USAWC STRATEGY RESEARCH PROJECT

THE U.S. STRATEGIC PETROLEUM RESERVE: NEEDED CHANGES TO COUNTER TODAY'S THREATS TO ENERGY SECURITY

by

Commander Bruce L. Peck Jr.
United States Navy

Captain Albert F. Lord
Project Adviser

This SRP is submitted in partial fulfillment of the requirements of the Master of Strategic Studies Degree. The U.S. Army War College is accredited by the Commission on Higher Education of the Middle States Association of Colleges and Schools, 3624 Market Street, Philadelphia, PA 19104, (215) 662-5606. The Commission on Higher Education is an institutional accrediting agency recognized by the U.S. Secretary of Education and the Council for Higher Education Accreditation.

The views expressed in this student academic research paper are those of the author and do not reflect the official policy or position of the Department of the Army, Department of Defense, or the U.S. Government.

U.S. Army War College
CARLISLE BARRACKS, PENNSYLVANIA 17013

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
15 MAR 2006		**00-00-2005 to 00-00-2006**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
U.S. Strategic Petroleum Reserve Needed Changes to Counter Today's Threats to Energy Security	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
Bruce Peck	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
U.S. Army War College,Carlisle Barracks,Carlisle,PA,17013-5050	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT
See attached.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**		**22**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

ABSTRACT

AUTHOR:	Commander Bruce L. Peck Jr.
TITLE:	The U.S. Strategic Petroleum Reserve: Needed Changes to Counter Today's Threats to Energy Security
FORMAT:	Strategy Research Project
DATE:	03 March 2006 WORD COUNT: 7183 PAGES: 22
KEY TERMS:	Oil Supply and Policy
CLASSIFICATION:	Unclassified

The Strategic Petroleum Reserve (SPR) of the United States is critical to its national security because of the nation's reliance on oil and refined petroleum products as the cornerstone of its economic and military power. The purpose of the SPR is to provide protection against disruption of the United States' oil supply in times of war, crisis, or natural catastrophe. However, conditions have changed since the SPR was formed that make it increasingly unable to provide the protection required to keep it strategically relevant. The SPR has several limitations that significantly limit its ability to protect against disruptions in petroleum supply, including its location and geography, capacity, composition, and glaring vulnerabilities in United States petroleum supply infrastructure. This paper, based on research and personal observation, asks and answers relevant questions regarding the SPR and concludes with the author's recommendations on how the United States' policy on its SPR should change to meet national security objectives- in the context of today's challenges and those predicted for the future- in order to keep the SPR strategically valuable and relevant until it may be no longer needed.

THE U.S. STRATEGIC PETROLEUM RESERVE: NEEDED CHANGES TO COUNTER TODAY'S THREATS TO ENERGY SECURITY

The United States' dependence on imported crude oil and imported refined petroleum products, particularly gasoline, is a strategic "Achilles Heel." A strike in this weak spot either accidentally through environmental conditions such as extreme weather, intentionally by human means in the form of a political act or a terrorist attack, or a well timed combination of both-would leave the U.S. very vulnerable to extreme disruption of its economy. In order to ensure a steady and reliable short term supply of oil within the United States in the event of internal disruptions or disruptions from our foreign suppliers, the United States, as part of its National Strategy regarding energy, has developed and maintains the largest reserve of crude oil in the world, known as the Strategic Petroleum Reserve (SPR). Although developing and maintaining a large, easily accessed reserve of crude oil has sufficed to meet past strategic needs, recent events in the United States and significant changes in its oil producing and refining capacity within the last 10 years suggest that the SPR, in its present form and capacity, is not sufficient to meet the current and future strategic needs of the United States. Specifically, the SPR's concentrated location along the Gulf Coast, its inability to directly send oil to all refining areas in the United States, strategic vulnerabilities in its existing distribution pipelines, its size and limited pumping capacity, and the absence of refined fuels as part of the SPR all combine to make the SPR increasingly unable to protect the United States from major disruptions in oil supply.

The importance of crude oil and refined petroleum products, like gasoline, diesel fuel, and aviation jet fuel, to the National Security of the United States cannot be overstated. The reliable and steady supply of these products is the cornerstone of the U.S. economy. They are absolutely essential to the ability of the U.S. Government and its elements that provide the foundations of national power, especially the military, to perform on a day-to-day basis at the required high level of performance that allows the U.S. to maintain its position as a world economic, military, and political leader. A quote from Robert E. Ebel, Chairman of the Center for Strategic and International Studies Energy Program, clearly states this point:

> First, as recognized by a wide range of officials ranging from President Bush and Alan Greenspan to Prince 'Abd Allah and President Chavez – energy (referring to petroleum specifically) is a strategic commodity. It is the lifeblood of our economic wellbeing, fuels the troops that protect our homeland, provides essential services in growing our crops, heating and lighting our homes, transporting goods to market, moving local regional, national and international commerce, making information transfer via the internet possible, and providing us with the quality of life and mobility that we have come to enjoy and expect.[1]

How severe could a major disruption in oil supply be to the United States? A global oil supply crisis simulation exercise, called "Oil Shockwave", was conducted in June, 2005 by the National Commission on Energy Policy and the non-profit group Securing America's Future Energy (SAFE). Participating in the event were nine former White House Cabinet and senior national security officials, acting as a mock White House Cabinet in order to advise the President regarding a simulated seven month oil crisis. The results were significant. The scenario for the exercise involved a combination of political unrest in Nigeria (the 8th largest supplier of oil to global markets and the 5th largest supplier of imported oil to the United States) resulting in a production loss of 800,000 barrels per day (b/d), a terrorist attack on the Haradh Natural Gas Facility in Saudi Arabia and a failed attack on Ras Tanura in Saudi Arabia, the world's largest oil port, both resulting in a decrease of 200,000 b/d in Saudi export capacity, and a coordinated terrorist attack on oil tankers and storage tanks in the port of Valdez, Alaska, resulting in a decrease of 900,000 b/d to global supply. The net effect of this simulated scenario to the United States was a projected rise in the price of oil, at one point in the scenario, to $121 dollars per barrel and gasoline prices to $4.74 per gallon. This was estimated to result in a recession, the loss of about two million jobs, a historically significant decline in the S&P 500, and a large increase in the federal government's current accounts deficit. By the end of the scenario the theoretical price of oil rose to $161 per barrel but the potential economic effects weren't estimated because they were too far out of the range of experience for participating economists to predict, although it was agreed upon by all of them that the results would be at least on the order of a severe recession or worse.[2]

Although this particular scenario was used for the simulation, it is pointed out in the exercise that there are virtually hundreds of other scenarios which could have the same effects. Richard M. Gates, former Director of Central Intelligence and participating in the simulation as the mock United States National Security Advisor, stated in his remarks "…the economic and national security risks of our dependence on oil- and especially on foreign oil- have reached unprecedented levels. The threat is real and urgent, requiring immediate and sustained attention at the highest levels of government." One of the key findings in the exercise report was that the SPR offered some protection against a major supply disruption, but only limited in duration and scope, and the SPR could not sustain the United States through a prolonged crisis.[3] Without changes implemented immediately, the SPR's ability to provide strategic protection will continue to decrease and leave the United States increasingly more vulnerable to the effects of attacks on its ability to receive, distribute, and refine oil, whether dealt by the hands of Mother Nature, Terrorists, or a well-timed combination of both.

Background

> The Strategic Petroleum Reserve is a large crude oil stockpile, under the control of the President of the United States. The Strategic Petroleum Reserve mission is to reduce vulnerability to economic, national security, and foreign policy consequences of supply interruptions by discouraging supply interruptions as a tool of other nations, and by adding to crude oil supplies in the United States, in the event of a disruption due to either political, military, or natural causes. The Strategic Petroleum Reserve is mandated by the Energy Policy and Conservation Act, as amended, and by the comprehensive energy plans of all Administrations since 1975 in recognition of the long term dependence of the United States on imported crude oil and petroleum products. Program Definition Mission Statement from U.S. Department of Energy Annual Report (1996) for the Strategic Petroleum Reserve [4]

The United States has recognized the need to maintain strategic petroleum reserves since the beginning of the 20th century. In the early 1900's, a series of executive orders set aside a number of oil and oil shale bearing properties owned by the United States Government, originally to ensure that a reserve supply of crude oil was available to provide fuel for U.S. naval vessels in the event of a supply shortage or an emergency. Secretary of the Interior Harold Ickes, in 1944, promoted the stockpiling of already-produced crude oil. President Truman's Minerals Policy Commission proposed a strategic oil supply in 1952 and, after the Suez Crisis in 1956, President Eisenhower also advocated for a strategic oil reserve. The push for a reserve continued in 1970 from the Cabinet Task Force on Oil Import Control. The formal requirement for the SPR was established in December, 1975, when President Gerald Ford signed the Energy Policy and Conservation Act, which declared it U.S. policy to establish a crude oil reserve of up to one billion barrels. The SPR was established as the U.S.' strategic answer to the Arab Oil Embargo in 1973 and early 1974, when many Arab countries led primarily by Saudi Arabia, stopped shipping oil to the U.S. in retribution for U.S. support of Israel during the Arab – Israeli Yom Kippur War.[5] The embargo had severe strategic effects on the United States, doubling the real price of crude oil at the refinery level, creating massive shortages of fuel, and driving the economies of the United States and the rest of the world deeper into a recession that had already begun. The United States has strategically used the SPR twice since its formation. In January, 1991, President George H.W. Bush authorized the release of 33.8 million barrels of oil from the SPR as part of a coordinated international effort to dampen supply decreases and price hikes during the Persian Gulf War. And in September 2005, President George W. Bush authorized 9 million barrels in emergency loans and ordered the sale of 11 million barrels of SPR crude oil in response to the disruption in Gulf Coast oil production caused by Hurricane Katrina.[6]

The U.S. Strategic Petroleum Reserve is located at four sites along the Gulf of Mexico, two in East Texas, and two in Louisiana. Bryan Mound near Freeport, Texas, is the largest of the storage sites and can hold 226 million barrels of oil. Big Hill, near Winnie, Texas, is the newest site and holds up to 160 million barrels. West Hackberry, located southwest of Lake Charles, Louisiana, can hold up to 219 barrels, and Bayou Choctaw, located southwest of Baton Rouge has a capacity of 72 million barrels. The oil at these locations is stored in numerous underground salt caverns that have been developed at each site and allow large quantities of oil to be securely stored in the ground without worry of leakage, primarily due to the non-porous nature of the salt domes from which the caverns were formed. This area of the Gulf Coast was chosen not only for the many salt domes that existed along its reach but also for its close proximity to the large number of refineries and distribution points for tankers, barges, and pipelines that existed in the region.[7] The total capacity of the SPR, including its four main storage sites and some above ground storage capacity at a federal pumping station in Louisiana, is 727 million barrels, and the inventory of the SPR as of the end of November 2005 was 685.6 million barrels of unrefined crude oil. Although additions to the SPR temporarily stopped during and just after Hurricane Katrina, the Department of Energy has planned additions of about two million barrels a month beginning in March 2006. This is in accordance with the President's direction to the Energy Secretary in 2001 to fill the SPR to capacity.

Vulnerability

> Mark my words, with everything that is going on in this world with regards to terrorism, sooner or later the terrorist is going to try to sink a tanker in the Strait of Hormuz, and when that occurs, and that free flow of oil out of the Persian Gulf ends, you're going to have another great energy crisis.
>
> —Senator Bill Nelson (D-Florida) Dec 6, 2001[8]

In order to function at the level it now does, the United States absolutely relies on the uninterrupted supply and distribution of the more than 20 million barrels of oil and petroleum products a day it consumes. The Al Qaeda attack on the Ab Qaiq Oil Refinery complex in Saudi Arabia on February 24, 2006 is clear evidence that Al Qaeda is intent on hurting the west economically by interrupting the flow of oil to American, European, and Asian markets. Al-Qaeda leaders have vowed numerous times to cut the "economic lifelines" of the world's industrialized societies. Such attacks would not only disrupt life in the west and around the world but also weaken and perhaps topple Arabian Gulf oil monarchies heavily dependent on oil revenues for their survival.[9] The United States faces numerous threats, both environmental and increasingly more human based from terrorist or political action, to maintaining the necessary

supply of imported and domestically produced crude oil and imported and domestically refined petroleum products it needs to survive economically and maintain its position as the great world power that it is. Getting oil from the well to the refinery requires a complex transportation and storage system. Millions of barrels of oil are transported every day in tankers, pipelines, and trucks. This transportation system has always been the "soft underbelly" of the oil industry but it has become even more so since the emergence of global terrorism.

The United States relies on imported crude oil for about two-thirds of its daily requirements. Eighty-three percent of its imported oil is received by tanker shipment from overseas. Oil tankers are used to ship 68 percent of the world's oil supply. One-third of that is transported by Very Large Crude Carriers (VLCC) and Ultra Large Crude Carriers (ULCC), also called "Supertankers," which have a capacity that can vary from two million to more than four million barrels of oil. To reach foreign ports with their oil, tankers may be required to transit through one or more narrow straits -- the entrances to the Red Sea (Bab-el-Mandeb), the Persian Gulf (Strait of Hormuz), the Straits of Malacca between Indonesia and Malaysia, the Straits of Gibraltar while entering or exiting the Mediterranean Sea, the Suez or Panama Canal, or several other geographically limited transit points. Several of these critical passages border countries where Al Qaeda and other terrorist organizations are known to operate. Tankers, especially VLCC's and ULCC's, have very limited maneuverability and are very susceptible to attack. Terror organizations have planned attacks against tankers in the Arabian Gulf and the Horn of Africa, and successfully attacked a French tanker off of Yemen in 2002. Attacks on British and American tankers passing through the Strait of Gibraltar were thwarted by the Moroccan Government in 2002. And according to FBI Director Robert Mueller, many other attacks on tankers have been thwarted as well. A burning tanker or large oil slick resulting from an attack on one or more tanker could easily shut down passage through one of these key chokepoints and disrupt United States, as well as world, oil supply significantly for several weeks or longer.[10] The United States' imported oil supply is also vulnerable to political disruption or unrest in the countries it originates from. Although its largest quantities of imported crude oil are received from Canada and Mexico, which are steady and reliable trading partners, about one-third of its supply comes from Saudi Arabia, Nigeria, and Venezuela. Saudi Arabia has had attempted terror attacks on its pipelines and oil infrastructure. Nigeria suffers extreme civil unrest that could significantly affect its ability to produce and export oil. And Venezuelan President Hugo Chavez continues to escalate his hard-line anti-American rhetoric. Because Venezuela's oil industry is nationalized, his actions could limit future oil exports to the United States.

Another significant threat to United States crude oil supply is the risk involved in its required movement of about 10 million b/d of crude oil from off-shore to on-shore, in order to get it into the distribution network and to refineries. About 1.6 million b/d is actually produced off the coastline, the majority in the Gulf of Mexico and also some off the coast of California. The other 8.4 million b/d is imported by tanker and moved into ports and receiving facilities.[11] Oil produced off-shore is transported to shore facilities via underwater pipeline and transfer stations. Oil brought to the United States via tanker is off-loaded in several ways. Smaller tankers are usually able to sail all the way into a port and unload oil pier side, directly into the distribution pipeline or onto barges or smaller ships for further transport. However, large tankers, particularly VLCC's and ULCC's, only have two ways to transfer their oil to shore. The first way is to transfer the oil off-shore first into smaller, U.S. owned and built, tankers that subsequently bring it into port and discharge it pier side. The other way is via the Louisiana Offshore Oil Port, also known as the LOOP. Located in the Gulf of Mexico about 18 miles south of Grand Isle, Louisiana, in about 110 feet of water, the LOOP is the only facility in the United States that can directly offload oil from VLCC's and ULCC's. It is connected to its shore pumping and storage facility 25 miles inland via a 48 inch pipe, and is subsequently connected to more than 50 percent of the United States' refinery capacity. The LOOP's onshore facility is also the terminus of the MARS pipeline system, which delivers deepwater Gulf of Mexico oil production to shore.[12] The LOOP handles the off-loading of about 1.2 million b/d, or about 13 percent of the United States oil imports. Although it does employ some security measures, the off-shore production of oil in the Gulf of Mexico and the infrastructure there used in the movement of oil, both produced and imported, from off-shore to on-shore is extremely vulnerable. Much of it is in open water or underwater and difficult to defend from a well planned terror attack. The other significant threat in this highly important region is severe weather in the form of Hurricanes. In August and early September of 2005, Hurricane Katrina shut down 91 percent of Gulf Coast off-shore oil production and about 10 percent of the nation's refining capacity. The year 2005 saw a record number of hurricanes or tropical storms form in the Atlantic and Caribbean region, and the number and intensity of storms during recent years has shown an increasing trend. Studies seem to indicate that a global weather pattern change resulting in more hurricanes is combining with slightly warmer sea surface temperatures that are believed to be creating stronger storms, both of which could have a tremendous impact on the Gulf Coast in coming years.[13]

Oil supply and movement on land in the United States is also vulnerable. Both imported and domestically produced crude oil and refined petroleum products rely on about 180,000

miles of pipeline for distribution throughout the country. Some pipelines can carry not only crude oil but refined products within the same system. The East Coast and Midwest rely on pipeline movement for 40 percent and 20 percent respectively of their refined products from Gulf Coast refineries, although only the Midwest refineries receive crude oil via pipeline from the Gulf Coast region.[14] Although most of these pipelines are underground, their sheer length alone makes them impossible to completely guard against attack. Also, the operation of pipeline systems is heavily reliant on computer control, and makes them very vulnerable to a cyber attack as well as a physical attack. Oil and gas pipelines have been a common target of terrorists outside of the United States, and federal warnings about Al Qaeda threats since September 11, 2001 have repeatedly mentioned energy infrastructure broadly and pipelines specifically as potential terror targets in the United States. In June of 2003, United States intelligence agencies warned about possible terror attack against energy facilities, including oil pipelines in the Houston area, although no attack actually occurred. To illustrate how vulnerable pipelines are and how much impact even a "minor" pipeline incident could have, note that a vandal's single gunshot penetration of the Trans-Alaska pipeline in 2001 shut down the pipeline for more than two days and caused extensive ecological damage. The 800 mile Trans-Alaska pipeline carries 17 percent of the United States' domestically produced oil from the North Slope to Valdez, Alaska, where it is loaded into tankers for transport to the lower 48 states.[15]

The bottom line is this: the threats to maintaining a sufficient and steady supply of oil and refined petroleum products to the United States are numerous, and exist from the point at which the oil comes out of the ground during production, whether in the United States or in a foreign country, all the way to and through refining and delivery of refined products to the consumer. The United States' primary hedge against these threats is its SPR. The SPR must contain the capability in its size, timeliness of supply, and its makeup of products to maintain its strategic effectiveness as the primary protector against disruption of what is certainly one of the most critical elements of the nation's strength.

Physical Limitations

Given the vulnerabilities to maintaining a steady, reliable, and sufficient source of oil and refined petroleum products, the United States' SPR has several physical characteristics that create limitations which must be addressed or fixed in order to make it strategically relevant for the future and maintain its ability to act as that primary hedge against disruptions to the nation's supply of oil. These include its concentrated location along the Gulf Coast, its inability to directly

distribute crude oil to all refining areas in the United States, its size and limited pumping capacity, and the absence of refined fuels as part of the SPR.

Location

Initially locating all of the SPR storage in salt caverns concentrated along the Texas and Louisiana Gulf Coast seemed to make sense, both economically because of pre-existing salt caverns which were initially used for storage and the relatively low cost of further salt dome development compared to construction and storage of oil in above ground tanks, and strategically because of the huge amount of United States refining capacity and oil movement infrastructure that exists in this region. However, locating all of the SPR's stocks of crude oil in this region has two major drawbacks which leave the United States extremely vulnerable to major disruption of crude oil supply. One is in the crude oil pipeline system which is relied on to transport SPR crude oil to refineries when released in an emergency. This pipeline system provides crude oil distribution to refineries throughout the Gulf Coast region and the Midwest. However, it does not provide access to any refineries in the Northeast or on the West Coast,[16] two of the most heavily populated and economically important regions in the United States. In the event of a disruption in crude oil supply where a release of SPR oil would be needed in these regions, it would have to be shipped to these areas of the country by sea via tankers, and both regions have only a couple main ports which can receive tankers and distribute oil to refineries via local pipeline or smaller ships and barges. California, which almost exclusively relies on its own refineries to supply its refined fuel needs, relies on oil imports through Long Beach for 25 percent of its crude oil requirements,[17] and the New Jersey, Delaware, and Philadelphia area refineries, which account for the large majority of refining capacity on the East Coast, rely on imported oil or domestically produced oil shipped via tanker for almost all of their crude oil needs.[18] This makes both regions very vulnerable to disruptions in port activities which could easily eliminate their ability to access SPR oil in the event of a national or global supply disruption requiring SPR release. The concentrated location of the SPR and its ability to be moved via pipeline only to the Gulf Coast and the Midwest strategically puts all of the SPR's "eggs in one basket," and assumes that in the event SPR oil is needed to offset a nationwide supply disruption, that it will be able to be loaded onto tankers and be delivered via ports on the West and Northeast Coasts, and also that it will be accessible to all the refinery capacity in the Gulf Coast and Midwest regions through the pipeline distribution network. The other main drawback to locating all of the United States' SPR storage only in the Gulf Coast region is the

vulnerability of this area to severe disruption due to extreme weather (Hurricanes), the frequency and strength of which have previously been discussed.

Size and Speed of Distribution

Another pair of glaring vulnerabilities in the SPR are the speed at which its oil can be pumped out of storage and into pipelines for distribution to refineries or port transfer into tankers, and the current size of the SPR compared to the United States' overall requirement for and reliance on imported crude oil.

The administrative timeline which occurs prior to a release of SPR oil is as quick and efficient as could be expected. Releasing oil from the SPR requires a Presidential order. Once the President has given an emergency order to offer SPR oil for sale, it takes about 13 days for the Department of Energy to solicit bids, select offers, and award contracts before oil can begin being pumped from the storage caverns into the distribution system for delivery. [19] This response time appears adequate for pre-planned draw downs of the SPR, like the release of SPR oil President George H.W. Bush ordered prior to the first Gulf War in order to decrease the impact of the war on oil prices and supply. The Secretary of Energy can also order emergency loans of SPR oil to refiners contingent on later replacement, and this process can allow oil to be released from the SPR within about 24 hours. This process occurred recently, as part of the government response to the severe interruption in Gulf Coast oil production during and immediately following Hurricane Katrina in August and September 2005.[20]

However, once authorization for SPR oil release has been given, the speed at which the oil can be delivered to refineries and the maximum quantity which can be pumped during a given amount of time limits the strategic effectiveness of the SPR. It can't provide oil fast enough to adequately respond to a rapidly occurring catastrophic event which would result in a significantly limited ability of the nation to receive and/or transport imported oil to refineries for processing. Once crude oil enters the pipeline system, it moves at between 3 and 8 miles per hour.[21] Delivery to refineries in the upper Midwest could take a week or more, and tanker deliveries to the Northeast and West Coasts even longer. Also, the maximum rate at which oil can be extracted from SPR storage is 4.4 million barrels per day for the first 90 days after which the drawdown rate begins to steadily decline until the storage caverns are empty. This rate is restricted by a combination of the process- saltwater displacement- that is used to remove oil from the SPR salt caverns and the limited number of sites (four) that SPR oil is stored.[22] Any disruption in oil supply larger than the SPR's discharge limit would limit the supply of oil available for refining.

Additionally, current demand in the United States for crude oil is about 15.2 million barrels per day. Of that amount, about 10.1 million barrels are imported.[23] Imported oil is brought into the United States either via pipeline from Canada, its biggest supplier of imported oil at about 1.7 million b/d, or it is brought from all other countries via tankers through its seaports.[24] The International Energy Agency, which has 26 member nations including the United States, Japan, United Kingdom, Korea, and almost all European countries, requires its members to hold oil reserves equal to 90 days of net imports averaged from the previous year, either in government owned stocks or a combination of government and private company inventory. [25] European countries maintain a combined reserve of approximately one billion barrels of crude oil, roughly equivalent to 90 days of total consumption, vice just imports. Japan maintains a combination of government and private company reserves for over 150 days of total consumption. And South Korea, the most recent member of the IEA, has built a 90-day stockpile of government and private reserves.[26] The SPR currently contains about 684 million barrels of oil.[27] At today's import requirements, it provides the United States with about 65 days of import protection, and the nation relies on industry held stocks to make up the difference in order to meet the 90 day IEA requirement. Even when filled to its current capacity of 727 million barrels, which President Bush has directed the Energy Secretary to do,[28] the SPR would only provide about 70 days of import protection. And United States oil import requirements are expected to increase to about 13.5 million b/d by 2030,[29] significantly decreasing the level of import protection provided by the SPR if it is maintained at its current capacity. The SPR is now not sufficiently large enough to protect the United States from a long term disruption in crude oil supply, and without an increase in capacity will be even less able to do so in the future.

Composition of Products

The third, and potentially most significant weakness of the SPR, particularly in its ability to protect the United States from short-term but large disruptions in crude oil supply, delivery, and refining capacity, is the SPR's absence of stocks of refined fuels, which are the products really necessary to allow the nation's critical air and ground transportation and energy sectors to continue to run during a crisis. The SPR currently consists of just the crude oil stocks mentioned previously, and also consists of the Northeast Home Heating Oil Reserve, a two million barrel supply of fuel oil located at storage facilities in Woodbridge, New Jersey, Newhaven, Connecticut, and Providence, Rhode Island. These stocks are held as an emergency source of fuel oil to supplement commercial supplies in the fuel oil heat-dependent northeast United States. The SPR does not currently contain stocks of aviation jet fuel,

gasoline, or diesel fuel, leaving the United States strategically vulnerable to a disruption in the supply of these products. This vulnerability is made more extreme by two issues: the location of a large portion of the refinery capacity in the United States along the Gulf Coast and the overall lack of refining capacity in the United States compared to demand for fuels.

About half of the gasoline consumed in the United States is produced in refineries located along a stretch of the Gulf Coast from Corpus Christi, Texas, to New Orleans.[30] Refinery production in this region was tremendously impacted in 2005 by hurricanes, with 91 percent of the region's crude oil production and 1.8 million bbl/d of its refining capacity (75.6 million gallons of gasoline a day) taken offline during and immediately following Hurricane Katrina in late August and September.[31] Because the SPR is also located in this same region along the Gulf Coast and consists of only crude oil, it is vulnerable to the same severe weather and does not help the United States with shortages in refined products when refinery capacity is so suddenly and significantly decreased. Also, refineries in the Midwest region, which have the next highest capacity to those of the Gulf Coast region,[32] depend on oil from Gulf Coast oil production and oil imports from the LOOP and other Gulf Coast ports to come through the pipeline system to meet their supply needs.[33] The bottom line is that 68 percent of the United States' refinery capacity depends on oil production and imported oil movement through a fairly small section of the Gulf Coast, and 61 percent of that refinery capacity is physically located along the coastal area itself.

In addition to the vulnerability of a large portion of United States refining capacity because of its location, the actual overall refining capacity itself of the United States is a strategic weakness which is not supported by strategic stocks of refined fuels contained in a strategic reserve. The United States' refining capacity cannot meet its demand and requires it to import refined fuels from foreign nations to meet our daily needs. There have been no new refineries built in the United States since 1976. In fact, as of the beginning of 2004 there were 149 operating refineries in the United States, 104 fewer than in 1982.[34] However, even with the fairly drastic reduction in the number of operating refineries, total national refining capacity has not decreased. It has actually increased, because of technical improvements to the refining process, improvements in management and production efficiency, and upgrades to equipment that have allowed fewer and more efficient maintenance procedures to be implemented.[35] But the demand for gasoline and other fuels in the United States has outpaced the increase in production capacity, with refining capacity only increasing by .6 percent a year since 2000 while demand for gasoline has increased about 2 percent a year during the same period.[36] The net result of this disparity between refining capacity and demand is the need to now import about 10 percent of its gasoline needs from foreign sources, mainly Europe, Venezuela, and the

Caribbean. However, each of these sources has issues that could potentially reduce or eliminate the availability of their fuel. The Caribbean is susceptible to the same severe weather trends which have recently impacted Gulf Coast refining capacity. Venezuela has political issues with the United States previously mentioned. And European gasoline imports, although probably not in danger of threats from weather or government action, may not be available in the future in the quantities they presently are. European refineries currently have excess gasoline refining capacity, mostly as a result of the trend in Europe away from gasoline powered autos to those powered by diesel. However, European refineries are currently converting refining technologies in order to produce more diesel fuel in the future, which will decrease the amount of surplus gasoline they produce for the import market.[37] And many experts doubt the ability of United States refineries to continue to increase production without building or re-activating new or pre-existing refineries, both of which would take many years even if started today. Efficiency increases in existing refineries have almost been maximized and new environmental requirements – mainly air quality mandates for custom "blended" fuels and low-sulfur diesel and gasoline – will divert the necessary investment in money and time from efficiency improvements to required modifications made in order to meet government standards.[38] Even with strategic stocks of crude oil, the lack of strategic stocks of refined fuels leaves the United States strategically vulnerable to a severe disruption in its ability to normally function. This is a result of the concentrated location of a large portion of its refining capacity in a single vulnerable geographic location and the reliance on refined fuel imports to meet demand because of a lack of domestic refining capacity. With the lack of speed in which crude oil stocks can get from the SPR to refiners, strategic stocks of refined fuels would provide a greater protection against a large disruption in crude oil supply or refining capacity that occurs rapidly and without any prior indicators that allow for advance preparation.

Getting It Right.....Now Not Later

The need for the United States to strengthen the SPR- right-size it, increase its output capacity, reduce its geographic vulnerability, and structure it to protect against not only a disruption in crude oil supply but a disruption in refining capability and capacity as well- is imminent and must be started now in order to allow the SPR to continue to protect the United States from being weakened by a disruption in its petroleum supply.

The SPR was established under the 1975 Energy Policy and Conservation Act (EPCA), Public Law 94-163 under 42 U.S.C. 6234.[39] There has been recent legislation enacted which does take steps in making the SPR a better protector of the United States' energy security, but it

does not go far enough. The 2005 Energy Policy Act (Public Law 109-58) signed on August 8, 2005, directs the Energy Secretary to expand the capacity of the SPR from its current capacity of 727 million barrels to the full one billion barrels which was originally authorized by the EPCA in 1975. This increase in capacity will improve the strategic value of the SPR by providing an increase of about 50 percent, from 65 to almost 100 days, in import protection at today's requirements for imported crude oil, and it will significantly improve the SPR's ability to keep up with predicted increases in demand for crude oil imports in the future. However, the Department of Energy's notice in the Federal Register on September 1, 2005 announced its proposal to only expand capacity at three of the existing SPR sites and develop a new salt dome site in the same area of the Texas or Louisiana Coast that the existing SPR sites are located.[40] Although salt cavern storage is the least expensive way to expand the SPR,[41] putting the entire further expansion of SPR capacity in this region is not a strategically sound proposal. The Energy Secretary should use the mandated expansion of the SPR to place strategic crude oil stocks in areas of the country where refining capacity would be most vulnerable to a shortage of crude oil if SPR stocks in the Gulf Coast region were inaccessible to them due to single or multiple catastrophic events. These additional SPR crude oil stocks should be developed in Southern California, and even more so in the Northeast, both critical regions whose refineries rely heavily on tanker receipts to supply them with crude oil. California refineries receive almost one million b/d of imported and Alaska crude oil via tanker shipment and Northeast refineries receive almost all of their refinery requirements, 1.3 million b/d of imported crude oil, from tankers.[42] Neither area has the ability to receive SPR or other sources of crude oil from the Gulf Coast or Midwest via pipeline and rely completely on tanker delivery if SPR oil shipments were necessary. Locating SPR crude oil stocks in these areas would figuratively "remove all of the SPR's eggs from the same basket," and provide crude oil supply protection that would be harder to completely disrupt than having it all concentrated on the Gulf Coast and dependent on the same supply infrastructure to distribute it in the event of a crisis. The added benefit of increasing the number of locations as well as dispersing them would potentially be a faster total pumping rate for all SPR sites as well as certainly a faster delivery time to refineries in these two densely populated and vital economic areas.

In addition to increasing the quantity of crude oil in the SPR, the United States needs to immediately develop strategic refined fuel reserves as part of the SPR. Strategic fuel stocks will decrease the country's vulnerability against regional disruptions in refining capacity, disruptions in imported fuels, and also provide a buffer in the event of a disruption in crude oil supply where SPR oil was needed but, because of transportation limitations from pipeline delivery speed or

time to deliver via tanker, could not be accessed immediately. The need for strategic fuel stocks has been recognized by congress. Senators Charles Schumer, of New York, and Richard Durbin, of Illinois, introduced legislation to congress in late 2005 which would create a national strategic reserve of gasoline and jet fuel. Senate Bill 1794, called the Strategic Gasoline and Fuel Reserve Act of 2005, would establish a 40 million barrel reserve of gasoline and a 7.5 million barrel reserve of jet fuel, located at between three and five strategically located sites across the United States.[43] This initiative should be aggressively pursued but with even increased reserve quantities. Current demand for gasoline in the United States is about 9.3 million b/d, and jet fuel demand about 1.7 million b/d. A strategic reserve of at least 7 days demand for each should be formed, which would make the suggested quantities about 65 million barrels of gasoline and about 12 million barrels of jet fuel. Additionally, a reserve of diesel fuel, which is the primary fuel used by the United States' critical truck and rail transportation system, should be included into this effort. A 30 million barrel reserve of diesel would be sufficient to cover one week's demand.[44] Because refined fuels, particularly gasoline, cannot be stored for long periods (more than a year) like crude oil can,[45] a system of stock rotation would have to be coordinated with refiners in order to cycle fresh product into and out of storage on a regular schedule.

Conclusion

As time continues to pass without the U.S. taking firm steps to decrease its vulnerability to disruptions in crude oil supply and the supply of refined fuels, the elements of national power that require petroleum as the cornerstone of their ability to function will continue to lose effectiveness. This condition is rapidly chipping away at the foundation of United States' power. The question is: What will it take to cause that foundation to begin to crack or even collapse, and fail to properly support the nation which relies on its foundation to keep it standing and structurally sound? The summer of 2005 provided a glimpse at just how much disruption to the United States' petroleum supply could be caused by severe storms along the Gulf Coast. And results of oil crisis simulations, like the Oil Shockwave exercise held in June 2005, reveal the potentially devastating effects a major disruption in the United States' supply of oil could have on its economy and national security. The scenario pointed to the large number of combinations of events that could create a similar crisis for the United States, making the risk and probability even greater for the future. Although the first order effects of an oil related crisis appear to be predominantly economic, the second and third order effects would certainly impact all facets of national security, particularly in political decisions made dealing with oil exporting

countries and the ability of the United States to fund, equip, and maintain the armed forces it relies on as a key component of that security. As the United States' demand for oil and refined products continues to rise, the effects of future events like the hurricanes of 2005 will be even more dramatic and will almost certainly have an even greater negative impact on the U.S. economy and national security. The outcome of multiple events occurring simultaneously, a hurricane on the Gulf Coast and a large accident or terrorist attack on Northeast port facilities, for example, could have truly disastrous effects. The U.S. must address this critical chink in its armor now, and act quickly to start fixing the problems identified here. Although the United States arguably needs to develop a long term energy strategy that reduces or almost eliminates its dependence on oil and petroleum products as the foundation of its national strength, that will not realistically happen for several decades at a minimum. The steps outlined in this paper are the basis for a realistic and do-able Strategic Petroleum Reserve policy and strategy that, at least for the near future, will ensure that the nation's national security will not be nearly as vulnerable to an oil related energy crisis as it is today. The policy motion in congress needed to make the necessary changes to the SPR is in place and on the political agenda. It is imperative that, while events like Hurricane Katrina and the results of simulated exercises like "Oil Shockwave" are fresh in the minds of government policymakers, the United States takes the initiative to make these changes as quickly as possible.

Endnotes

[1] Robert E. Ebel, *Middle East Economic Survey*, Vol. XLVIII, No. 44, 31 October 2005. http://mees.com/postedarticles/oped/v48n44-5OD01.htm

[2] *Oil Shockwave: Oil Crisis Executive Simulation* . Simulation report and summary of findings. Published by the National Commission on Energy Policy and Securing America's Energy Future (SAFE). A copy of the Oil Shockwave report can accessed at National Commission on Energy Policy website: http://www.energycommission.org/ewebeditpro/items/O82F6801.pdf pg.12

[3] Ibid pg. 2

[4] Quote taken from *Strategic Petroleum Reserve Annual Report*, US Dept of Energy, 15 February, 1996, pp. 4.

[5] Jewish Virtual Library. http://www.jewishvirtuallibrary.org/jsource/US-Israel/spr.html

[6] Dept. of Energy website. http://www.fossil.energy.gov/programs/reserves/spr/spr-facts.html.

[7] Jewish Virtual Library. http://www.jewishvirtuallibrary.org/jsource/US-Israel/spr.html

[8] Quote from Institute for the Analysis of Global Security web page on "*Threats to Oil Transport*" http://www.iags.org/oiltransport.html

[9] Institute for the Analysis of Global Security (IAGS) website. "*Threats to Oil Transport*" http://www.iags.org/oiltransport.html

[10] Ibid

[11] U.S. Energy Information Agency (EIA) website: Charts depicting total crude oil imports and offshore domestic crude oil production. http://tonto.eia.doe.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_m.htm AND http://tonto.eia.doe.gov/dnav/pet/pet_move_impcus_a2_nus_epc0_im0_mbbl_m.htm

[12] Louisiana Offshore Oil Port website. http://www.loopllc.com/f1.cfm?n=1

[13] Washington Post http://www.washingtonpost.com/wp dyn/content/article/2005/09/15/AR2005091502234_pf.html

[14] Briefing Paper: "*How Pipelines Make the Oil Market Work -Their Networks, Operation and Regulation*" Information paper prepared by Allegro Energy Group, Cheryl J. Trench, President, for the Association of Oil Pipelines, Dec. 2001, pg. 9 https://www.piersystem.com/external/index.cfm?cid=888&fuseaction=EXTERNAL.docview&documentID=58155

[15] Paul W. Parfomak, Science and Technology Specialist. "*Pipeline Security: An Overview of Federal Activities and Current Policy Issues*". Congressional Research Service, The Library of Congress. Feb. 5th, 2004. http://www.fas.org/sgp/crs/RL31990.pdf

[16] Pipeline 101 website. Informational website sponsored by American Petroleum Institute(API) and the Association of Oil Pipelines (AOPL) http://www.pipeline101.com/Introduction/index.html

[17] Stephen E. Flynn, "*The Unguarded Homeland: A Study in Malign Neglect*". From *How Did This Happen: Terrorism and the New War.* James F. Hoge JR. and Gideon Rose, Eds. New York 2001. pg. 186

[18] EIA website. Chart depicting delivery method of crude oil to refineries by region. http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/petroleum_supply_annual/psa_volume1/current/pdf/table_46.pdf

[19] Department of Energy (DOE) website. SPR FAQ's. http://www.fossil.energy.gov/programs/reserves/spr/spr-facts.html

[20] DOE website. http://www.fossil.energy.gov/programs/reserves/spr/spr-drawdown.html

[21] Briefing Paper: "*How Pipelines Make the Oil Market Work -Their Networks, Operation and Regulation*" Information paper prepared by Allegro Energy Group, Cheryl J. Trench, President, for the Association of Oil Pipelines, Dec. 2001, pg. 12. Accessed at:https://www piersystem.com/external/index.cfm?cid=888&fuseaction=EXTERNAL.docview&documentID=58155

[22] DOE website. http://www.fossil.energy.gov/programs/reserves/spr/spr-facts.html

[23] EIA website. Chart depicting U.S. total crude oil supply and domestic production figures. http://tonto.eia.doe.gov/dnav/pet/pet_sum_sndw_dcus_nus_w.htm

[24] EIA website. Chart depicting crude oil imports by specific country. http://tonto.eia.doe.gov/dnav/pet/pet_move_impcus_a2_nus_ep00_im0_mbbl_m.htm

[25] International Energy Agency (IEA) website.http://www.iea.org/textbase/ work/2002/beijing/hartpetres.pdf

[26] OxResearch. Oxford. February 26, 2003. pp.1

[27] DOE website. http://www2.spr.doe.gov/DIR/SilverStream/Pages/pgDailyInventoryReportView DOE_new.html

[28] American Geological Institute. Government Affairs Program section. Accessed at www.agiweb.org/gap/legis107/spr.html

[29] EIA website. Chart showing U.S. annual energy outlook predictions from 2003 to 2030. http://www.eia.doe.gov/oiaf/aeo/excel/aeotab_11.xls

[30] DOE website. http://www.fossil.energy.gov/programs/reserves/heatingoil/index.html

[31] John W. Schoen, MSNBC, updated November 22, 2004. http://msnbc.msn.com/id/6019739/

[32] EIA website. Table showing refinery capacity by region in the U.S. http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/petroleum_supply_annual/psa_volume1/current/pdf/table_37.pdf

[33] Pipeline 101 website. Informational website sponsored by American Petroleum Institute(API) and the Association of Oil Pipelines AOPL)http://www.pipeline101.com/Introduction/index.html

[34] Jeffrey Winters, "*A Case of the Vapors*", Mechanical Engineering, December 2004. http://memagazine.org/backissues/dec04/features/vapors/vapors.html

[35] Ibid

[36] National Petrochemical and Refiners Association newsletter, July 14, 2004. http://www.npra.org/news/releases/detail.cfm?docid=1318&archive=1

[37] Jeffrey Winters, "*A Case of the Vapors*", Mechanical Engineering, December 2004. http://memagazine.org/backissues/dec04/features/vapors/vapors.html

[38] John W. Schoen, MSNBC, updated November 22, 2004. http://msnbc.msn.com/id/6019739/

[39] Library of Congress. http://thomas.loc.gov/cgi- bin/bdquery/z?d094:SN00622:@@@L|TOM:/bss/d094query.html|

[40] Engineering News Record. New York. Sep 19, 2005. Vol. 255, Iss.11; pg. 24

[41] DOE website. SPR information page. http://www.fe.doe.gov/programs/reserves/spr/spr-sites.html

[42] EIA website. Chart depicting refinery receipts of crude oil by transportation method. http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/petroleum_supply_annual/psa_volume1/current/pdf/table_46.pdf

[43] Senator Richard Durbin, D-Illinois, website. http://durbin.senate.gov/record.cfm?id=248146

[44] EIA website. Chart depicting average petroleum product supplied in the U.S. http://tonto.eia.doe.gov/dnav/pet/pet_cons_wpsup_k_w.htm

[45] Chevron Corporation website. http://www.chevron.com/products/prodserv/fuels /bulletin/longterm_gasoline/