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The Strategic Petroleum Reserve: Authorization, Operation, and Drawdown Policy

-name redacted-
Specialist in Energy Economics

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Summary

Congress authorized the Strategic Petroleum Reserve (SPR) in the Energy Policy and Conservation Act (EPCA) of 1975 to help prevent a repetition of the economic disruption caused by the 1973-1974 Arab oil embargo. EPCA specifically authorizes the President to draw down the SPR upon a finding that there is a "severe energy supply interruption." The meaning of a "severe energy supply interruption" has, over time, been controversial. The authors of EPCA intended the SPR only to ameliorate discernible physical shortages of crude oil. Historically, increasing crude oil prices typically signal market concerns for supply availability. However, Congress deliberately kept price trigger considerations out of the President's SPR drawdown authority because of the question about what price level should trigger a drawdown, and the concern that a price threshold could influence market behavior and industry inventory practices. As a member of the International Energy Agency—a coalition of 28 countries—the United States agrees to support energy supply security through energy policy cooperation, commit to maintaining emergency reserves equal to 90 days of net petroleum oil imports, develop programs for demand restraint in the event of emergencies, and participate in allocation of oil deliveries among the signatory nations to balance a shortage.

The Department of Energy (DOE) manages the SPR, which is comprised of 62 underground storage caverns that were solution-mined from naturally occurring salt domes located at four sites in Texas and Louisiana. The 2005 Energy Policy Act directed SPR expansion to its authorized capacity of 1 billion barrels, but the SPR's physical expansion has not proceeded beyond 727 million barrels. The SPR's maximum drawdown capability is 4.4 million barrels per day, based on the capacity of the pipelines and marine terminals that serve it. Legislation restricts SPR sales to no more than 30 million barrels over a 60-day period for anything less than a severe energy supply interruption.

Congress initially appropriated funds to fill the SPR through crude oil purchases, but ended that practice in 1994. In 2000, the Department of Energy began acquiring oil to fill the SPR through the royalty-in-kind (RIK) program. In lieu of paying cash royalties on Gulf of Mexico leases, producers diverted a portion of their production volume to the SPR. The Secretary of the Interior administratively terminated the RIK program in 2009.

The DOE has conducted sales and loans of crude oil from the SPR for several different reasons. The 1990 Energy Policy and Conservation Act Amendments expanded SPR drawdown authority to include responding to short-term supply interruptions stemming from situations internal to the United States. U.S. Presidents have authorized emergency sales of SPR crude to meet IEA obligations during the 1990 Persian Gulf War, in the aftermath of Hurricanes Katrina and Rita in 2005, and after a prolonged disruption of Libyan crude in 2011. In addition to these emergency sales, the Department of Energy has released oil, from time-to-time, to test the SPR system and make loans to help refiners bridge temporary supply disruptions, and has sold oil at the direction of Congress to generate revenue for budget deficit reduction.

The 30.64 million barrel SPR sale in 2011 reduced the SPR's inventory from 726.6 million barrels to 695.9 million barrels. The SPR currently holds the equivalent of 139 days of import protection (based on 2016 data of 4.871 million barrels per day of net petroleum imports).

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Introduction

The changing role of the United States in world petroleum markets has driven a reassessment of the size of, and perhaps even need for, the Strategic Petroleum Reserve (SPR). Lower oil prices, beginning in mid-2014, the Organization of the Petroleum Exporting Countries (OPEC) strategy of protecting market share rather than stabilizing price, excess capacity in the market, and evolving consumption patterns suggested an oil market that may be less susceptible to price and supply shocks.

On the other hand, a variety of conflicts in the Middle East and North Africa, uncertainty concerning Iran's nuclear program and role in Middle East conflicts, and the seeming reversal of the Saudi Arabian-led OPEC market-share strategy suggest that care should be exercised before major decisions on the SPR are taken.

In addition to the changing oil environment, the SPR is seen by some as a potential revenue source to fund programs outside of energy policy.[1]

New resource development and production in Texas (Eagle Ford and Permian Basin), North Dakota (Bakken), and Ohio (Utica) has added significantly to U.S. light, tight, crude oil production (LTO). Over the past several years, LTO, originally sold at a discount and shipped to U.S. refineries by rail, pipeline, barges, and trucks, has caused U.S. net imports of crude oil to decline while increasing U.S. exports of refined products. In addition, prohibitions on U.S. exports of crude oil have been lifted, resulting in increased exports.[2]

A majority of U.S. refineries (some 115) were originally designed to process primarily heavy crude oils. Moreover, these refineries account for roughly 75% of U.S. refining capacity.[3] Should the prospect of releasing SPR oil arise, the relevant question may be whether to sell heavy or light oil as much as the quantity of oil that should be released to the market. For example, in 2011, President Obama ordered a sale of 30 million barrels of light sweet crude oil to offset a curtailment in Libya's production when NATO forces intervened militarily in that country's internal conflict. The oil released from the SPR was thought to be a close substitute of curtailed Libyan supplies. As expected, the oil sale had short-term influence on global crude oil prices, but a limited (if any) influence on long-term prices.

Background: Creating the SPR

From the mid-1970s through the present day, the United States has had to absorb a number of significant spikes in the price of crude oil and petroleum products.[4] Whether driven by disruptions

[1] For example, see P.L. 114-256 and CRS Report R44720, *The 21st Century Cures Act (Division A of P.L. 114-255)*, coordinated by (name redacted) .

[2] CRS Report R43442, *U.S. Crude Oil Export Policy: Background and Considerations*, by (name redacted) et al.

[3] Refer to CRS Report R41478, *The U.S. Oil Refining Industry: Background in Changing Markets and Fuel Policies*, by (name redacted) et al.

[4] These have included the Arab oil embargo (1973-1974), the deposing of the Shah of Iran, followed by the Iranian revolution (1979-1980), the first Gulf War (1990), and periodic production cuts by the Organization of the Petroleum Exporting Countries (OPEC), as well as rapid growth in world oil demand. Starting in 2003, with the U.S. invasion of Iraq, crude oil and product prices again began rising, leading to the peak prices that were reached in the summer of 2008. Natural events and accidents have also affected oil production and prices. Natural events, including Hurricanes Rita, Katrina, and Gustav disrupted oil production in the Gulf of Mexico Outer Continental Shelf (OCS). The 2010 BP Macondo oil well blowout that resulted in a moratorium on OCS drilling permits also affected oil production and

in the physical supply of crude or refined fuels, unexpected demand growth, or by uncertainties owing to international conflicts and instabilities, these price increases have had consequences for the U.S. economy. Elevated petroleum prices affect the balance of trade by increasing the value of oil imports and siphoning away disposable income that might support local economies, investment, or savings.

The SPR came about as a result of the 1973 Arab-Israeli War. In reaction to the United States' support for Israel, the Organization of Arab Petroleum Exporting Countries (OAPEC) imposed an oil embargo on the United States, the Netherlands, and Canada, and reduced production. While some Arab crude did reach the United States, the price of imported crude oil rose from roughly $4/barrel (bbl) during the last quarter of 1973 to an average price of $12.50/bbl in 1974. In addition, local spot shortages of gasoline created a shortage mentality in U.S. markets.

In response to the 1973 oil embargo, Congress created a Strategic Petroleum Reserve of up to 1 billion barrels in the Energy Policy and Conservation Act (EPCA) of 1975.[5] The SPR was meant to contain enough crude oil to replace net imports for 90 days, with a requirement initially to store 150 million barrels. In May 1978, Congress authorized expansion of the SPR's physical capacity to 750 million barrels, and in 2005 directed further expansion to the authorized size of 1 billion barrels.[6] The George W. Bush Administration unsuccessfully attempted to persuade Congress of the need to expand the SPR to 1.5 billion barrels.

Congress intended the SPR to help prevent a repetition of the economic disruption that the 1973 Arab oil embargo had caused. While no amount of strategic stocks can insulate an oil-consuming nation from paying the market price for oil in a supply emergency, the availability of strategic stocks can help mitigate the magnitude of the market's reaction to a crisis. One of the original perceptions of a strategic stockpile's value was that it would discourage the use of oil as a political weapon. OAPEC intended to create a physical supply disruption with the embargo. Congress's motivation in creating the SPR focused especially on a deliberate and dramatic physical oil supply disruption and on mitigating the economic effects of a shortage stemming from international events. In the event of a supply interruption, proponents reasoned that introducing oil into the U.S. market from the SPR would offset the lost supply and in doing so help calm markets, mitigate sharp price spikes, and reduce economic disruptions (i.e., gross domestic product loss). The holding of crude oil rather than petroleum products was done because then, as now, the United States had sufficient domestic refining capacity to meet domestic demand. As a result, potential oil market disruptions would most likely affect the United States through the disruption of crude oil, and not petroleum product, supplies. The SPR could also buy time for the crisis to sort itself out or for diplomacy to seek some resolution before a potentially severe oil shortage escalated the crisis.

International Energy Agency Obligation

The OAPEC oil embargo also fostered the establishment of the International Energy Agency (IEA) to develop plans and measures for emergency responses to energy crises. Strategic stock

prices. The potential for increasing oil prices in 2017 are discussed in CRS In Focus IF10388, *Higher Oil Prices?*, by (name redacted)

[5] P.L. 94-163, Section 154 Strategic Petroleum Reserve Plan.

[6] The Energy Policy Act of 2005, P.L. 109-58, Section 301, Permanent Authority to Operate the Strategic Petroleum Reserve and Other Energy Programs.

holdings are one of the policies included in the agency's International Energy Program (IEP). IEA member countries, including the United States, are committed to maintaining oil stocks (inventories) equivalent to 90 days of their prior year's net imports, developing programs for demand restraint in the event of emergencies, and agreeing to participate in allocation of oil deliveries to balance a shortage among IEA members.[7] In 2011, the United States participated in a coordinated IEA drawdown in response to the shutdown of Libyan oil exports. (See below.) At its current inventory of about 691 million barrels, the SPR provides the United States 139 days of net import protection and surpasses the 90-day IEA obligation. At the full drawdown rate, the SPR can deliver 4.4 MMb/d of crude oil for 90 days, dropping to a rate of 3.8 MMb/d for an additional 30 days, and dropping further in drawdown rate for up to 180 days as stocks deplete.[8] These measures of days of protection assume a total curtailment of oil supply to importing nations, a scenario that is highly unlikely. This would be especially true for the United States, given that Canada, Mexico, and Venezuela are currently the nation's major foreign sources for imported crude oil.

Some IEA member nations require a certain level of stock holding by the private sector or by both the public and private sectors. The private oil sector holds roughly 60% of IEA required stocks, whereas governments and supervisory agencies hold the remaining 40%.[9] The U.S. federal government holds 100% of the SPR stock.

Net or Gross Imports

U.S. net imports of crude oil and petroleum products declined from 9.667 MMb/d in 2009 to 4.871 MMb/d in 2016. The decline in net imports resulted from a decline in gross imports, from 11.691 MMb/d in 2009 to 10.05 MMb/d in 2016, coupled with an increase in exports from 2.024 MMb/d in 2009 to 5.185 MMb/d in 2016. While the 2016 export value includes some crude oil sold to Canada, a growing share is finding other destinations.

A question concerning the ability of the SPR to maximize its contribution to U.S. energy security is whether, in times of emergency, gross imports should be replaced by supplies from the SPR, thereby preserving U.S. consumption as well as exported petroleum product sales, or whether only net import supplies should be preserved. An additional question is whether SPR releases in time of emergency should be required to be used only in the United States, or whether SPR oil sales should be released into the world market for use outside the United States.

SPR Drawdown Authorities

Presidential authority to authorize a drawdown depends on making the determination that a severe supply interruption exists nationally or internationally, or is imminent. The United States is obligated by agreement to join in an IEA coordinated response. In the case of an international interruption, the President may release an unlimited volume of crude oil. In the case of a national interruption, some statutory limitations apply. The Secretary of Energy also has limited authority to release crude oil for a test drawdown.

[7] IEA member countries are Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Republic of Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, and the United States. See http://www.iea.org/about/membercountries.asp.

[8] Personal communication, Diana Greenhalgh, DOE SPR Program Analyst, April 18, 2012.

[9] See http://www.iea.org/Textbase/subjectqueries/keyresult.asp?KEYWORD_ID=4103.

Severe Energy Supply Interruption Emergencies

The Energy Policy and Conservation Act (EPCA, P.L. 94-163) authorized drawdown of the Reserve upon a finding by the President that there is a "severe energy supply interruption." By the statute, such an interruption exists when the President determines that,

1. an emergency situation exists and there is a significant reduction in supply which is of significant scope and duration;
2. a severe increase in the price of petroleum products has resulted from such emergency situation; and
3. a price increase is likely to cause a major adverse impact on the national economy.[10]

Severe Domestic Energy Supply Interruption

Congress enacted additional drawdown authority in the 1990 Energy Policy and Conservation Act Amendments (P.L. 101-383) after the Exxon Valdez oil spill, which interrupted the shipment of Alaskan oil, triggering spot shortages and price increases. The intention was to provide for an SPR drawdown under a less rigorous determination than EPCA mandated. This provision authorized the President to use the SPR for domestic energy supply shortages without having to declare a "severe energy supply interruption" or the need to meet obligations of the United States under the international energy program.[11]

Under the additional authorities in P.L. 101-383, the President can initiate a drawdown in the event of a circumstance that "constitutes, or is likely to become, a domestic or international energy supply shortage of significant scope or duration" and where "action taken ... would assist directly and significantly in preventing or reducing the adverse impact of such shortage." This authority limits SPR sales to no more than 30 million barrels over a maximum 60-day period only when the SPR inventory is above 500 million barrels.

Test Sale

By law, the Secretary of Energy must periodically evaluate SPR drawdown and sale procedures, and carry out a test drawdown and sale, or exchange of petroleum products from the reserve, up to 5 million barrels.[12] The last SPR test sale was in 2014.

SPR Sites

The SPR physically comprises four sites, two in Texas and two in Louisiana (**Figure 1**). The sites offer access to both marine terminals and pipeline systems needed for moving crude oil to and from the SPR. Each site consists of an underground salt dome (a naturally occurring geologic structure), solution-mined to create storage caverns. Stored crude oil is removed by injecting

[10] 42 U.S.C. §6241 (a).

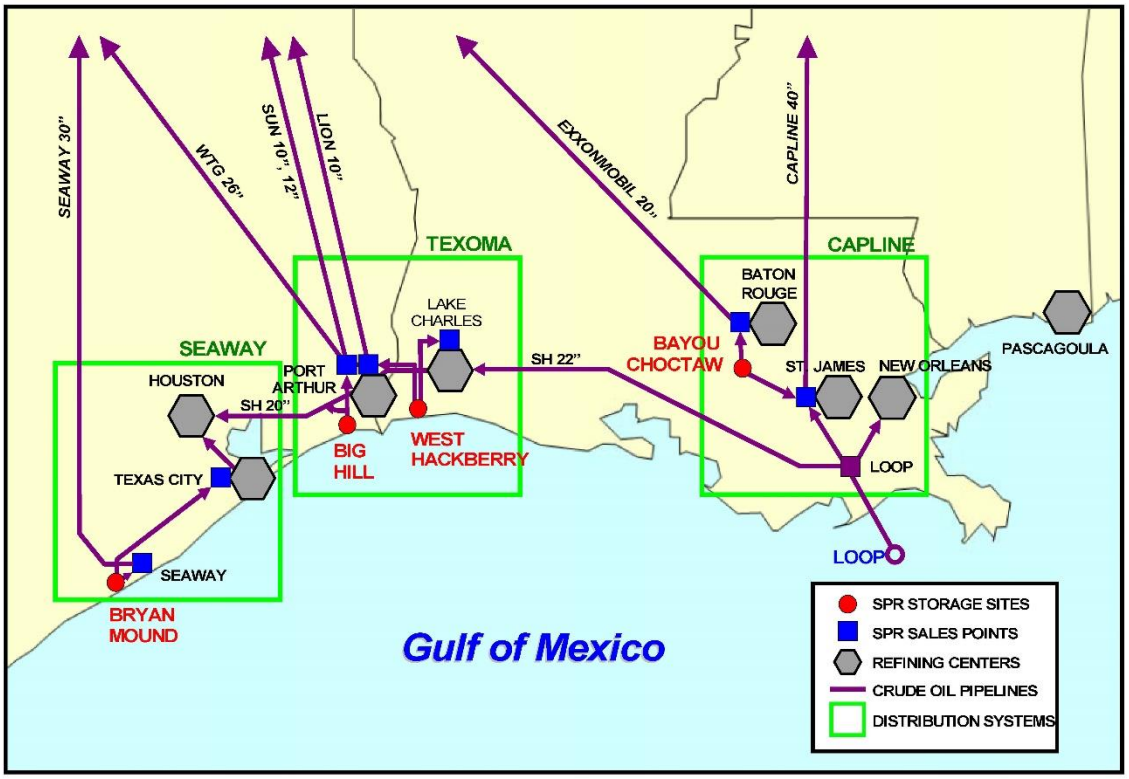
[11] 42 U.S.C. §6241 (h).

[12] 42 U.S.C. §6241 (g).

water to displace the oil. The cavern remains structurally intact as long as the stored oil remains in place. In the event of multiple sales or exchanges over time, repeated water injections will cause salt leaching and begin to compromise the structural integrity of the caverns.[13]

The SPR's storage capacity had expanded to 727 million barrels, and its inventory had reached nearly 700 million barrels before Hurricanes Katrina and Rita in 2005. Following the storms, DOE loaned some crude oil to refiners and sold some through competitive bidding. Borrowers of SPR oil were required to repay their loans "in-kind" with a premium, essentially returning a larger amount of oil than borrowed.[14] The SPR reached its maximum fill of 727 million barrels by 2010 (through royalty-in-kind acquisition) and remained at that level until the 2011 drawdown reduced the inventory to 695 million barrels.[15] The SPR currently holds the equivalent of 139 days of import protection (based on 2016 import data of 4.871 million barrels per day of net petroleum imports). **Table 1** shows the current SPR inventory level, accounting for the 30 million barrels sold in the summer of 2011.

Figure 1. Strategic Petroleum Reserve



Source: DOE Strategic petroleum Reserve Annual Report for Calendar Year 2010.

[13] Oil stored at a fifth SPR site, Weeks Island, LA, was transferred and the site was decommissioned in 1996 because of problems with the structural integrity of the cavern unrelated to drawdown activity.

[14] Details and current levels of SPR inventory are updated regularly at http://www2.spr.doe.gov/DIR/SilverStream/Pages/pgDailyInventoryReportViewDOE_new.html.

[15] DOE Notice of Sale DE-NS96-11PO97000.

Table 1. Strategic Petroleum Reserve Inventory as of May 31, 2015
(million barrels)

Site	Sweet[a]	Sour[b]	Total[c]
Bryan Mound, Brazoria County, Texas	64.4	176.4	242.1
Big Hill, Jefferson County, Texas	67.6	94.5	162.2
West Hackberry, Cameron Parish, Louisiana	107.6	105.5	213.2
Bayou Choctaw, Iberville Parish, Louisiana	21.7	51.8	73.6
Subtotal Underground Inventory	261.3	428.2	689.5
Tanks and Pipelines	0.2	0.9	1.1
Total Inventory	261.5	429.1	690.6

Source: DOE, Strategic Petroleum Reserve Annual Report for Calendar Year 2014 minus quantities noted in DOE Notice of Sale DE-NS96-11PO97000.

Notes:

a. Sulfur content not exceeding 0.5%.
b. Sulfur content greater than 0.5%.
c. Total may not add due to rounding.

Bryan Mound

The Bryan Mound storage site is located in Brazoria County, TX, approximately three miles southwest of Freeport. The site has 20 storage caverns with a total storage capacity of 254 million barrels, and a cavern inventory of 242.1 million barrels. The Bryan Mound site began operation in 1986 and has remained operational since then.

Big Hill

The Big Hill storage site is located in Jefferson County, TX, approximately 26 miles southwest of Beaumont. The site has 14 storage caverns, a combined storage capacity of 171 million barrels, and a cavern inventory of 162.2 million barrels. The Big Hill site began full operation in 1991 and has remained operational since then.

West Hackberry

The West Hackberry storage site is located in Cameron Parish, LA, approximately 25 miles southwest of Lake Charles. The site has 22 storage caverns with a combined storage capacity of 228 million barrels, and a cavern inventory of 213.2 million barrels. The West Hackberry site began full operation in 1988 and has remained operational since then.

Bayou Choctaw

The Bayou Choctaw storage site is located in Iberville Parish, LA, approximately 12 miles southwest of Baton Rouge. The site has six storage caverns, an authorized storage capacity of 74

million barrels, and a cavern inventory of 73.6 million barrels. The Bayou Choctaw site began full operation in 1987 and has remained operational since then.

In October 2007, Bayou Choctaw's authorized cavern capacity temporarily decreased from 76 million barrels to 73.5 million barrels. Bayou Choctaw Cavern 20 had crept to within 60 feet of the salt dome's edge and required replacement due to the risk of breaching the salt dome.[16] The cavern passed all integrity tests and remains out of any immediate danger of leaking, however. To limit any risk, DOE reduced the oil stored in Cavern 20 from 7.5 million barrels to 3.2 million barrels by using only the upper portion of the cavern. DOE temporarily stored Cavern 20's oil in the Big Hill and West Hackberry caverns. Instead of physically expanding the caverns, additional storage space came from displacing the brine cushion at the bottom of the two caverns. The brine cushion helps counteract naturally occurring cavern creep that results from the salt dome's geological deformation. In November 2011, DOE acquired a 10-million-barrel replacement cavern, designated Cavern 102, in the Bayou Choctaw salt dome. The replacement cavern's development was scheduled for integration into the Bayou Choctaw system by January 2013. Cavern 102's completion will increase the site's capacity by 2.5 million barrels, replacing a 7.5 million barrel cavern with a 10 million barrel cavern.

SPR Capacity

The Energy Policy Act of 2005 (EPAct) required expansion of the SPR to a maximum physical capacity of 1 billion barrels "as expeditiously as practicable." Advocates for expansion argued that the SPR would need to be larger for the United States to be able to maintain stocks equivalent to 90 days of net imports. DOE evaluated a site in Richton, MS, as a possible location for an additional 160 million barrels of capacity. However, in FY2011, the Obama Administration cancelled SPR expansion plans, citing an Energy Information Administration projection that "U.S. petroleum consumption and dependence on imports will decline in the future and the current Reserve's projection will gradually increase to 90 days by 2025."[17]

The SPR is designed with a drawdown rate of roughly 4.4 million barrels per day for up to 90 days; thereafter, the rate would begin to decline. Drawdown is limited by the capacity of the takeaway capacity of pipelines and marine terminals servicing the SPR. The first major drawdown in early 1991 (the Persian Gulf War) confirmed SPR's operability. A life extension program, initiated in 1993, upgraded or replaced all major systems to ensure the SPR's readiness to 2025.

The SPR's current capacity is physically limited to 713.5 million barrels, with current inventory at about 691 million barrels.[18] Refilling the SPR after an ordered drawdown remains a presidential discretion, presumably at a time when the price of crude oil declines, or political and market conditions make it economically advantageous to do so.

The initial crude oil that filled the SPR came from purchases paid though appropriated funds. As an alternative to appropriated funds, DOE proposed accepting transfer of a discrete portion of the royalties payments collected by the Department of the Interior (DOI) for Gulf of Mexico oil leases in the form of royalty-in-kind (RIK) oil rather than as revenues. While RIK avoids the

[16] Personal communication with David Johnson, DOE Deputy Assistant Secretary for Petroleum Reserves, March 7, 2011.

[17] Department of Energy, "Cancellation of Supplemental Environmental Impact Statement for Ancillary Facilities for the Richton Site of the Strategic Petroleum Reserve," 76 *Federal Register* 55890, September 9, 2011.

[18] Department of Energy, "SPR Quick Facts," fill data and capacity as of April 21, 2017.

necessity of making outlays for purchasing oil, it also meant a loss of revenues in settling royalties in wet barrels rather than in cash payments to the U.S. Treasury. DOI worked out final details during late 1999 and 2001. The RIK program was used to transfer oil to the SPR to replace oil sold in the mid-1990s for deficit reduction purposes. In mid-November of 2001, President Bush ordered the SPR filled to 700 million barrels, principally through oil acquired as RIK. Between 1999 and 2009, RIK deliveries totaled roughly 162 million barrels and forgone receipts to the U.S. Treasury, an estimated $6.49 billion. In 2009, Secretary of the Interior Ken Salazar announced that he was ending the RIK program.[19]

Without the planned Richton site, even if the RIK program resumed, no additional capacity exists to store additional crude oil beyond the 727 million barrels.

SPR Releases

DOE sells SPR oil through competitive bidding. It publishes a "notice of sale" that includes the volume, characteristics, and location of the petroleum for sale; delivery dates and procedures for submitting offers; as well as measures for assuring performance and financial responsibility. Bids are reviewed by DOE and awards offered.[20] DOE estimates that oil could enter the market roughly two weeks after the appearance of a notice of sale.[21]

To date, the SPR has released over 160 million barrels for various purposes (**Table 2**). Presidents have ordered releases on three occasions, some 63 million barrels in total, in response to severe energy supply interruptions in coordination with other IEA member countries—the SPR's original intent. On 11 other occasions, DOE has lent oil (nearly 68 million barrels in total) to mitigate temporary supply interruptions. The borrowers repaid their loans by replacing the crude oil and added a small volume as a premium. On two occasions, sales generated revenue as a budget deficit reduction tool, as did the initial 1985 Weeks Island test sale.

The Clinton Administration introduced a new dimension to SPR drawdown and sale with its proposal in its FY1996 budget to sell 7 million barrels to help finance the SPR program. While agreeing that a sale of slightly more than 1% of SPR oil would not cripple U.S. emergency preparedness, some in Congress vigorously opposed the idea, in part, because it might establish a precedent that would bring about additional sales of SPR oil for purely budgetary reasons, as did indeed occur. There were three sales of SPR oil during FY1996. The first was to pay for the decommissioning of the Weeks Island site. The second was for reducing the federal budget deficit, and the third was to offset FY1997 appropriations. The total of 28.1 million barrels sold raised revenues of $544.7 million. Since then, the Obama Administration proposed selling SPR oil to reduce deficit spending in FY2011.

EPCA authorities permit "exchanges" of oil for the purpose of acquiring additional oil for the SPR. Under an exchange (also sometimes referred to as a loan), a company borrows SPR crude and later replaces it, including an additional quantity of oil as a premium for the loan. There were seven exchanges between 1996 and 2005. In June of 2006, after a temporary closure of a ship

[21] U.S. Department of the Interior, Secretary Salazar Ends Controversial Royalty in Kind Program, http://www.doi.gov/news/radioactualities/2009_09_16_actuality.cfm.

[20] 10 C.F.R. §625.

[21] See http://www.fe.doe.gov/programs/reserves/spr/spr-facts.html. For more detail on the sales procedure, see U.S. *Federal Register*, Department of Energy, *Price Competitive Sale of Strategic Petroleum Reserve Petroleum; Standard Sales Provisions: Final Rule*, July 27, 2005, pp. 39,363-39,382; available at http://www.fe.doe.gov/programs/reserves/spr/spr_rule_070705.pdf. DOE has a history of SPR drawdowns, sales, and exchanges on the web at http://www.fe.doe.gov/programs/reserves/spr/spr-drawdown.html.

channel blocked crude oil shipments to two refineries, ConocoPhillips and CITGO borrowed 750,000 barrels of sour crude from the SPR and later replaced it plus additional "premium" barrels. In fall 2008, the SPR conducted a test exchange to address shortages that resulted from damages to petroleum infrastructure from Hurricanes Gustav and Ike. Following Hurricane Isaac, 1 million barrels was exchanged with Marathon Oil due to disruptions to the commercial oil production, refining, and distribution operations in the Gulf Coast.

Some of the events precipitating major releases are discussed below.

Table 2. Strategic Petroleum Reserve History of Crude Oil Releases Summary
(sale or exchange in barrels)

Date	Purpose	Sale	Budget Deficit Reduction	Exchange
1985 - November	Test Sale After extending the Energy Policy and Conservation Act in June 1985, Congress authorized DOE to conduct test sales of up to 5 million barrels to involve the private sector in the competitive sales process.	967,000		
1990 - October	Desert Shield President George H. W. Bush ordered a 5-million-barrel test sale to "demonstrate the readiness of the [Reserve] system under real life conditions." Only 3.9 million barrels sold because of the lack of bids for one of the six types of crude oil advertised.	3,900,000		
1991 - January	Desert Storm President Bush authorized a 33.75 million barrel drawdown over a 45-day period under a coordinated emergency response plan drawn up by the International Energy Agency. DOE accepted bids from 13 companies that bid on only 17.3 million barrels of Reserve oil because industry offers for the higher-sulfur "sour" crude oil were substantially lower than bids for the lower-sulfur "sweet" crude.	17,300,000		
1996 - March	Weeks Island Sale After the site became geologically unstable, DOE decided to decommission it, and offered 5.1 million barrels for sale.	5,100,000		
1996 - April	Pipeline Blockage, Seaway Pipeline System During a pipeline blockage to Cushing, OK, ARCO paid a fee plus a future price differential for leasing the oil, and replaced the oil with an equivalent grade of crude within six months under an emergency crude oil lease exchange agreement.			900,416
1996 - May	Deficit Reduction Omnibus Consolidated Rescissions and Appropriations Act of 1996, P.L. 104-134.		12,800,000	

Date	Purpose	Sale	Budget Deficit Reduction	Exchange
1996 - October	Deficit Reduction Omnibus Consolidated Appropriations Act of 1997, P.L. 104-208.		10,200,000	
1998 - August	Maya Exchange DOE exchanged 11 million barrels of Maya crude for 8.5 million barrels of other higher value crude oil to improve the SPR's operational efficiency.			11,000,000
2000 - June	Calcasieu Ship Channel Closure DOE exchanged 500,000 barrels each with CITGO and Conoco, due to blockage of the ship channel that allowed incoming crude oil shipments to those refineries. Action taken in order to avert temporary shutdown of both refineries.			1,000,000
2000 - August	Establish NEHHOR DOE exchanged 2.8 million barrels of crude oil to pay for the first year of tank-storage and stocks for establishing a 2-million-barrel Northeast Home Heating Oil Reserve.			2,836,000
2000 - October	Exchange 2000 DOE exchanged 30 million barrels in response to concern over low distillate levels in Northeast.			30,000,000
2002 - October	Hurricane Lilli DOE exchanged 98,000 barrels with Shell Pipeline Co. to secure Capline storage tanks in advance of Hurricane Lili.			98,000
2004 - September	Hurricane Ivan DOE exchanged 5.4 million barrels of sweet crude due to disruptions in the Gulf of Mexico caused by Hurricane Ivan.			5,400,000
2005 - September	Hurricane Katrina President George W. Bush issued a Finding of a Severe Energy Supply Interruption as defined in Section 161(d) of the Energy Policy and Conservation Act (EPCA - 42 U.S.C. 6 241(d)) and directed DOE to offer 15 million barrels of sweet crude and 15 million barrels of sour crude as part of an IEA coordinated effort. 10.8 million barrels of sweet crude and 200,000 barrels of sour crude sold.	11,000,000		9,800,000
2006 - January	Barge Accident, Sabine Neches Ship Channel DOE exchanged 767,000 barrels of sour crude with Total Petrochemicals USA due to closure of the Sabine Neches ship channel to deep-draft vessels after a barge accident in the channel. Action was taken to avert temporary shutdown of the refinery.			767,000

Date	Purpose	Sale	Budget Deficit Reduction	Exchange
2006 - June	Calcasieu Ship Channel Closure DOE exchanged 750,000 barrels of sour crude with ConocoPhillips and Citgo due to the closure for several days of the Calcasieu Ship Channel to maritime traffic. The closure resulted from the release of a mixture of storm water and oil. Action was taken to avert temporary shutdown of both refineries.			750,000
2008 - September	Hurricanes Gustav and Ike Following Hurricanes Gustav and Ike, DOE loaned nearly 5.4 million barrels to Marathon, Placid, ConocoPhillips, Citgo, and Alon USA after their supplies had been cut off due to shutdown of the petroleum industry in the Gulf region. The companies repaid the loans with a premium of 93,350 barrels.			5,389,000
2011 - July	IEA Coordinated Release President Obama issued a Finding of a Severe Energy Supply Interruption and directed DOE to offer 30 million barrels of sweet crude as part of an IEA coordinated effort to offset Libya's production curtailment.	30,640,000		
2012 - September	Following Hurricane Isaac, 1 million barrels was exchanged with Marathon Oil due to disruptions to the commercial oil production, refining, and distribution operations in the Gulf Coast.			1,000,000
2014 - March	Test sale of 5 million barrels.	5,000,000		
Total to date		73,907,000	23,640,000	68,940,416

Source: U.S. DOE, http://fossil.energy.gov/programs/reserves/spr/spr-drawdown.html.

Notes: Barrels rounded to thousands.

1990-1991 Severe Energy Supply Interruption—Desert Storm Desert Shield

In the aftermath of the Iraqi invasion of Kuwait on August 2, 1990, escalating gasoline prices and the prospect of a worldwide crude shortfall (approaching 4.5 million-5.0 million barrels daily) prompted calls for an SPR drawdown. The debate focused on whether SPR oil should be used to moderate anticipated price increases, before oil supply problems had become physically evident.

The George H. W. Bush Administration indicated that it would not draw down the SPR in the absence of a physical shortage simply to lower prices. On the other hand, some argued that a perceived shortage does as much immediate damage as a real one, and that flooding the market with stockpiled oil to calm markets is a desirable end in itself. From this perspective, the best opportunity to use the SPR came during the first months of the crisis, which some argued the Administration squandered. It became clear during the fall of 1990 that in a decontrolled market,

physical shortages are less likely to occur. Instead, an expression of supply shortages comes in the form of higher prices, as purchasers are free to bid as high as they wish to secure scarce supply.

Within hours of the first air strike against Iraq in January 1991, the White House announced that President Bush was authorizing a drawdown of the SPR, and the IEA activated the plan on January 17. Crude prices plummeted by nearly $10/barrel in the next day's trading, falling below $20/bbl for the first time since the original invasion. Oil analysts attributed the price drop to optimistic reports about the allied forces' crippling Iraqi air power and the diminished likelihood, despite the outbreak of war, of further jeopardy to world oil supply. There appeared to be no need for the IEA plan and the SPR drawdown to help settle markets, and there was some criticism of it. DOE offered more than 30 million barrels of SPR oil for bid, but only accepted bids on 17.3 million barrels. Successful bidders took oil delivery in early 1991.

The Persian Gulf War drawdown provided an important example about ways to maximize the SPR's usefulness in decontrolled markets. Legislation enacted during the 101st Congress (P.L. 101-383), as previously noted, had expanded SPR drawdown authority by allowing its use in preventing minor or regional shortages from escalating into larger ones; for example, the shortages on the West Coast and price jump that followed the Alaskan oil spill of March 1989. In the 102nd Congress, omnibus energy legislation (H.R. 776, P.L. 102-486) broadened the drawdown authority further to include instances where a reduction in supply appeared sufficiently severe to bring about an increase in the price of petroleum likely to "cause a major adverse impact on the national economy."

2005 Severe Domestic Energy Supply Interruptions—Hurricanes Katrina and Rita

Prior to 2005, growth in worldwide oil demand had begun to constrain U.S. refinery production, particularly as the demand for gasoline and refined products increased with an expanding economy. Hurricane Katrina followed by Hurricane Rita had severe and far-reaching effects on the U.S. petroleum. Each approaching hurricane caused production facilities in the Gulf of Mexico to shut down. The operations of the refining and distribution systems were interrupted once the hurricanes made landfall. Within two days of the devastation, DOE approved emergency loans of 9.8 million barrels of crude oil from the SPR to refineries whose supplies had been cut. The EIA then announced that its member countries had agreed to a coordinated emergency response to make 60 million barrels of crude oil and refined products available to help mitigate the disruptions in the flow of oil worldwide. DOE offered 30 million barrels for sale and executed sales contracts for 11 million barrels. Together with the loans, the SPR released 20.8 million barrels. The other EIA member countries released 8.8 million barrels of crude oil and 18.53 million barrels of refined petroleum products, for a total 27.33 million barrels, into the market. The EIA-released refined products, in particular, benefited the East Coast, which normally depended on Gulf Coast refineries. Receipts to the U.S. Treasury SPR Petroleum Account for 11 million barrels sold totaled $615.3 million. The 9.8 million barrels loaned to the petroleum industry were repaid to the SPR along with 500,000 additional premium barrels.

2011 IEA Coordinated Release in Response to Libyan Crude Oil Curtailment

In its FY2012 Budget Request, the Obama Administration had proposed a $500 million sale of petroleum from the SPR, proposed for completion by March 1, 2012, for deposit in the General

Fund of the Treasury. The House voted to approve the $500 million sale (H.R. 2354, 112th Congress) provided that the quantity sold would be replaced during FY2012 under paragraph (a)(1) or (3) of Section 160 of the Energy Policy and Conservation Act (42 U.S.C 6240 (a)(1) or (3)), which authorizes acquisition of crude oil produced from federal lands, or through purchase or exchange, respectively.

However, political unrest that began in Tunisia and spread to Egypt and Libya in early 2011 had led to the surge in oil prices observed during the first quarter of the year. To offset the loss of Libyan exports, calm markets, and to moderate prices, some in Congress called for releasing oil from the SPR. Some reasoned that an oil release from the SPR would dampen speculative bidding that was driving the market, and would reduce prices in the short run.

By early March 2011, the price of West Texas Intermediate (a light sweet crude) traded on the New York Mercantile Exchange (NYMEX) exceeded $100 per barrel. In Europe, the price of Brent crude oil (a heavier and higher in sulfur crude than WTI) exceeded $115 per barrel. These prices (approximately 20% higher than before the outbreak of political unrest) reflected at least two important factors: first, expectations that the unrest could spread to other countries (some of which could be major oil producers), and second, an actual curtailment of Libyan exports (to an uncertain extent and for an unknown duration). As an offset to the lost Libyan crude exports, Saudi Arabia indicated that it would expand its exports to keep the world market supplied.

On June 23, 2011, the International Energy Agency (IEA) announced that its 28 member countries would release 60 million barrels of crude oil and refined products into the global market. As part of that action, the President directed a drawdown of the SPR to meet the U.S. response obligations for 30 million barrels, and DOE issued a Notice of Sale that same day. On June 24, 2011, DOE opened its web-based Crude Oil Sales Offer System for a five-day sale of 30.237 million barrels of light, sweet crude oil at a bid reference price of $112.78 a barrel.[22] DOE received more than 90 offers for SPR crude oil, and awarded 28 contracts to sell 30.64 million barrels of crude oil at an average price of $107.21 per barrel. The oil was sold from the Bryan Mound and Big Hill sites in Texas, and the West Hackberry, LA, site.

2014 Test Sale

The Secretary of Energy, under Section 161(g) of the Energy Policy and Conservation Act, authorized a test sale of 5 MMb to test drawdown and sales procedures at the TEXOMA facilities. The sale's purpose was to test procedures currently in place in light of the changes in domestic crude oil production, increased imports from Canada, and changes in the domestic crude oil distribution network. The test sale showed that while five oil companies contracted to purchase the available oil, infrastructure issues on the SPR and private sector sides of the transaction needed to be addressed.[23]

The oil from the test sale was sold at a weighted average price of $93.75 per barrel, against an average price paid for oil in the reserve of $29.70 per barrel. Replacement of the test sale oil

[22] The bid reference price is determined by the average five-day price of Louisiana Light Sweet Crude oil traded prior to the Notice of Sale. Offers are submitted against the price and, as the sale progresses, bids will reflect market conditions. Under the terms of the SPR's Standard Sales Provisions, final prices are not determined until delivery to purchaser has been completed.

[23] Department of Energy, "Strategic Petroleum Reserve Test Sale, March, 2014, Report to Congress," November 2014, pp. 16-19.

began in May 2015 and was completed by July 31, 2015. When DOE announced the re-purchase plan, oil was trading at about $45 per barrel.

Other Policy Considerations

In a market where there is no physical shortage, oil companies may have limited interest in purchasing SPR oil unless they have spare refining capacity to turn the crude into useful products, or want to build crude oil stocks.[24] The U.S. government bases its notice of sale on the previous five-day average of the price of the grade of crude oil it intends to sell, and accepts bids it considers responsive. If the notice itself does not prompt, or contribute to, a softening of prices, there may be limited interest on the part of the oil industry in bidding on SPR supply. Although the possibility exists that prices might decline if additional refined product is released into the market, it is impossible to predict what quantitative effect an SPR crude drawdown would have. For example, following the June 23, 2011, announcement of a 30 million barrel release of oil from the SPR, daily oil prices briefly declined from $94.96 per barrel to $90.70, and then returned to their previous levels within a week.

There are additional considerations. A unilateral drawdown on U.S. strategic stocks would probably have less impact on the world oil market than a coordinated international drawdown of the sort that occurred after the 2011 release to meet IEA obligations vis-à-vis Libya's production curtailment. Some might argue that it would be unwise under any scenario for the United States to draw down its strategic stocks while other nations continue to hold theirs at current levels. Additionally, it is always possible that producing nations will reduce production to offset any SPR oil delivered into the market. In 2017, some might argue that the market is already well-supplied and that short-term supply concerns are not affecting prices, but market conditions and current and anticipated geopolitical events are affecting prices. Others argue that the oil commodity futures market is behind speculative bidding that has driven prices.

Some have perceived the SPR as a defensive policy tool against high oil prices. If an SPR release has no discernible impact on oil prices, it is possible that the SPR will lose some of whatever psychological advantage it exercises on prices when left as an untapped option.

Refining Capacity vs. Crude Supply

While the number of U.S. refineries that process crude oil into fuels has decreased over the last decade, refining capacity has increased somewhat. In 2016, the EIA reported 141 refineries operating with over 18 million barrels per day in capacity (this includes three refinery complexes each made up of two formerly independent refineries). Some 55 refineries have coking processes for converting petroleum resid to higher value products. The Gulf Coast region (Petroleum Administration for Defense District 3) makes up nearly 45% of the U.S. refining capacity, with 57 refineries processing more than 9.0 million barrels per day. The region also has the highest concentration of coking refineries.

Over the last 25 years, the API gravity of imported crude oils had been decreasing, while average sulfur content had been increasing. API gravity, a measure developed by the American Petroleum Institute, expresses the "lightness" or "heaviness" of crude oils on an inverted scale. With a

[24] Refining capacity utilization rates are 83.7% for the first quarter of 2012, about 1.3% higher than the same period in 2011 taking into account seasonal maintenance and other events that will take refinery units offline temporarily. See Table 2 at http://www.eia.doe.gov/oil_gas/petroleum/data_publications/weekly_petroleum_status_report/wpsr.html.

diminishing supply of light, sweet (low sulfur) crude oil until relatively recently, U.S. refineries had to add coking capacity to convert lower-priced heavier, sour crude oils to high-value products such as gasoline, diesel, and jet fuel. More recently the problem has become how to effectively integrate growing production of LTO into the refinery input stream.

The Government Accountability Office (GAO) observed in 2006 that 40% of the crude oil refined by U.S. refineries was heavier than that stored in the SPR, and that the proportion of stored crude oil grades was not as compatible as it could be with refineries that had been moving towards heavier grades of crude oils.[25] Based on a 2005 SPR crude oil compatibility study, DOE agreed that the SPR could store a small percentage of heavy crude to satisfy the short-term needs of a few refineries in the event of a supply disruption. However, DOE argued, the current mix of crudes was compatible for use in the majority of refineries, and suggested considering the addition of heavy crude for any future expansion of the SPR.[26]

Refineries that process heavy oil cannot, in general, operate at normal capacity if they run lighter oils. Refiners reported to the GAO that running lighter crude in units designed to handle heavy crudes could impose as much as an 11% penalty in gasoline production and 35% in diesel production. The agency reported that other refiners indicated that they might have to shut down some of their units. The types of oil currently stored in the SPR would not be fully compatible with 36 of the 74 refineries considered vulnerable to supply disruptions. (A majority of the refineries that have pipeline access to the SPR are located in the Gulf Coast region and the Midwest region.) GAO cited a DOE estimate that U.S. refining throughput would decrease by 735,000 barrels per day (or 5% of total U.S. refining capacity) if the 36 refineries had to use SPR oil—a substantial reduction in the SPR's effectiveness during an oil disruption, especially if the disruption involved heavy oil.

In response to the 2006 GAO report, DOE agreed to consider storing heavy crudes if an opportunity were to occur through expansion. However, the expansion plans were cancelled in 2011. In addition, since 2006, the SPR updated its crude compatibility study and concluded in its 2010 report that storing heavy crude in the SPR would not provide a net benefit in the event of a supply disruption.[27]

As of late, however, light sweet crude production has increased in the United States. Unconventional resources such as the Bakken, Utica, and Eagle Ford shales are producing crude oils comparable to West Texas Intermediate (WTI), the benchmark for light sweet crude oil. Producers have also returned to the Texas Permian Basin, the historic source of WTI. The increasing supply of lower-priced light sweet crude oil has begun to edge out heavier crude oils in supplying U.S. refineries. Some refineries are bypassing their coking units to run the lighter crudes given the economic advantage that these lower-priced crudes offer.

Gasoline Price Increases

In recent years, increases in the price of gasoline have been tied to calls for the release of reserves from the SPR. For example, over the first two months of 2012, retail gasoline prices increased by over 15%. The price of gasoline rose from an average of $3.21 per gallon in late December 2011

[25] U.S. Government Accountability Office, *Strategic Petroleum Reserve—Options to Improve the Cost-Effectiveness of Filling the Reserve*, GAO-08-512T, February 26, 2008, http://www.gao.gov/new.items/d08521t.pdf.

[26] Personal communication with Diana Greenhalgh, DOE SPR Program, April 18, 2012.

[27] Office of Deputy Assistant Secretary for Petroleum Reserves, *Strategic Petroleum Reserve Updated Crude Compatibility Study*, Department of Energy, April 2010.

to $3.64 in late February. Prices continued to go up, rising to a U.S. average of $3.92 per gallon as of March 26.[28] With these higher prices came calls for, and against, the release of crude oil from the SPR as a way to control price increases.

Although there is a general recognition that a release from the SPR would likely only provide temporary relief from rising prices, some view it as a signal to the market that a continuing spiral of prices would be met by resolve and policy action by the United States.

The judgment that a release of crude oil from the SPR provides only temporary relief from rising prices seems well founded. On June 23, 2011, when gasoline prices were at $3.60 a gallon, President Obama announced a 30 million barrel release from the SPR under IEA obligation. The price of gasoline declined by about 2% over the next two weeks following the SPR release announcement, but by July 8, 2011, the price had again reached $3.61 per gallon, approximately the same level as before the release. Gasoline prices continued to rise through the first week of August, before declining later that month. Gasoline prices averaged about $3.60 per gallon in August 2011, declining to $3.40 per gallon in October and $3.21 per gallon in December. The gasoline price reductions in the fourth quarter of 2011 were likely related to the reductions in crude oil prices between August and October 2011, in light of the lag between acquiring title to crude oil and the oil becoming available as retail gasoline, as well as refineries switching production from summer to winter grade gasoline.

Crude oil prices also responded immediately to the release of oil from the SPR. The price of oil was $94.96 per barrel on June 22, 2011.[29] On June 23, the day President Obama announced the SPR release, the price fell to $90.70 per barrel. By June 30, 2011, the price had risen to $95.73 per barrel, exceeding the price before the announcement. The initial market response to the SPR release lasted about one week. However, the announcement of the SPR release promised to deliver the oil to market by the end of August. The price of oil began to decline in August 2011 and generally declined during August and September, until reaching $75.40 per barrel on October 4, 2011. Thereafter, prices began to rise, exceeding $100 per barrel later in the year.[30]

The gasoline price increases of 2012, like virtually all previous price increases, resulted from an increase in the price of crude oil. Crude oil price increases generally result from actual or anticipated market tightening, that is, an increase in demand, a reduction in supply, or both. For example, many viewed the price increases of 2008 as related to the rapid expansion of petroleum demand in China, India, and other emerging markets. In 2011, the price increases were thought to be largely attributable to the loss of Libyan production during the revolution in that country. In 2012, although there were some reductions in supply due to instability in South Sudan, Yemen, and other areas, the primary driver of higher prices seem to be tensions with Iran and related policy responses by both sides in the controversy over Iranian nuclear capability.

This environment, where current supplies are uninterrupted but speculation concerning future availability is active, may appear to some observers to be a situation that a release from the SPR would do little to mitigate. For example, if Iranian military action succeeded in blocking the Strait of Hormuz, it would prevent over 17 million barrels per day of crude oil from reaching the market. This quantity is almost four times the size of the maximum drawdown capability of

[28] Gasoline prices in this section are for Energy Information Administration, conventional regular gasoline. Available at http://www.eia.doe.gov.

[29] The price of crude oil used in this section is the West Texas Intermediate spot price. The data are available at http://www.eia.doe.gov.

[30] Definitive conclusions concerning the relationship between the release of oil from the SPR, changes in the price of oil, and changes in the price of gasoline are imprecise. Many other factors may have also affected the prices during the period, either reinforcing or moderating the effect of the SPR release.

the SPR, if acting alone. However, an event of such size would almost certainly trigger an international response and a coordinated release of crude oil and products from the United States as well as the 27 other IEA member countries.

The Future of U.S. Imports of Crude Oil

The ability of the SPR to supplement the domestic U.S. supply of crude oil and effectively replace imports depends on the size of the reserve as well as its drawdown capabilities. Its effectiveness also depends on the volume of U.S. imports and the rate of U.S. consumption.

Crude oil imports are the difference between U.S. demand and domestic production. If either demand falls, or domestic production rises, the need for imports declines. Because of a number of factors, some temporary, including the recession, high prices, and conservation, U.S. consumption of petroleum products has declined since 2005 by about 9.5%. This decline in consumption has reduced the demand for crude oil. Over the same period, U.S. production of crude oil increased from 5.18 million b/d to 5.67 million b/d, an increase of 9.5%. The combination of falling consumption and increasing production has reduced the share of imports in total consumption from 49% in 2005 to about 25% in 2016. In addition, Canada increasingly provides the United States with crude oil imports, and arguably represents a secure source of supply.

If recent trends continue, the United States will rely less on crude oil imports. Consequently, the SPR, even if its capacity and contents remain fixed, may be better able to meet U.S. requirements in times of supply shortage on the world market.

Use of the SPR as a Funding Instrument

Since 2015, several laws were passed by the 114th Congress which required the sale of oil from the SPR, with the proceeds to be used largely for program funding. The Bipartisan Budget Act of 2015 (P.L. 114-74) authorized the sale of 58 million barrels of oil from the SPR over the period FY2017 through 2025. In addition to sales revenues to be deposited in the U.S. Treasury, $2 billion is to be used to modernize and maintain SPR facilities. The 21st Century Cures Act (P.L. 114-256) authorizes the sale of 25 million barrels of SPR oil from FY2017 through FY2019 for a variety of health-related uses. The Fixing American Surface Transportation Act (P.L. 114-94) authorized the sale of 66 million barrels of SPR oil from FY2023 through FY2015 to supplement highway and transit programs.

Because the SPR sales authorized by this legislation are specified in millions of barrels, it does not guarantee a value of revenue for program funding. The price of oil can change rapidly, yielding potentially large swings in sale proceeds.

In total, this legislation will reduce the inventory of the SPR by some 149 million barrels by 2025, a reduction of about 21%. All of this legislation includes restrictions to prevent a fall in SPR balances below the 90-day net import coverage level consistent with U.S. IEA obligations. The SPR balance consistent with the 90-day net import coverage value could change for a variety of reasons. Factors that could lead to reduced SPR inventories include reduced U.S. petroleum imports, which itself could be linked to increased U.S. petroleum production, or reduced consumption, or increased petroleum exports. If these factors were reversed, the required SPR balance would increase. While it is likely the petroleum position of the United States will remain favorable and might well improve, rapid changes and volatility have characterized oil markets in the past.

Author Contact Information

(name redacted)
Specialist in Energy Economics
/redacted/@crs.loc.gov, ...