		558,000 bbl/D
Oil Fill Rate:		110,000 bbl/D
Brine Disposal Rate:		110,000 bbl/D

Distribution Facilities

DOE-owned 37.2-mile, 36-inch pipeline to Shell's Sugarland Terminal and Capline Pipeline.
Shell-owned 16-mile, 24-inch pipeline to Baton Rouge.

Acquisition

Acquired 355.95 acres fee simple, through eminent domain, in April 1977, from numerous private owners. Union Texas Petroleum (a subsidiary of Allied Corporation) was the previous operator.

In 1985, DOE acquired an additional existing cavern through a cavern exchange agreement with Union Texas Petroleum. The transaction involved a 3.5-acre exchange with no net change in government-owned acreage.

In November 2011, DOE acquired an existing cavern through eminent domain from A. Wilbert's L.L.C. to replace Cavern 20, which has experienced preferential leaching and is within 60 feet of the edge of the dome, posing an environmental risk with continued use.

List of Acronyms

A&E	Architectural and Engineering
BBL	Barrels
CAS	Contractor Assurance System
C&D	Construction and Demolition
CY	Calendar Year
DOE	Department of Energy
DOI	Department of Interior
E&P	Exploration and Production
EPEAT	Electronic Product Environmental Assessment Tool
EPCA	Energy Policy and Conservation Act
FFPO	Fluor Federal Petroleum Operations
FY	Fiscal Year
GHG	Greenhouse Gases
ISO	International Organization for Standardization
LED	Light-Emitting Diode
Mbbl	Thousand Barrels
Mbbl/D	Thousand Barrels per Day
MMbbl	Million Barrels
MMbbl/D	Million Barrels per Day
M&O	Management and Operating
NGSR	Northeast Gasoline Supply Reserve
OSHA	Occupational Safety and Health Administration
QPAD	Quality and Performance Assurance Division
RIK	Royalty-in-Kind
SPR	Strategic Petroleum Reserve
SPR PMO	Strategic Petroleum Reserve Project Management Office
VOC	Volatile Organic Compound
VPP	Voluntary Protection Program

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