DOE/EA-0954

Environmental Assessment of Oil Degasification at Four Strategic Petroleum Reserve Facilities in Texas and Louisiana

U.S. Department of Energy

September 1994

DOE/EA-0954

Environmental Assessment of Oil Degasification at Four Strategic Petroleum Reserve Facilities in Texas and Louisiana

U.S. Department of Energy
Washington, D.C. 20585

September 1994

Printed with soy ink on recycled paper

DOE F 1325.8
(8-89)
EFG (07-90)

United States Government **Department of Energy**

memorandum

DATE: **September 1, 1994**

REPLY TO ATTN OF: Office of NEPA Oversight:Thurston:6-1509

SUBJECT: Environmental Assessment for the Oil Degasification at Four Strategic Petroleum Reserve Facilities in Texas and Louisiana (DOE/EA-0954)

TO: Patricia Fry Godley
Assistant Secretary
Office of Fossil Energy

This is in response to your request for approval of the subject Environmental Assessment transmitted by your memorandum of August 10, 1994. The Office of Environment, Safety and Health has reviewed the Environmental Assessment (DOE/EA-0954) and the finding of no significant impact in accordance with the DOE Order 5440.1E regarding compliance with the National Environmental Policy Act (NEPA). We note that the Environmental Assessment was sent to the States of Louisiana and Texas for a 14-day review period on May 27, 1994, and written comments were received from the Louisiana Departments of Natural Resources and Environmental Quality, and the Texas Office of State-Federal Relations.

Per the comments received, the Environmental Assessment was revised to incorporate some of the comments, and explanations are provided in Appendix E to address all other, non-incorporated comments. Also, as noted by the State of Louisiana's Department of Natural Resources, only the West Hackberry site is within Louisiana's Coastal Zone; however, the proposed work would not adversely impact the coastal zone or require a Federal agency consistency determination under 15 CFR 930.35(d). Given that the actions at Bayou Choctaw would occur in a floodplain, a Floodplain Statement of Findings has been prepared in conjunction with the Environmental Assessment.

Based upon my staff's review and analysis, and after consultation with the Office of General Counsel, I have determined that the Environmental Assessment is adequate for publication. Further, based on the Environmental Assessment, I have determined that the proposed action is not a major Federal action significantly affecting the quality of the human environment, within the meaning of NEPA. Therefore, the preparation of an environmental impact statement is not required. Accordingly, I have approved this Environmental Assessment and signed the accompanying Finding of No Significant Impact. The Office of Fossil Energy is responsible for providing public notice of the availability of the Environmental Assessment and Finding of No Significant Impact as required by 40 CFR 1506.6.

Please provide five copies of the Environmental Assessment, a record of distribution of the Environmental Assessment and Finding of No Significant Impact, and an electronic file version of the Environmental Assessment to the Office of NEPA Oversight and send one copy of the Environmental Assessment and Finding of No Significant Impact to the Public Reading Room in the Forrestal Building.

for Iara O'Toole, M.D., M.P.H.
Assistant Secretary
Environment, Safety and Health

Attachments (2)

cc: Hal Delaplane, (FE-423)
Strategic Petroleum Reserve

Jim Johnson, (FE-6)
NEPA Compliance Officer

[6450-01]

DEPARTMENT OF ENERGY

10 CFR Part 1021

Finding of No Significant Impact and Floodplain Statement of Findings of Oil Degasification at Four Strategic Petroleum Reserve Facilities in Texas and Louisiana

AGENCY: Department of Energy

ACTION: Notice.

SUMMARY: The Department of Energy (the Department) has prepared an environmental assessment (Assessment), DOE/EA-0954, of the proposed treatment of gassy crude oil stored at four Strategic Petroleum Reserve (the Reserve) storage facilities in Texas and Louisiana. Transportable degasification plants would be installed and operated initially at the Bryan Mound facility in Texas and the West Hackberry facility in Louisiana and would then be moved to the Big Hill facility in Texas and the Bayou Choctaw facility in Louisiana, respectively. The actions at Bayou Choctaw would occur in a floodplain; therefore, a floodplain assessment has been prepared in conjunction with this Assessment.

Based on the analyses in DOE/EA-0954, the Department has determined that the proposed action is not a major Federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321, et seq.). Therefore, the preparation of an Environmental Impact Statement is not required, and the Department is issuing this Finding of No Significant Impact (Finding). This

Finding also includes a Floodplain Statement of Findings in accordance with 10 CFR Part 1022.

ADDRESSES: Copies of the Assessment are available from Mr. Hal Delaplane, Strategic Petroleum Reserve (FE-423), Department of Energy, 1000 Independence Ave., S.W., Washington, D.C. 20585, telephone (202) 586-4730, facsimile (202) 586-7919.

The Assessment also is available for review at the above address in the Freedom of Information Reading Room, 1E-190, during normal operating hours, 9 a.m. to 4 p.m., Monday through Friday.

FOR FURTHER INFORMATION ON THE DOE NEPA PROCESS, CONTACT:
Ms. Carol Borgstrom, Director, Office of NEPA Oversight (EH-25), Department of Energy, 1000 Independence Avenue, S.W., Washington, D.C. 20585, telephone (202) 586-4600 or (800) 472-2756.

SUPPLEMENTARY INFORMATION:

I. Proposed Action

The proposed action is to treat 350 million barrels or less of gassy crude oil stored underground by the Reserve in salt dome caverns at four crude oil storage facilities: Bryan Mound and Big Hill in Texas, and West Hackberry and Bayou Choctaw in Louisiana. Degasification is necessary because over time, gases, principally methane and nitrogen, have migrated into the caverns and become dissolved in the stored crude oil. This influx of gas has raised the crude oil

vapor pressure above limits required by safety and emission guidelines for a drawdown.

The Department would use a turnkey services contract for engineering, procurement, fabrication, installation, operation, and maintenance of two degasification plants, each with a throughput capacity of 100,000 barrels per day. These would be installed initially at Bryan Mound and West Hackberry. Following completion of degasification at Bryan Mound and West Hackberry, the units would then be moved to Big Hill and Bayou Choctaw. Degassing operations would be complete at all four sites by December 1997.

The contractor could propose a single process scheme and a single degasification design for all four sites that would meet the Reserve's performance specifications, which include emissions limits. The degasification unit would be centrally located within the existing facilities at each site and would tie into the site's electric power, fire water, and city water. Each unit would occupy a ground surface area of approximately 60 meters by 76 meters (200 feet by 250 feet).

In the degasification process, pressurized gassy crude oil would be pumped from a cavern to the onsite degasification plant where the oil would be depressurized and the excess gases would come out of solution and be separated. Hydrogen sulfide and valuable light hydrocarbons (i.e., propane, butane, pentane, and any higher hydrocarbons) entrained in the off-gases would be recovered and reinjected into the crude oil as the oil is returned to underground storage. The remaining off-gases (methane, ethane, and nitrogen) would comprise the exit

waste stream which would be either incinerated onsite or recovered and sold as discussed below.

Two methods of circulating the oil would be used. An "intercavern" scheme is planned for Bryan Mound and Big Hill where brine would be used as a working fluid to displace gassy oil from one cavern through the degasification plant and return it to an empty cavern onsite. With this method, the onsite brine pond would function as an open surge reservoir for brine circulating in contact with crude oil.

At West Hackberry and Bayou Choctaw, crude oil manifolds and cavern wells would be reconfigured to obviate the need for a displacement fluid, such as brine; crude oil would be the only fluid flow. Crude oil would be pumped from a cavern, processed through the degasification plant and returned to the same cavern. This "intracavern" scheme has an advantage of substantially lower electric power requirements. At West Hackberry and Bayou Choctaw, where electric rate structures are comparatively high, power costs and site configuration factors make the intracavern method cost effective, notwithstanding its high setup costs.

II. Alternatives

Two alternatives for disposing of the desulfurized waste gas were examined. The more likely alternative would be incineration at the degasification plant. An enclosed combustion device with a direct-flame, low-nitrogen oxide burner and a

99.98-percent destruction efficiency for volatile organic compounds would be required to meet regulatory limits. The incineration system would be expected to be operational around the clock with an assumed down time of five percent or less.

The recovery and sale of methane and ethane was assessed so that a bid proposing this option could be considered. However, there is little evidence of any interest in the business community for such an operation, presumably because it would be short term and small scale. This alternative would require the construction and operation at each site of refrigeration or compression facilities to liquefy or compress up to 105,000 gallons per week and a tank truck loading rack capable of 10.5 truck loads per week.

Under the no action alternative, the Reserve's gassy crude oil would remain untreated and would thus remain at an undesirably elevated vapor pressure creating safety hazards and excessive air emissions during an emergency drawdown. This would reduce the rate and duration of the Reserve's ability to replace imported crude oil during a supply disruption.

Other alternatives that were eliminated from detailed study because of excessive costs and/or impracticality included: lowering the oil's True Vapor Pressure to an acceptable level by supercooling it during drawdown; and continuously replacing inventory through a program of Government sales and replacement purchases of new, stable oil.

III. Environmental Impacts

The proposed action would have minor air quality impacts. Construction would directly produce 5 tons or less of fugitive dust at each site over a 60-day period. Offsite air quality would be unaffected. In addition, the increase in associated vehicular particulate emissions onsite and offsite would total 3 tons or less. These impacts would not affect the local areas' attainment status for particulate matter or their air quality. The increase in onsite and offsite vehicular emissions of volatile organic compounds, carbon monoxide, and nitrogen oxides associated with construction and degasification operations would be negligible.

The overall increase in emissions of volatile organic compounds attributable to degasification would be about 12 tons per year at Bryan Mound and Big Hill where the intercavern method of oil circulation would be used. The largest emission source would be the brine ponds. The emissions increase at West Hackberry and Bayou Choctaw would be substantially less because the closed-cycle intracavern oil circulation method proposed for those sites would not involve the brine ponds. Differences in emissions between the waste stream disposal alternatives (i.e., fume incineration versus recovery and sale) would be minor. In all cases, emissions would be far below the levels that would trigger the applicability of programs designed to protect air quality and attain and maintain the National Ambient Air Quality Standard.

The proposed action would reduce the potential to emit large quantities of volatile organic compounds and hydrogen sulfide into the environment during a

drawdown at Bryan Mound, Big Hill, West Hackberry, Bayou Choctaw, and at the receiving terminals, thus producing substantial potential beneficial air quality impacts. The no action alternative, conversely, potentially could result in substantial adverse impacts. Without degasification, emissions during drawdown could exacerbate the severe ozone-nonattainment status for Bryan Mound's local area, pose a problem for the attainment status of the other sites' areas, and substantially increase the risk of worker exposure to flammable and toxic vapor clouds. Because of these concerns, a drawdown under the no action alternative would be restricted with regard to rate and available inventory and could require an exemption pursuant to section 118 of the Clean Air Act.

An accidental release to the air from process equipment failure or operator error could be as large as 40 kilograms (90 pounds) of flammable gas per minute. If an ignition source were present, an explosion could result. Additionally, the vapor cloud could be toxic. However, the degasification process is commonly used in industry and the likelihood of such a release is small. The likelihood of an accidental release, fire, or explosion would be greater for the recovery option than the incineration option because of the additional facilities and operations required for recovery.

The risk of oil and brine spills from degasification operations would not be measurably different from a drawdown event. The average oil spill at any site is predicted to be 21 barrels and the predicted number of spills ranges from less than 1 at Bayou Choctaw to 2.5 at Bryan Mound. Existing site containment and control devices and appropriate training of site personnel in emergency response procedures would prevent or minimize harm in the event of a spill.

The proposed action would not adversely affect surrounding surface waters. Discharges associated with the proposed action would be stormwater which would be controlled and treated to comply with the standards and limits currently specified in each site's National Pollutant Discharge Elimination System pursuant to Section 402 of the Clean Water Act. If a site project design should require a new outfall, the site's current National Pollutant Discharge Elimination System permit would be modified to incorporate and regulate it as a non-impacting outfall.

Construction and operation of the degasification unit at any of the four SPR sites would not cause any adverse impacts to natural and scenic resources, cultural, historical, and archaeological sites, Native American tribal land, other minority or low-income communities, or ambient noise levels. No wetlands or endangered species would be impacted by the proposed action at any of the four sites. The proposed action at West Hackberry would not directly affect the Louisiana Coastal Zone because the proposed action would not alter surface water quality or quantity in the coastal zone or watershed, result in dredge fill, development, construction, or waste discharge in or into coastal waters. The proposed action would have minor air quality impacts in the coastal zone. Other than the floodplain at Bayou Choctaw, no sensitive environments would be involved. No cumulative or long-term impacts of the proposed project have been identified.

IV. Floodplain Statement of Findings

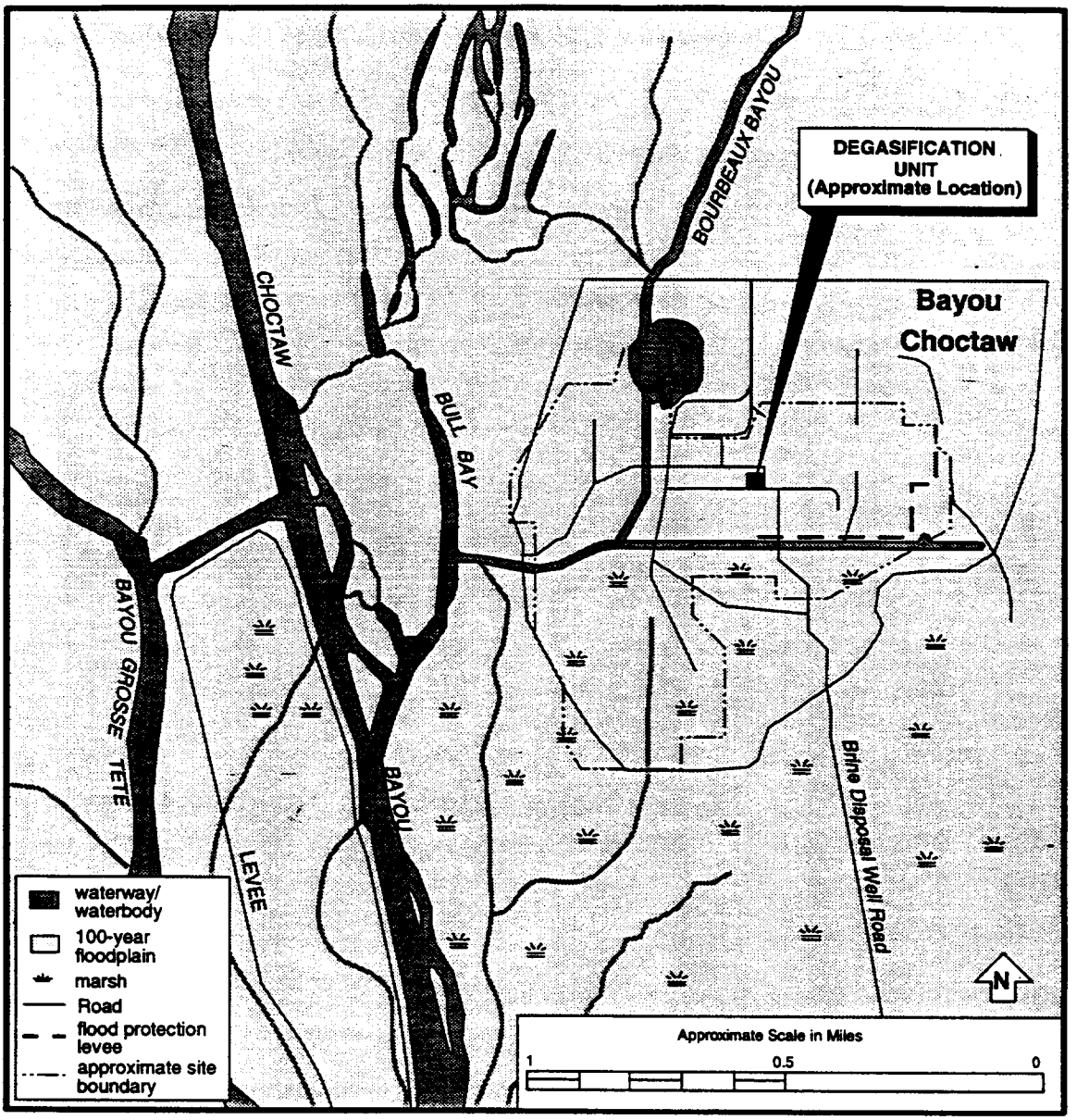
The Bayou Choctaw degasification unit would be built in a 100-year floodplain, and levees in the vicinity would not provide sufficient protection from the 100-year flood (Figure 1). Construction and operation of the oil degasification unit at Bayou Choctaw would conform to applicable procedures and standards and would not adversely affect the natural and beneficial values served by the 100-year floodplain. The oil degasification units at Bryan Mound, Big Hill, and West Hackberry would be protected from the 100-year flood or constructed outside the floodplain.

Given the location of the Reserve's Bayou Choctaw facility, there is no practicable alternative to locating the project in a floodplain. The project is required to correct a condition potentially harmful to the environment and to maintain the Bayou Choctaw facility in a safe and environmentally sound state.

Potential impacts of the proposed action at Bayou Choctaw on the 100-year floodplain would be direct, minor, and short-term. All construction and development would occur on an existing laydown yard that is centrally located in the physical plant of the existing storage facility. The yard is a previously disturbed area of compacted soil. Sedimentation from the project would be controlled by approved standard methods and would not affect lives or property or alter the natural beneficial floodplain values. A notice of floodplain involvement was published in the Federal Register (59 FR 18107, April 15, 1994). No comments were received.

Figure 1

Bayou Choctaw Floodplain Assessment



Source: Federal Emergency Management Agency, National Flood Insurance Program, Flood Insurance Rate Map, Iberville Parish, Louisana, Unincorporated Areas, Page 4 of 11, Community Panel Number 220083 0004 B, June 1, 1978.

V. Determination

Based on the information and analyses in the Assessment, the Department has determined that the proposed degasification of crude oil at the four Strategic Petroleum Reserve facilities does not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of NEPA. Therefore, the preparation of an Environmental Impact Statement is not required and the Department is issuing this Finding of No Significant Impact.

Issued at Washington, D.C., this 1st day of SEPTEMBER, 1994.

for Tara O'Toole, M.D., M.P.H.
Assistant Secretary
Environment, Safety and Health

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

SUMMARY

The U.S. Department of Energy (DOE) proposes to treat gassy oil at four Strategic Petroleum Reserve (SPR) storage sites to lower the gas content of the stored crude oil and help ensure safe transfer of the oil during drawdown. The crude oil is stored underground in caverns created in salt domes. The degree of gassiness of the oil varies substantially among sites and among caverns within a site.

This environmental assessment describes the proposed degasification operation, its alternatives, and potential environmental impacts. The need for degasification has arisen because over time, gases, principally methane and nitrogen, have migrated into and become dissolved in the stored crude oil. This influx of gas has raised the crude oil vapor pressure above limits required by safety and emission guidelines. When oil is drawn from the caverns, excess gases may come out of solution. Based on preliminary data from an ongoing sampling program, between 200 and 350 million of the 587 million barrels of crude oil stored at these four sites would require processing to remove excess gas.

Degasification, a commonly used petroleum industry process, would be done at four crude oil storage facilities: Bryan Mound and Big Hill in Texas, and West Hackberry and Bayou Choctaw in Louisiana. DOE would use a turnkey services contract for engineering, procurement, fabrication, installation, operation and maintenance of two degasification plants. These would be installed initially at Bryan Mound and West Hackberry. Degasification would be complete in less than three years of continuous operations. The units would then be moved to Big Hill and Bayou Choctaw.

The contractor could propose a single process scheme and a single degasification design for all four sites that would meet the SPR's performance specifications, which include emissions limits. The degasification unit would be centrally located within the existing facilities at each SPR site and would tie into the site's electric power, fire water, and city water. Each unit would occupy a ground surface area of approximately 60 meters by 76 meters (200 feet by 250 feet). In general, the degasification process would involve separating the gas from the liquid phase and reinjecting the propane, butane, pentane, etc. (C_3 hydrocarbons and higher) into the crude oil. At Bryan Mound and Big Hill, an intercavern treatment method is proposed. Gassy oil would be drawn from one cavern, treated, and returned to an empty onsite cavern. At West Hackberry and Bayou Choctaw, an intracavern treatment method is proposed. The intracavern method would cycle gassy oil in one cavern through the degasification unit and back into the same cavern.

The proposed degasification includes two alternatives for handling the waste stream: degasification with incineration of methane and ethane and degasification with recovery and sale of methane and ethane. In either alternative, C_3 hydrocarbons and higher and hydrogen sulfide (H_2S) would be reinjected into the crude oil. Although current market conditions would likely not support the recovery and sale of methane and ethane, this alternative is assessed so that a bid proposing this alternative could be considered. The recovered methane and ethane would most likely be transported offsite in trucks. Potential emissions from degasification that could impact the environment and occupational safety and health include fugitive emissions or accidental releases of crude oil, brine, volatile organic compounds (VOCs) including benzene/toluene/xylenes (BTXs), H_2S, amine (if used), and other treatment chemicals. In the event of an accidental release, degasification could pose toxic, flammable, and/or explosion hazards.

Under the no action alternative, the gassy SPR crude oil would remain untreated and would thus remain at an undesirably elevated vapor pressure creating safety hazards and excessive air emissions during an emergency drawdown. This would reduce the rate and duration of the SPR's ability to replace imported crude oil during a crude oil supply disruption.

Untreated gassy crude oil could not be safely transferred from the SPR facilities at design rates during an emergency drawdown because it would liberate gas that could damage transfer equipment (e.g., fittings, valves, pumps, tanks) and possibly cause a major leak resulting in personnel exposure to toxic gas, fire, or explosion. The use of gassy oil during a full emergency drawdown would release excessive quantities of VOCs and H_2S into the air. At the terminals that receive oil from each of the four sites, air emissions would violate permits. Under certain conditions, however, the SPR currently could safely conduct a limited drawdown of up to 520 million barrels at up to 2 million barrels per day.

The proposed action would reduce the potential to emit large quantities of VOCs and H_2S during a drawdown into the environment at Bryan Mound, Big Hill, West Hackberry, and Bayou Choctaw and at the receiving terminals, thus producing major beneficial air quality impacts. The extremely small particulate emissions during construction of the degasification unit would be of short duration, and would have no impact on the attainment status or air quality of the areas of all four sites. The differences in emissions among the alternatives comprising the proposed action (e.g., fume incineration versus recovery) are minor. The no action alternative, however, potentially could result in substantial adverse impacts. These emissions may pose a problem for the attainment status of the areas in which the facilities and terminals are located and may contribute to further violations of the ozone National Ambient Air Quality Standard (NAAQS), both in terms of the frequency and severity of violations. Thus, the overall impact of the proposed action would be positive because it would eliminate the potential to emit excessive air emissions during a drawdown.

The oil degasification units at Bryan Mound, Big Hill, and West Hackberry would be protected from the 100-year flood or constructed outside the floodplain. The Bayou Choctaw degasification unit, however, would be built in a 100-year floodplain, and levees in the vicinity would not provide sufficient protection from the 100-year flood. Impacts from construction and operation of the oil degasification unit at Bayou Choctaw would not affect the natural and beneficial values served by the 100-year floodplain.

Because pipeline accident rates are a function of the length of pipeline, and degasification would involve short, onsite pipeline configurations, the probability of oil spills during degasification would be low. Accidental releases of oil and brine are somewhat more likely at Bryan Mound and Big Hill because of the method used to move the oil at the site. The no action alternative would increase the likelihood for operating problems and equipment damage (i.e., pumps, valves, meters, floating roofs) at all four sites and along distribution pipelines and at terminals.

Construction and operation of the degasification unit at any of the four SPR sites would not cause adverse impacts to natural and scenic resources, cultural, historical, and archaeological sites, Native American land, other minority or low-income communities, or ambient noise levels. No wetlands or endangered species would be impacted by the proposed action at any of the four sites. Although the West Hackberry site is located within the Louisiana Coastal Zone, the

proposed action there would not directly affect the Coastal Zone and pursuant to 15 CFR 930.35(d) a Federal coastal consistency determination is not required. No other sensitive environments would be involved other than the floodplain at Bayou Choctaw. No cumulative or long-term impacts of the proposed action have been identified. Worker occupational safety and health would be assured by appropriate administration of DOE's Construction Contractor Safety Program pursuant to DOE Order 5480.9, Construction Safety and Health Program.

1.0 NEED FOR AND PURPOSE OF THE PROPOSED ACTION

The Strategic Petroleum Reserve (SPR) was created to provide the United States with sufficient petroleum reserves to reduce the impact of crude oil supply disruptions and to carry out the obligations of the United States under the International Energy Program. The SPR currently has a storage capacity of 750 million barrels of crude oil and a design delivery rate of 4.5 million barrels per day during a drawdown. This capacity is divided among five underground oil storage sites: Weeks Island, Bayou Choctaw, and West Hackberry in Louisiana; and Big Hill and Bryan Mound in Texas. The SPR is also comprised of a marine storage and distribution terminal on the Mississippi River at St. James, Louisiana, and the Project Management Office (PMO) in New Orleans (Figure 1).

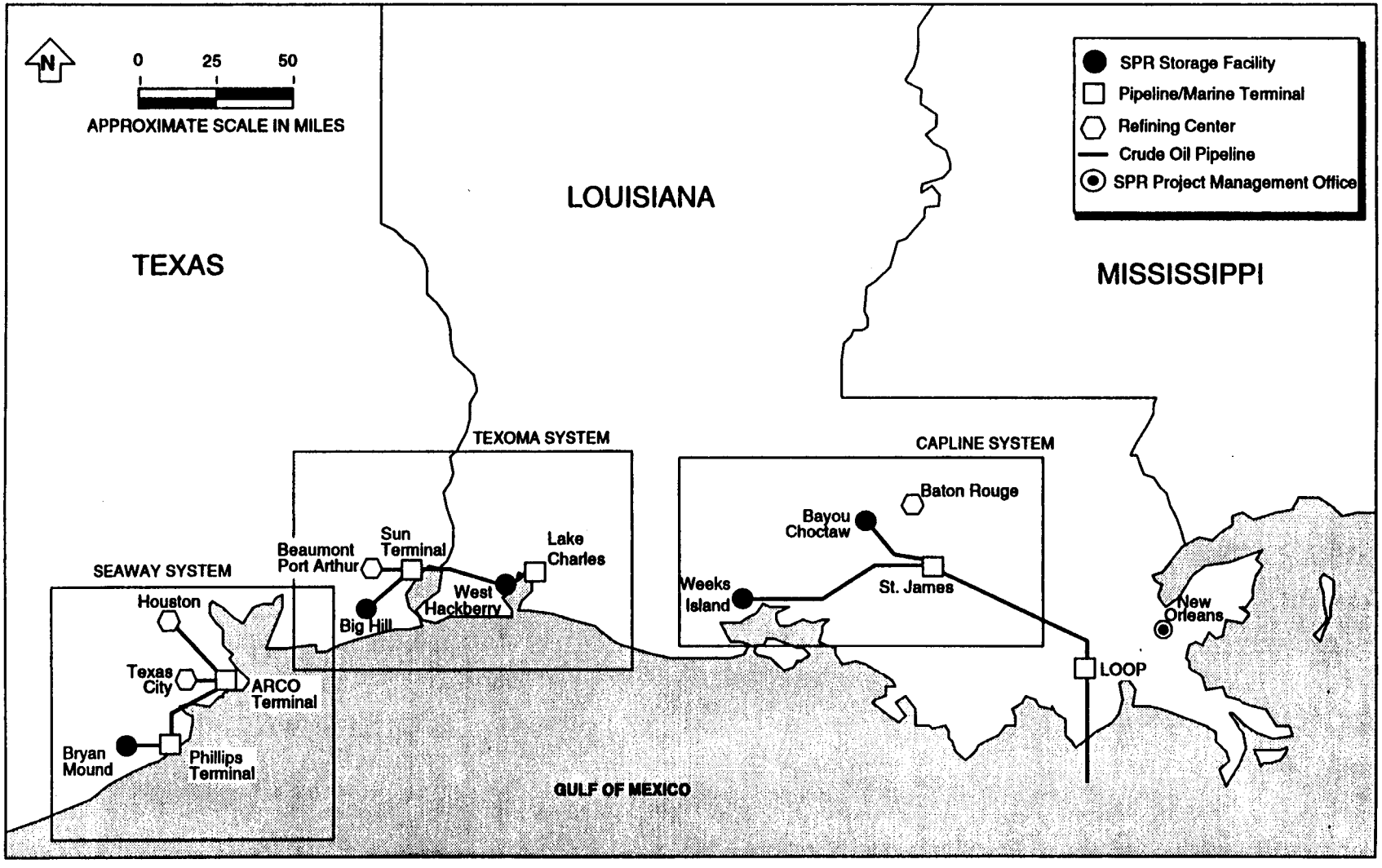
The Weeks Island facility was a conventional room-and-pillar salt mine in a salt dome before DOE converted it to oil storage. The other four storage facilities store crude oil in caverns constructed by solution-mining or leaching of salt domes. The number of caverns at a site varies from as many as 22 at West Hackberry to as few as 6 at Bayou Choctaw. Excluding Weeks Island, the SPR has 62 caverns. Of this number, 14 were preexisting caverns acquired from industry. These have various shapes and range in size from 6 to 34 million barrels. In contrast, the 48 caverns developed by DOE are more uniform, being roughly cylindrical, up to 670 meters (2,200 feet) high by 80 meters (260 feet) in diameter, located between 610 meters (2,000 feet) and 1520 meters (5,000 feet) below the surface, and have an average capacity of 10.5 million barrels.

The five SPR storage sites are connected by pipeline to a network of marine terminals, refineries, and major common carrier pipelines. The common carrier pipelines transport domestic and foreign crude oil from the Gulf Coast to inland refining centers. Crude oil can also be loaded at the marine terminals aboard tankers for transport to the East Coast, the Caribbean, and other areas of the U.S.

In the course of the development of the 750-million-barrel reserve, DOE has prepared a number of Environmental Impact Statements (EISs). A programmatic EIS, published in 1976, addressed the development of a 500-million-barrel storage program.[1] A supplement to the programmatic EIS, addressing an expansion of the SPR to one billion barrels, was prepared in January 1979.[2] Eight EISs and Supplements addressing Phase I of the three-phase development, acquisition and conversion of existing space in salt domes were published in 1977 and 1978.[3] Three additional EISs were published in 1978 to address Phase II, the expansion of the SPR by solution-mining new space at existing and new salt dome sites.[4] A Phase III EIS was prepared in 1981 to address a second expansion of the SPR by solution-mining to the present 750-million-barrel-capacity and increase drawdown to 4.5 million barrels per day.[5] Four Environmental Assessments (EAs) were prepared between 1985 and 1990 to cover various configuration and operational changes in the SPR system.[6]

When crude oil is produced, it is stabilized so that its true vapor pressure (TVP) is less than approximately 11 pounds per square inch absolute (psia), which is equivalent to a bubble point of 14.7 psia (atmospheric pressure) at 98 °F. All SPR crude oil was stable when purchased and stored, i.e., its TVP was at or below 11 psia. Over time, gases, principally methane and nitrogen, have migrated into and become dissolved in some of the stored crude oil. Methane and

Figure 1
Location of SPR Facilities



Source: U.S. Department of Energy, Strategic Petroleum Reserve.

other trace gases are naturally occluded in the salt formations and are apparently migrating through the bulk salt into the stored oil. The source of the excess nitrogen is the air that was dissolved in the surface water used in solution-mining the caverns. In many instances, the partial pressure of nitrogen greatly exceeds the partial pressure of methane in samples of oil with excess dissolved gas.

In addition to the occurrence of excess dissolved gases, another natural phenomenon of concern is the warming of the oil by the geothermal gradient in the domal salt. These two phenomena, although distinctly different, are adversely impacting the vapor pressure of crude oil stored in the SPR caverns.

For crude oil with TVP greater than approximately 11 psia, emissions of volatile organic compounds (VOCs) and hazardous pollutants to the atmosphere during shipment through floating roof tanks and aboard marine vessels could potentially exceed regulated limits. If true vapor pressure of the crude oil is greater than atmospheric pressure, it could boil when it is pumped out of caverns and into tanks. Gases that evolve during boiling would strip other heavier hydrocarbons from solution, increasing the quantity of VOCs emitted.

If excess gas evolves too quickly, foaming could occur, causing the floating roofs used on many of the larger storage tanks to tilt, thereby allowing oil to flow onto the roof and increasing VOC emissions. Increased VOC emissions could also occur during transfers to tankers and barges or at refineries. If excessive pressure drops occur in pipelines, pump cavitation could occur resulting in loss of suction and damage to pumps, valves, and meters. Finally, these emissions are potentially explosive, may exceed VOC regulatory limits, and may be a public and occupational safety and health hazard.

With the exception of the Weeks Island mine, some gassy oil is present at the other SPR sites. Preliminary data from sampling of oil from SPR caverns indicate that between 200 and 350 million of the 587 million barrels of oil currently stored in the SPR have a TVP that is too high to be mitigated by blending or dilution with less gassy oil due to excess dissolved gases.[7] The problem currently appears to be most extensive at the Bryan Mound and West Hackberry sites. These two sites would be treated first. After degasification is complete at these sites, Big Hill and Bayou Choctaw would be treated. The crude oil stored at Weeks Island does not require treatment.

Sampling and analysis of the extent of gassy oil in the SPR is ongoing. Preliminary analysis of incomplete testing indicates a wide range in concentration of excess dissolved gases in oil among the sites and among caverns within a site. Presumably, this is due both to variable rates of migration and nonuniform distribution of gas in rock salt within a salt dome and among salt domes. At West Hackberry, as much as 141 of the 205 million barrels of oil may be considered gassy; that is, the TVP exceeds 11 psia at delivery temperature and the bubble point exceeds 14.7 psia.[8] At Bryan Mound, all of the 217 million barrels of stored crude oil may be affected. The entire crude oil inventories at Big Hill and Bayou Choctaw, 38 million barrels and 52 million barrels, respectively, may be gassy. Quantities of SPR oil that are determined to be gassy would not be acceptable to commercial terminals, pipelines, tankers, and refiners.

As mentioned above, geothermal heating in salt domes elevates TVP of the oil in storage. However, geothermal heating is a separate problem that affects all underground salt dome caverns

regardless of the concentration of gases dissolved in the oil. DOE is addressing this problem by installing shell-and-tube heat exchangers in the drawdown systems at Bryan Mound, West Hackberry, and Bayou Choctaw. DOE will address Big Hill when its inventory becomes large enough to warrant the installation and use of shell-and-tube heat exchangers.

During a national emergency drawdown, the degasified oil would be pumped out of the caverns and through a heat exchanger to cool it to 100 °F. At 100 °F, the oil would have a TVP less than 11 psia and a bubble point less than atmospheric pressure (14.7 psia) which would meet the operational and environmental requirements of terminal and pipeline operators. This crude could then be further handled, transported, and refined using routine safety precautions.

The raw water that displaces the oil from a cavern during a drawdown would also serve as the coolant in the exchanger. The coolant surface water would be directed through the tubes of each heat exchanger prior to injection into the cavern where it would remain as brine. This type of closed-system cooling unit would not affect design process flow rates, alter water consumption, or measurably affect emissions or spill risk.

Acquisition and installation of heat exchangers at SPR sites are currently in progress. Such actions are categorically excluded under the National Environmental Policy Act (NEPA), as "modifications to oil . . . facility pump and piping configurations. . . that would not change design process flow rates or affect permitted air emissions" pursuant to Appendix B5.2 to Subpart D, 10 CFR 1021.[9]

ENDNOTES

1. Federal Energy Administration, *Strategic Petroleum Reserve, Final Environmental Impact Statement, Volume 1*, Federal Energy Administration, Office of Strategic Petroleum Reserve, Washington, DC, National Technical Information Service, December 1976, Document Number PB-261 799.

   Federal Energy Administration, *Strategic Petroleum Reserve, Final Environmental Impact Statement, Volume 2,* Federal Energy Administration, Office of Strategic Petroleum Reserve, Washington, DC, National Technical Information Service, December 1976, Document Number PB-261 800.

2. U.S. Department of Energy, *Strategic Petroleum Reserve, Expansion of Reserve, Final Supplement Environmental Impact Statement*, Office of Strategic Petroleum Reserve, Washington, DC, 1979, Document Number DOE/EIS-0034.

3. Federal Energy Administration, *Strategic Petroleum Reserve, West Hackberry Salt Dome, Final Environmental Impact Statement*, Federal Energy Administration, Office of Strategic Petroleum Reserve, Washington, DC, 1977, Document Numbers: FEA/S-76/503, NTIS No. PB262508.

   Federal Energy Administration, *Strategic Petroleum Reserve, Bryan Mound Salt Dome, Final Environmental Impact Statement*, Federal Energy Administration, Office of Strategic Petroleum Reserve, Washington, DC, 1977, Document Numbers: FEA/S-76/502, NTIS No. PB262839.

   Federal Energy Administration, *Strategic Petroleum Reserve, Weeks Island Mine, Final Environmental Impact Statement*, Federal Energy Administration, Office of Strategic Petroleum Reserve, Washington, DC, 1977, Document Numbers: FEA/S-77/017, NTIS No. PB263075.

   Federal Energy Administration, *Strategic Petroleum Reserve, West Hackberry Salt Dome, Supplement to Final Environmental Impact Statement* (FEA/S-76/503), Federal Energy Administration, Office of Strategic Petroleum Reserve, Washington, DC, 1977, Document Numbers: FEA/S-77/114, NTIS No. PB265796.

   Federal Energy Administration, *Strategic Petroleum Reserve, Bayou Choctaw Salt Dome, Supplement to Final Environmental Impact Statement* (FEA/S-76/501), Federal Energy Administration, Office of Strategic Petroleum Reserve, Washington, DC, 1977, Document Numbers: FEA/S-77/129, NTIS No. PB270435.

   Federal Energy Administration, *Strategic Petroleum Reserve, Supplement to Final Environmental Impact Statement for Weeks Island and Cote Blanche Mines* (FEA/S-77/016 and FEA/S-77/017), Federal Energy Administration, Office of Strategic Petroleum Reserve, Washington, DC, 1977, Document Number FEA/S-77/228.

   U.S. Department of Energy, *Strategic Petroleum Reserve, Final Supplement to Bryan Mound Salt Dome, Brazoria County, Texas, Final Environmental Impact Statement* (FEA/S-76/502),

Office of Strategic Petroleum Reserve, Washington, DC, 1977, Document Number DOE/EIS-0001.

U.S. Department of Energy, *Strategic Petroleum Reserve, Sulphur Mines Salt Dome, Calcasieu Parish, Louisiana, Final Environmental Impact Statement*, Office of Strategic Petroleum Reserve, Washington, DC, 1978, Document Number DOE/EIS-0010.

4. U.S. Department of Energy, *Strategic Petroleum Reserve, Seaway Group Salt Domes, Brazoria County, Texas, Final Environmental Impact Statement*, 3 Volumes, Office of Strategic Petroleum Reserve, Washington, DC, 1978, Document Number DOE/EIS-0021.

U.S. Department of Energy, *Strategic Petroleum Reserve, Capline Group Salt Domes, Iberia, Iberville, and Lafourche Parishes, Louisiana, Final Environmental Impact Statement*, 4 Volumes, Office of Strategic Petroleum Reserve, Washington, DC, 1978, Document Number DOE/EIS-0024.

U.S. Department of Energy, *Strategic Petroleum Reserve, Texoma Group Salt Domes, Cameron and Calcasieu Parishes, Louisiana, and Jefferson County, Texas, Final Environmental Impact Statement*, 5 Volumes, Office of Strategic Petroleum Reserve, Washington, DC, 1978, Document Number DOE/EIS-0029.

5. U.S. Department of Energy, *Strategic Petroleum Reserve, Phase III Development, Texoma and Seaway Group Salt Domes, Final Environmental Impact Statement,* Office of Strategic Petroleum Reserve, Washington, DC, 1981, Document Number DOE/EIS-0075.

6. U.S. Department of Energy, *Strategic Petroleum Reserve, Seaway Complex Distribution Enhancements, Brazoria, Galveston, and Harris Counties, Texas, Environmental Assessment*, Office of Strategic Petroleum Reserve, Washington, DC, 1985, Document Numbers: DOE/EA-0252, NTIS No. DE8501664.

U.S. Department of Energy, *Strategic Petroleum Reserve, Texoma Complex Distribution Enhancements, Orange and Jefferson Counties, Texas, and Calcasieu and Cameron Parishes, Louisiana, Environmental Assessment*, Office of Strategic Petroleum Reserve, Washington, DC, 1987, Document Numbers: DOE/EA-0272, NTIS No. DE87009311.

U.S. Department of Energy, *Strategic Petroleum Reserve, Seaway Complex Distribution Enhancements, Brazoria, Galveston, and Harris Counties, Texas, Revised Environmental Assessment*, Office of Strategic Petroleum Reserve, Washington, DC, 1987, Document Numbers: DOE/EA-0299, NTIS No. DE87002290.

U.S. Department of Energy, *Strategic Petroleum Reserve, Sulphur Mines Decommissioning and Big Hill Expansion, Calcasieu Parish, Louisiana, and Jefferson County, Texas, Environmental Assessment*, Office of Strategic Petroleum Reserve, Washington, DC, 1990, Document Numbers: DOE/EA-0401, NTIS No. DE90008675.

7. U.S. Department of Energy, Strategic Petroleum Reserve, *Initial Fiscal Year 1995 Budget Request, Excess Gas in Crude Oil, (Module 6)*, May 25, 1993.

8. Personal communication, *L. Rousseau and L. Nicholson*, February 25, 1994.

9. U.S. Department of Energy, Strategic Petroleum Reserve, *Categorical Exclusion Determination SPR-A03, Cooling of Hot Crude Oil*, October 18, 1993.

2.0 PROPOSED ACTION AND ALTERNATIVES

DOE proposes to treat as much as 350 million barrels of gassy SPR crude oil at four existing SPR facilities to help ensure a safe drawdown and enable delivery of crude oil within industry transportation specifications. The degasified crude would then be returned to storage in the salt dome caverns.

Gassy oil, a common problem in producing oil fields, is treated by readily available standard oil field equipment that separates the dissolved gases from the liquid phase by various physical methods. As a cost effective measure, DOE is soliciting a turnkey services contract for engineering, procurement, fabrication, installation, operation and maintenance of transportable degasification facilities that would be wholly owned and operated by the contractor. Through competitive solicitation of bids, a contractor would be selected to design, construct, and operate a process scheme with equipment and capacities to meet the SPR's performance specifications. Such specifications would include process flow rate, product crude oil quality, transportability, emissions limits established by the air permits, and electrical power limits. Accordingly, this environmental assessment analyzes the environmental impacts of the operation of such equipment under the performance specifications designated by DOE. The single process scheme and a single degasification facility (or "degas" plant) design, to be used at all four SPR sites, would be centrally located within the existing facilities at each SPR site and would tie into the site's electric power, fire water, and municipal water. The contractor would have to provide for all other utilities and the handling of sanitary wastes and industrial wastes.

The contractor would prepare the plant site designated by the SPR, including vegetation clearing; construction of a concrete slab foundation for the plant, curbed for secondary containment; short access roads from the SPR site roads; gravel parking areas; utility connections; and any support facilities and structures. The curbing around the degas unit would be designed to handle the maximum amount of oil that the unit could contain at any point in time. DOE would contract separately for piping and site modifications necessary to support the degas plant.

The design, construction, and operation of the degasification units would be in accordance with all local, State, and Federal requirements. Engineering design would conform with applicable codes and standards issued by various associations including the American Society of Mechanical Engineers, the American Petroleum Institute (API), and the National Fire Protection Association (NFPA). The facilities would be centrally located within the developed plant property but apart from the main buildings and other potential ignition sources, such as electrical substations, motor control centers, and pump stations. Operating directives, operating procedures, emergency procedures, and waste minimization would be in accordance with DOE orders and other applicable regulations.

The contractor would operate the facility around the clock with a total staff of approximately 16. Upon completion of degasification at a site, the contractor would remove the plant, piping, and support facilities, structures, equipment, and material, leaving only the gravel areas and concrete slab foundation.

Two transportable, modular degasification units on multiple skids would be acquired, each with a throughput capacity of 100,000 barrels per day (BPD). One unit would be installed at Bryan Mound (near Freeport, Texas) and the other unit at West Hackberry (near Lake Charles,

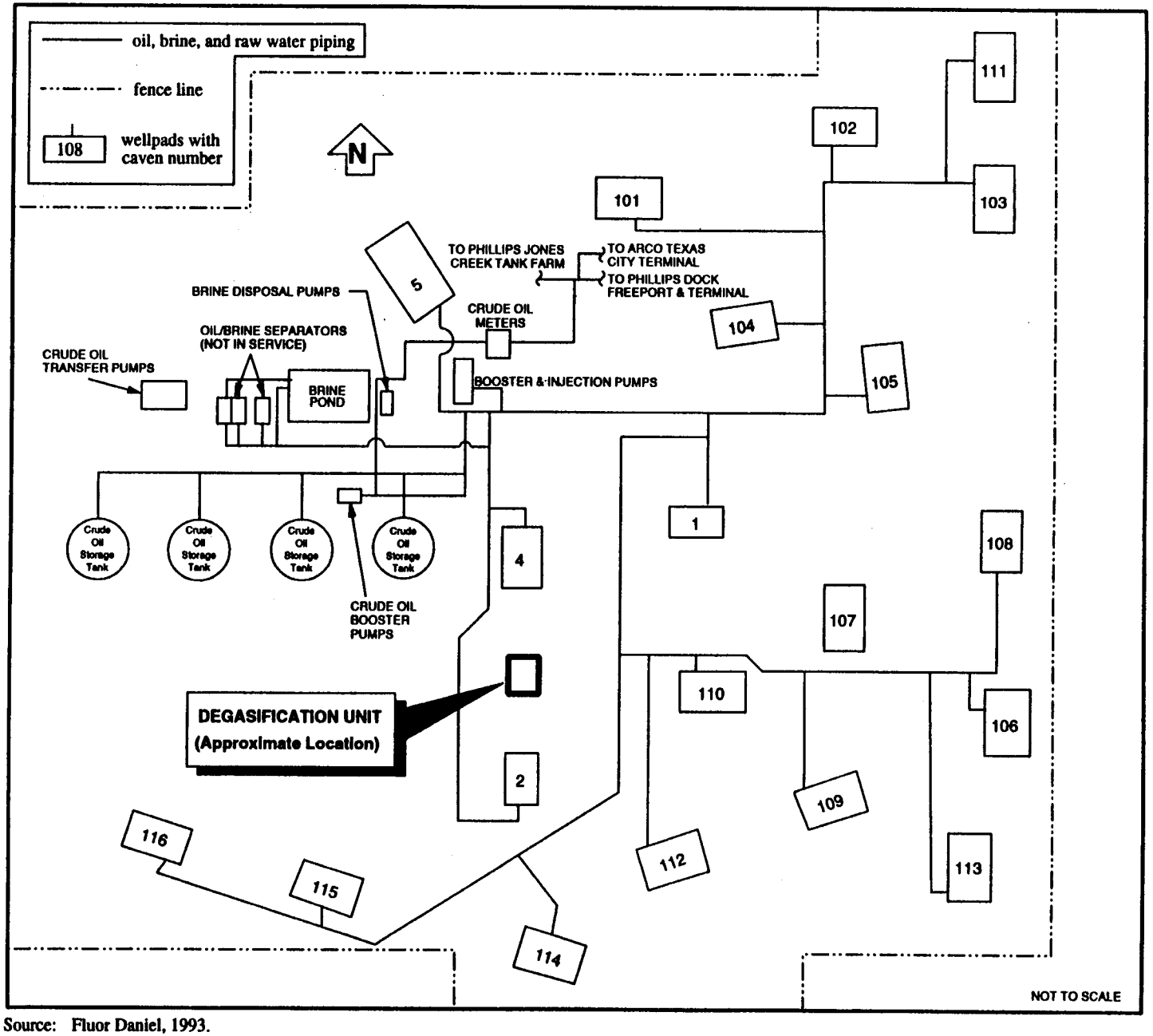
Louisiana). Each unit would be expected to occupy a ground surface area of approximately 60 meters by 76 meters (200 feet by 250 feet). The degas units would be expected to begin degasifying oil at Bryan Mound and West Hackberry in February, 1995. Following the completion of degasification at Bryan Mound and West Hackberry, the Bryan Mound unit would be relocated to the Big Hill site near Winnie, Texas and the West Hackberry unit would be relocated to the Bayou Choctaw site near Baton Rouge, Louisiana. The estimated duration for degassing Bryan Mound is 27 months; for West Hackberry, 24 months; for Big Hill, 6 months; and for Bayou Choctaw, 10 months. Degassing operations would be complete at all four sites by December 1997.

Caverns at each site containing the gassiest oil, in cubic feet of gas per barrel of oil, would be treated. The general process would consist of removing the pressurized crude oil from the cavern and depressurizing it to liberate light-weight hydrocarbon gases and nitrogen. The separation of the gas from the liquid would take place in a special-purpose pressure vessel called a "crude stabilizer" and form two exit streams: (1) the degassed crude oil; and (2) the off-gases. Degasification would remove sufficient gas such that treated crude oil would not exceed a bubble (boiling) point pressure of 12.4 psia at 100 °F. After exiting the degasification unit, the degassed crude oil would be reinjected into the storage cavern. During a drawdown, the degassed oil would then be blended with untreated, moderately gassy crude oil at the site to obtain a blended crude with a bubble point of 14.7 psia at the cooled delivery temperature of 100 °F.[1,2] This bubble point is the threshold boiling point at atmospheric pressure which makes the oil suitable for surface storage and further processing. The off-gases from the degasification unit would include primarily nitrogen, methane, ethane, propane, butanes, pentanes, hydrogen sulfide (H_2S), and some oxygen. The heavier hydrocarbons (i.e., propanes (C_3H_8) and higher) are desirable components of the crude and would be recovered, returned to the crude oil, and reinjected.

H_2S occurs naturally in many crude oils at low concentrations and does not appreciably contribute to their vapor pressure. During degasification, it would be stripped from crude oil. Regulations preclude incineration of gas streams with greater than 160 parts per million (ppm) H_2S in order to limit sulfur oxide emissions (SO_x). Therefore, H_2S would be removed from the incinerator gas stream and returned to the crude oil prior to reinjection into the cavern. The technologies for dealing with H_2S would include non-proprietary processes such as lean oil absorption and amine treating as well as proprietary processes such as certain solvents, selective absorption, and pressure swing adsorption.

At Bryan Mound, the degasification skid would be located south of cavern 4 (Figure 2). Here, degasification would be a successive intercavern process; i.e., oil from one cavern would flow to the degasification unit and then be reinjected into another empty cavern. Oil from a successive cavern would then be treated and reinjected into the preceding cavern, and so on. To circulate the oil, brine would be used as the working displacement fluid instead of surface water in order to prevent unwanted cavern growth due to leaching. The manifolds at the onsite brine pond would be changed so that the brine disposal pumps would pump brine from the pond to the caverns. Brine displaced from a cavern by treated oil from the degas unit would flow back to the brine pond; i.e., the brine pond would serve as an open surge reservoir for brine that is circulating in contact with crude oil. If practicable, a closed system to exchange brine directly between caverns would be considered. Because there are currently no empty caverns at Bryan Mound, oil

Figure 2
Bryan Mound Site Schematic



Source: Fluor Daniel, 1993.

from the first cavern would be treated and then distributed among several other caverns that do not need treatment and have some additional capacity available.

After degassing is complete at Bryan Mound, the degasification unit would be transported to Big Hill. The unit would be located between caverns 108 and 109 (Figure 3). The intercavern approach would be used at Big Hill.

At West Hackberry, the degasification unit would be located between caverns 107 and 115 (Figure 4). Here, the oil would be treated using an intracavern process. Oil would flow from a cavern through a temporary manifold to the degasification unit and then back to the same cavern through a second temporary manifold. Prior to the start of this process, the cavern would be filled beyond its authorized storage capacity, (i.e., a portion of the nominal 1-million-barrel brine "cushion" for cavern creep would be displaced) and the bottom pipe joint of the water/brine casing would be cut off with a shaped explosive. This would put the cavern in "oil only" service, that is, oil would be the only fluid flow. To start the process, one of the cavern manifolds would be packed with oil and the pressure in the cavern would cause the oil to flow out of the cavern into the degasification unit.

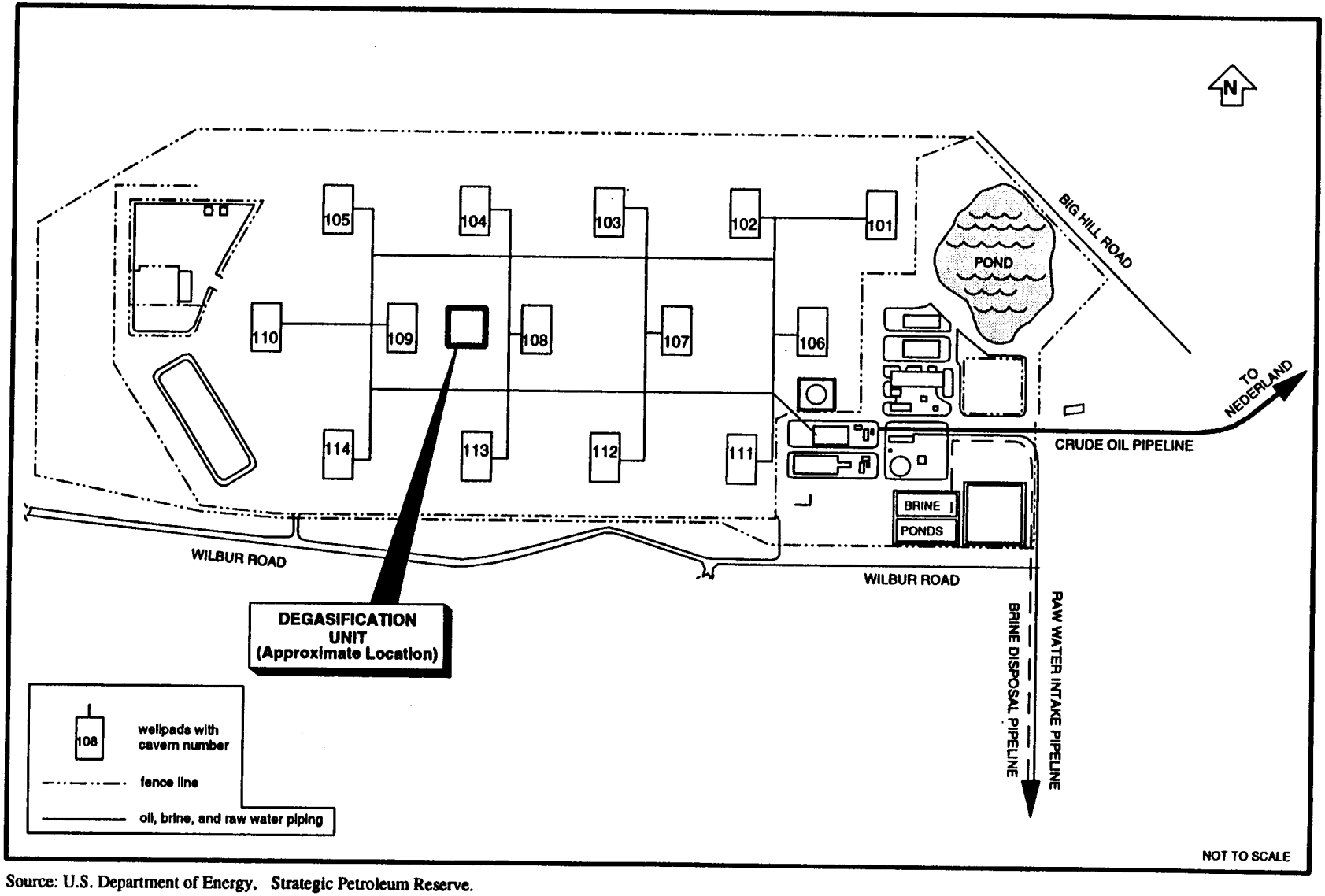
To minimize internal mixing in the cavern while treatment is ongoing, gassy oil would be removed from the top and treated oil, which is more dense, would be reinjected at the bottom. Only a portion of a cavern's inventory would be treated to provide a bubble point as low as 12.4 psia for the cavern as a whole. After treatment, the oil would become convectively mixed throughout the cavern and the missing joint of water/brine casing would be replaced to restore the cavern to normal service. The treated caverns would form the primary blending stock which would be blended during a drawdown with oil from untreated caverns at the manifolds to provide an oil shipment with a bubble point of no more than 14.7 psia at 100 °F as it leaves the storage site.

The intracavern process is being proposed for West Hackberry because it would be the more cost effective approach. The intracavern process requires substantially less electric power because the oil flow cycle is virtually self-priming and there is no need to pump dense brine. Electricity is more expensive at the Louisiana SPR sites, and the costs of the additional temporary manifolds and connections would be less than the extra cost imposed by the electricity power demand of the intercavern method.

When the gassy oil at West Hackberry has been treated, the degasification unit would be moved to Bayou Choctaw. The unit would occupy the existing laydown yard, a staging and storage area located along the north side of the brine pond (Figure 5). Replacement laydown areas would be designated in several separate open spaces on the Bayou Choctaw site. Gassy oil at Bayou Choctaw would be treated using the intracavern approach used at West Hackberry. As mentioned above, the intracavern process is proposed for West Hackberry and Bayou Choctaw because it would be more cost effective than the intercavern due to the higher cost of electric power at the Louisiana sites.

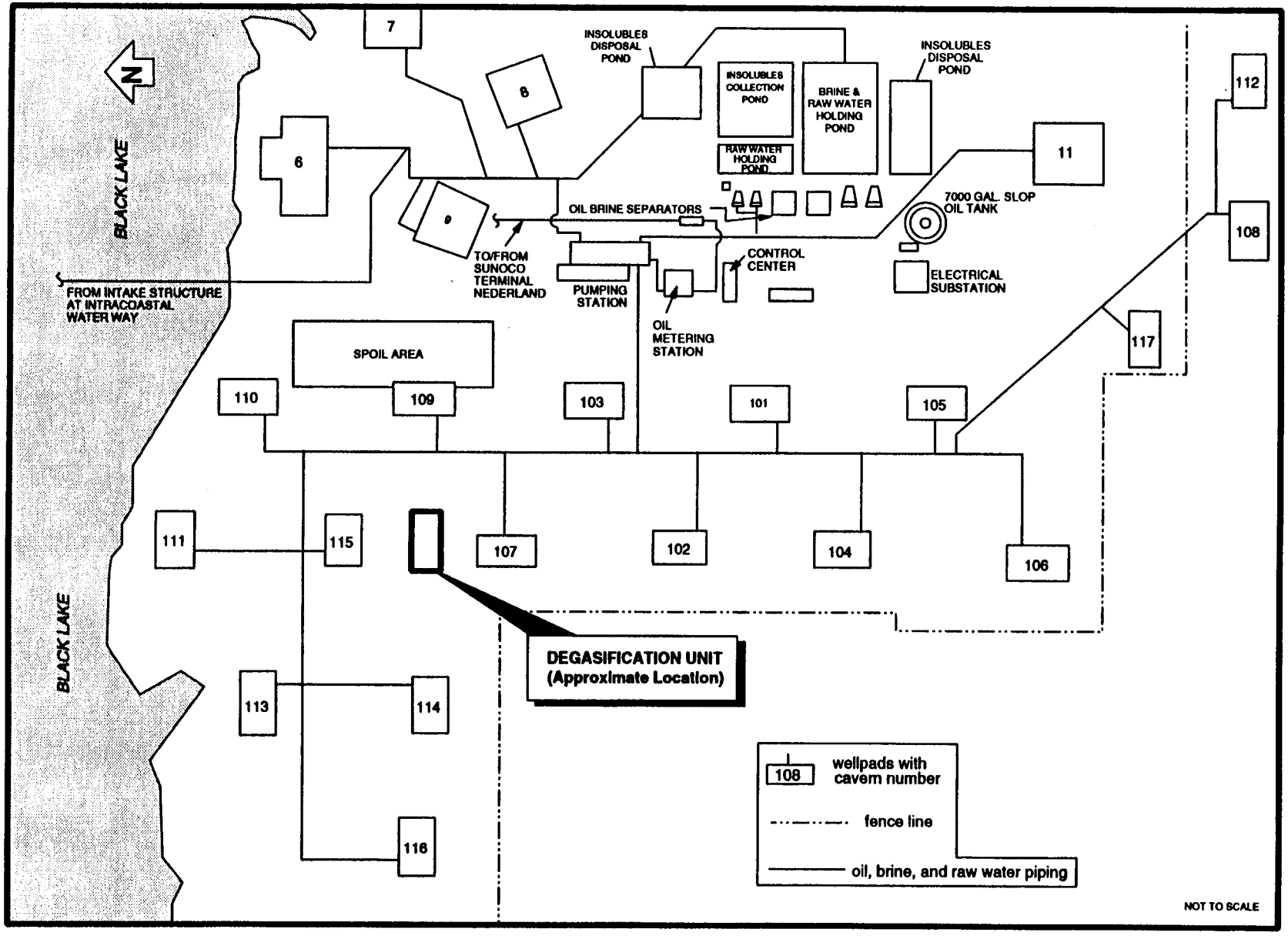
Once degasification operations are complete at the four sites, monitoring of the crude oil quality would continue. Gas intrusion from domal salt may reoccur, and the degasification process may need to be repeated periodically throughout the life of the SPR.

Figure 3
Big Hill Site Schematic



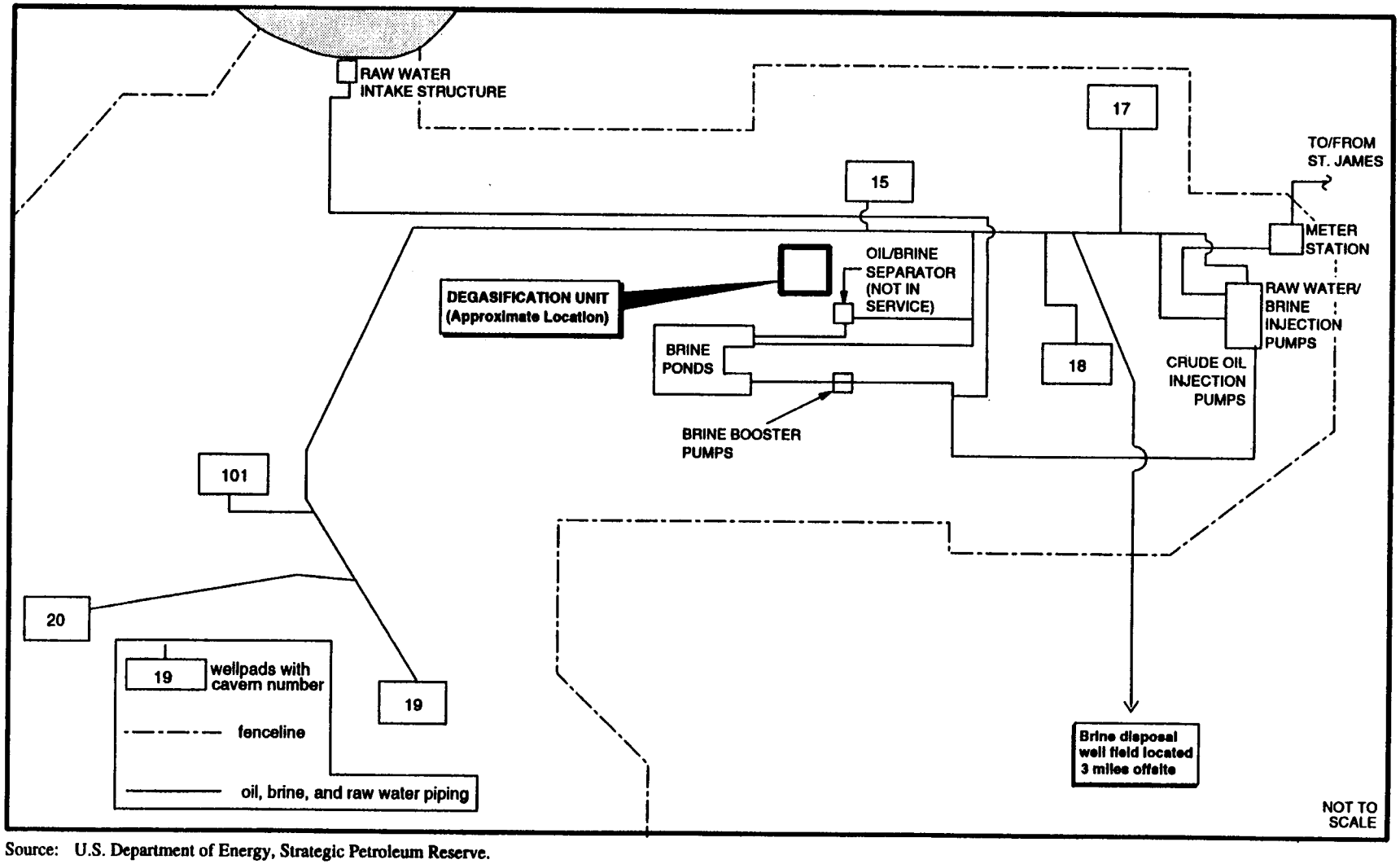
Source: U.S. Department of Energy, Strategic Petroleum Reserve.

Figure 4
West Hackberry Site Schematic



Source: Jacobs/D'Appolonia Engineers

Figure 5
Bayou Choctaw Site Schematic



Source: U.S. Department of Energy, Strategic Petroleum Reserve.

The proposed degasification includes two alternatives for handling the waste off-gas stream: degasification with incineration of the byproduct gases; and degasification with recovery and sale of the byproduct gases. Although current market conditions would likely not support the recovery and sale of byproduct gases, this alternative is assessed so that a bid proposing this alternative may be considered. Such a bid would have to demonstrate the feasibility of this alternative and specify the location of the additional equipment required (i.e., storage tanks and truck racks).

2.1 Degasification with Incineration of Byproduct Gases

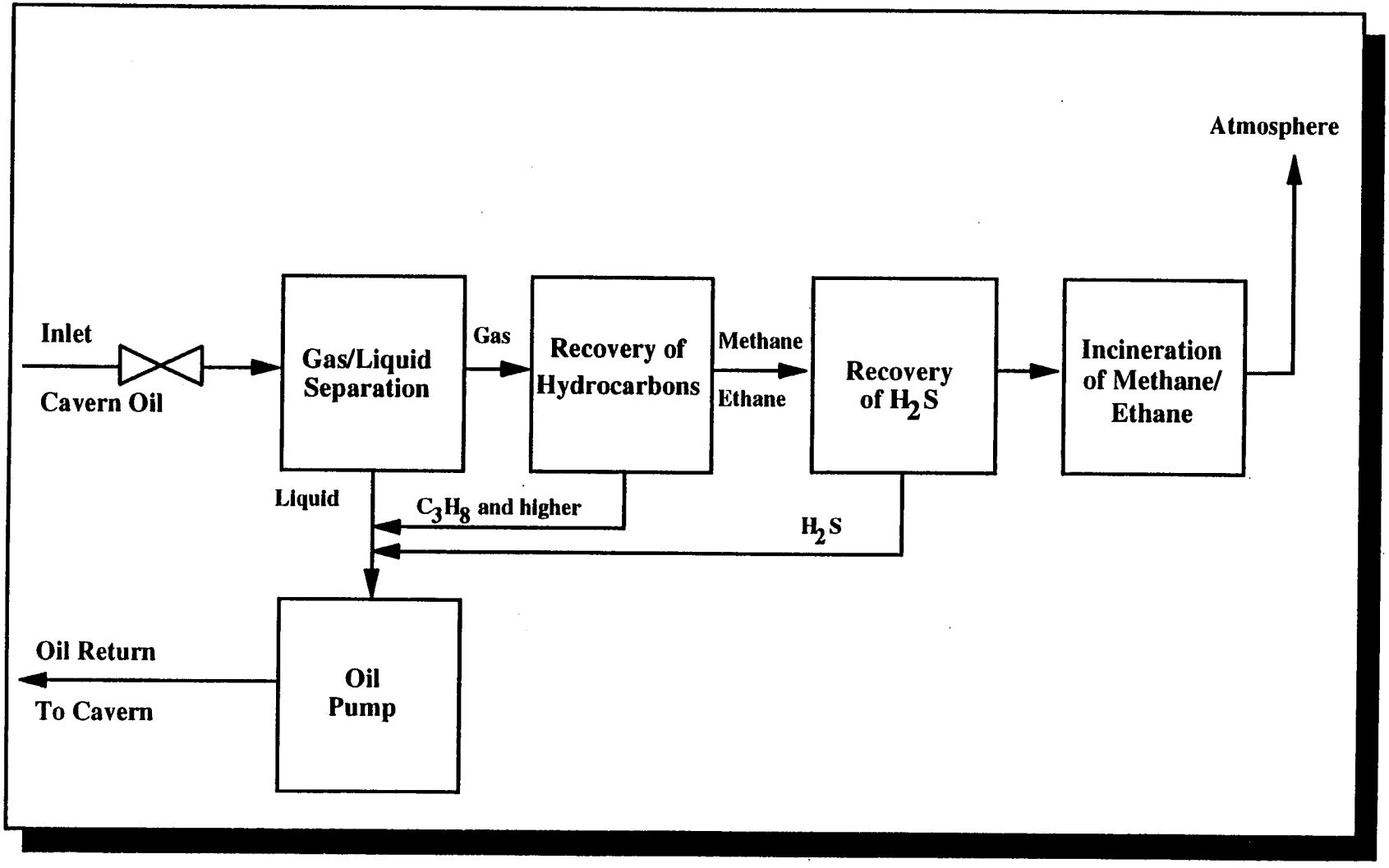
Under the more likely alternative, light hydrocarbons that evolve from the crude during degasification would be oxidized by fume incineration (Figure 6). Methane is the primary hydrocarbon constituent of the non-condensable gases in the crude oil. As previously discussed, the heavier hydrocarbon components of the off-gases are desirable components of the crude. In this option, the methane fraction would be incinerated and much of the heavier hydrocarbon fraction would be recovered and recombined with the degasified crude oil. Several methods of non-methane hydrocarbon recovery may be considered, including compression-condensation, lean oil absorption, solvent absorption, and solid bed adsorption.

The gas (primarily methane) that reaches the incinerator following non-methane hydrocarbon recovery and H_2S removal would be incinerated in an enclosed combustion device. An enclosed combustion device instead of a flare would be necessary to achieve high destruction efficiency and to limit formation of nitrogen oxides (NO_x) by using low-NO_x burners. Comprehensive controls are necessary to manage combustion temperatures and control quantities of excess oxygen to meet regulatory NO_x limits. The VOC emissions from the incinerator also would meet regulatory requirements and state air permits. Combustion efficiencies of 99.98 percent would be expected.[3] No regulatory limits apply to carbon dioxide emissions. Generally carbon monoxide (CO) emissions from a new, modified, or reconstructed facility would have to exceed 1000 tons per year before they would be considered significant. CO emissions from the degas unit would be expected to be far below this threshold.

The desulfurized off-gas could be used as fuel to produce heat which could be used in the process provided the combustion achieved the same required levels of incineration emission control. Supplemental start-up fuel would be required to bring the combustion equipment up to operating conditions before off-gas is incinerated. An emergency relief flare would be necessary for safety reasons (i.e., in case of equipment overpressurization or an incinerator emergency shut-down). The flare is both a safety device and an emergency emission prevention device; as such, it would not be used during routine operations. The design and operational specifications of the flare have yet to be determined. These characteristics would be part of the air permit submitted to the state air quality agencies. The degasification and incineration system would be expected to be operational around the clock with an assumed down-time of five percent or less.

Potential emissions from the degasification-with-incineration alternative that could impact the environment and occupational safety and health include fugitive emissions or accidental releases of crude oil, brine, VOCs, H_2S, amine (if used), and other treatment chemicals. In the event of an accidental release, this alternative could pose toxic, flammable, and/or explosion hazards.

Figure 6
Block Diagram of
Oil Degasification Process with Incineration



2.2 Degasification with Recovery of Byproduct Gases

The degasification-with-recovery option is the same as the action above except that all of the gaseous hydrocarbon components would be recovered rather than incinerating the methane and ethane and reinjecting the C_3 and higher hydrocarbons into the crude oil. The process of hydrocarbon recovery is shown in Figure 7. Current market conditions indicate that bidders are unlikely to propose a gas recovery operation. DOE solicited interest in the purchase of the gas through a notice in the *Commerce Business Daily* but did not receive any strong interest.[4]

If sold, the hydrocarbon product, consisting of methane and ethane, would most likely be transported offsite in trucks. Pipeline transport would be unlikely because the limited period of use during degassing operations would not justify the resources for environmental studies, permit acquisition, and construction.

For truck transport, the gas would be liquefied or compressed (either by refrigeration or compression), pumped through a short pipeline into a storage tank, and loaded into tank trucks via a loading rack. Equipment and procedures for loading/unloading and the transport/storage of the liquified gas product would conform to Department of Transportation (DOT) regulations and NFPA and other industry standards and codes.

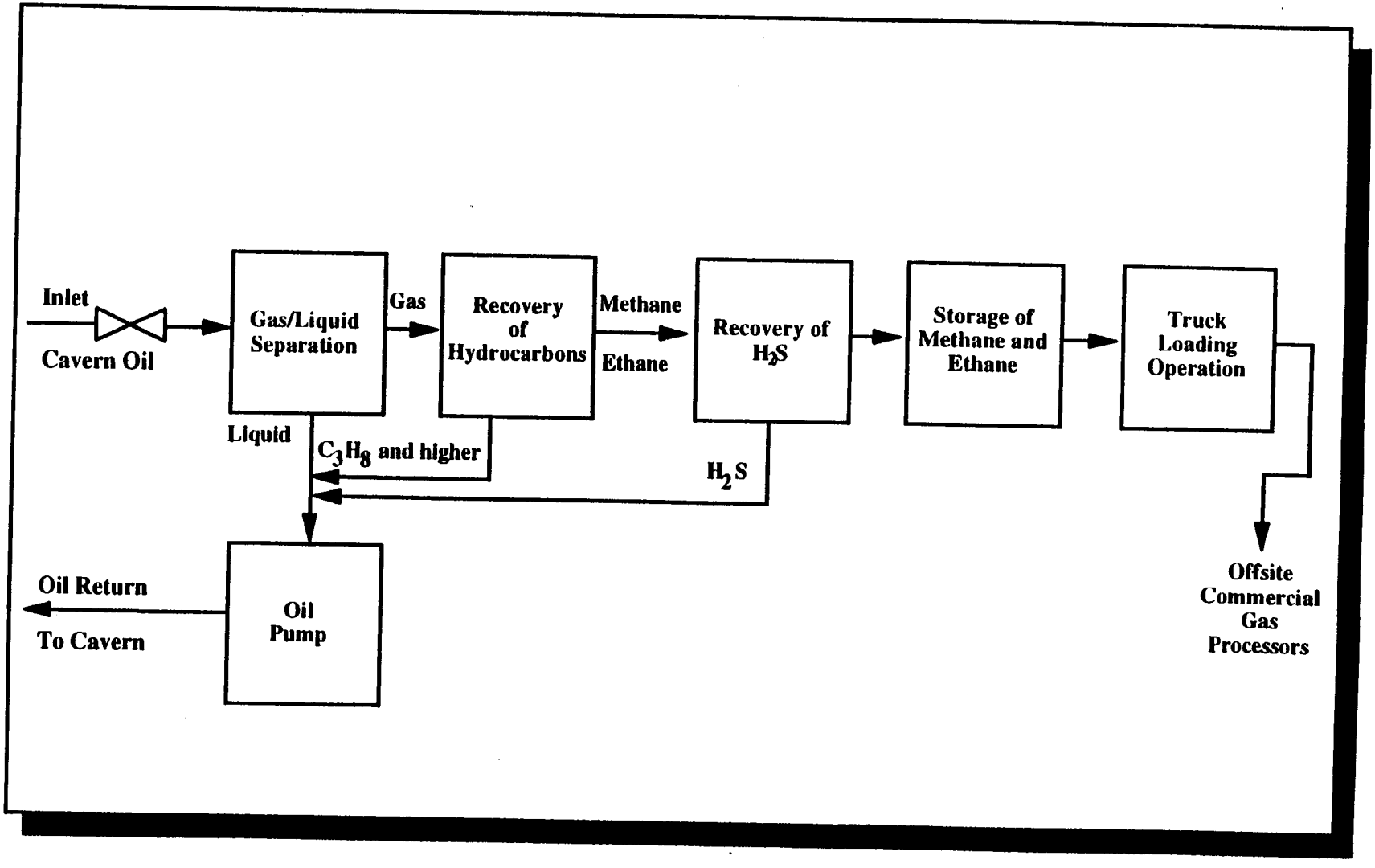
Based on gas/oil ratio data from the Bryan Mound site, it is estimated that approximately 1.5 truckloads, each truck with a capacity of 10,000 gallons, could be loaded per day with liquefied or compressed hydrocarbon gases. An onsite storage vessel would hold approximately 105,000 gallons each of liquefied or compressed methane and ethane (a one-week supply from the degasification unit). At West Hackberry, approximately 0.5 trucks could be loaded per day (See Appendix A).[5] An onsite storage vessel would hold approximately 35,000 gallons of liquefied or compressed methane and ethane (a one-week supply from the degasification unit).[6] At Bayou Choctaw and Big Hill, approximately one truck would be needed per day at each site.[7] An onsite storage vessel would hold approximately 70,000 gallons of liquefied or compressed methane and ethane at Bayou Choctaw and Big Hill. The storage tank, loading rack, and truck access area would be located onsite, either adjacent to the degasification unit or nearby with a connection to an SPR site road, at a safe distance from any ignition sources, and in accordance with applicable regulations and industry standards and codes. For all sites, some road construction and additional vehicle emissions would be considerations for this option.

Potential impacts of the degasification-with-recovery alternative include fugitive emissions or accidental releases of crude oil, brine, VOCs, H_2S, amine (if used), and other treatment chemicals. In the event of an accidental release, this alternative could pose toxic, flammable, and/or explosion hazards.

2.3 No Action Alternative

Under the no action alternative, the gassy SPR crude oil would remain untreated and would thus remain at an undesirably elevated vapor pressure creating safety and environmental problems during an emergency drawdown. Untreated gassy crude oil could not be safely transferred from the SPR at design rates during an emergency drawdown because it would

Figure 7
Block Diagram of
Oil Degasification Process with Hydrocarbon Recovery



liberate gas that could damage transfer equipment (e.g., fittings, valves, pumps, tanks) and possibly cause a major leak, resulting in personnel exposure to toxic gas, fire, or explosion. Preliminary data indicate that as much as 70 percent of the West Hackberry crude oil and 100 percent of the Bryan Mound, Big Hill and Bayou Choctaw crude oil may be too gassy to be acceptable to the receiving terminals at design flow rates. This would reduce the rate and duration of the SPR's ability to replace imported crude oil during a crude oil supply disruption.

A full drawdown of gassy oil would emit excessive quantities of VOCs and H_2S into the air. For example, emissions from the Bryan Mound site, which has four 400,000-barrel surge tanks aboveground, are estimated to be 4,500 tons of VOCs, 94 tons of H_2S, and 38 tons of BTXs.[8] At the terminals that receive oil from each of the four sites, air emissions would exceed current terminal permits.

The gassy oil would also require altered operations. Readiness exercises at the sites could not involve gassy oil. Readiness exercises consist of testing and maintaining equipment to ensure that the facilities are ready if a national emergency should be declared. However, if the quantity of oil required from each site during the emergency exceeded the quantity of available stable (non-gassy) oil in storage, the gassy oil would be blended in-line with stable oil to reduce the gas emissions when the oil entered a tank at atmospheric pressure. This could occur only under limited circumstances. Based on a tank test at Bryan Mound, an atmospheric dispersion modeling exercise, and a safety analysis, it was determined that highly gassy crude oil, e.g., with 30 psia bubble point and 7 ft^3 of gas/barrel could not be transferred safely during an emergency drawdown. However, oil with no more than 1 ft^3 of gas/barrel could be safely moved into a tank at a maximum rate of 20,000 barrels/hour if the wind were at least 8 kilometers (5 miles) per hour to dissipate the toxic and flammable gases. Therefore, without the proposed action, the SPR could safely draw down and distribute no more than 520 million barrels of crude oil at no more than 2 million barrels per day at the present time. However, this capability would decline if the concentration of dissolved gases in the oil continued to increase.

To conduct a limited drawdown without degasification, the SPR would take certain safety precautions. Monitoring devices would be placed 27 meters (90 feet) from the tank. Personnel would be evacuated if a 10 percent lower explosive limit (LEL) or 10 ppm H_2S were observed. Oil flow would be stopped if 20 percent LEL or 15 ppm H_2S were observed.

2.4 Alternatives Considered but Eliminated from Detailed Study

DOE considered other alternatives but eliminated them from detailed study because they were not feasible. One alternative was to treat the oil through super-cooling during drawdown to lower the temperature to a level where the TVP would be acceptable to the refineries receiving the oil. This alternative was eliminated from detailed study for several reasons. The size of the compressors and other equipment required to process the large volumes of oil shipped during a drawdown would be extremely costly. In addition, a drawdown during the summer would raise the costs of super-cooling even higher, because of re-heating during transfer and storage. Finally, because the super-cooling equipment would only be used in a drawdown, it would sit idle for long periods of time, thereby increasing the likelihood that the equipment would be damaged during an actual drawdown. Similarly, degasification with incineration at drawdown was eliminated from detailed study, because of the prohibitive cost of such a large-scale operation (i.e., up to 1.25

million barrels per day) and the increased risk that the equipment would be damaged as a result of infrequent use.

Another alternative considered was continuous inventory replacement. DOE would sell the inventory of gassy oil to refiners and replace it at the same rate with newly purchased, stable oil. At a rate as low as 100,000 BPD, this could be accomplished without the environmental or safety problems that would occur at the design drawdown rate. However, the operational cost of continually buying, storing, selling, and shipping the oil would outweigh the cost of degasification.

ENDNOTES

1. Fluor Daniel, Inc., *Environmental Assessment Support Task Information (Informal Project Management Office revision to preliminary action decision memorandum)*, January 26, 1994.

2. U.S. Department of Energy, Strategic Petroleum Reserve, *Initial Fiscal Year 1995 Budget Request, Excess Gas in Crude Oil, (Module 6)*, May 25, 1993.

3. Meeting with Strategic Petroleum Reserve Project Management Office Staff on January 27, 1994.

4. *Commerce Business Daily*, Issue No. PSA-0857, June 1, 1993.

5. The MITRE Corporation, *Estimated Gas Sales*, U.S. Department of Energy, Strategic Petroleum Reserve, December 2, 1993.

6. *Ibid.*

7. *Ibid.*

8. Fluor Daniel, Inc., Draft report on gas emissions at Bryan Mound, U.S. Department of Energy, Strategic Petroleum Reserve, November 24, 1993, Table 2.

3.0 DESCRIPTION OF AFFECTED ENVIRONMENT

Detailed descriptions of the regional and site-specific environments for the four sites are provided in the EISs for the three phases of development that were referenced in Chapter 1.0. The discussion of air quality below focuses on the evolving regulatory strategy resulting from the Clean Air Act Amendments of 1990.

3.1 Air Quality

As authorized by the Clean Air Act, the United States Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for six pollutants: ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), lead (Pb), and particulate matter smaller than 10 micrometers (PM_{10}). Because ozone generally is not emitted directly but is formed in the atmosphere by photochemical reactions of nitrogen oxides (NO_x) and volatile organic compounds (VOCs), strategies to attain and maintain the ozone NAAQS typically involve reducing area wide NO_x and VOC emissions. Ozone, CO, SO_2, NO_2, Pb, and PM_{10}, along with NO_x and VOCs, are typically referred to as "criteria" air pollutants. The primary NAAQS specify ambient concentrations of these pollutants that are protective of the public health, while secondary NAAQS specify ambient concentrations that are protective of welfare (e.g., property, etc.). Areas in which a pollutant in the ambient air exceeds the primary NAAQS are designated as nonattainment for that pollutant. Thus, an area may be nonattainment for one or more pollutants, and in attainment for others.

In particular, the Clean Air Act Amendments of 1990 classify ozone nonattainment areas by degree of nonattainment, using "design value" as a measure of how far the area is out of attainment. Design value is the second highest hourly measured ozone value within the area. The classifications of ozone nonattainment areas by design values are shown in Table 1.

Table 1
Ozone Nonattainment Classifications

Class	Design Value (parts per million, ppm)	Attainment Date
Marginal	0.12 - 0.138	1993
Moderate	0.138 - 0.160	1996
Serious	0.160 - 0.180	1999
Severe	0.180 - 0.280	2005/2007
Extreme	0.280 +	2010
NAAQS	0.12	

Source: Section 181(a), Clean Air Act Amendments of 1990.

It should be noted that few if any facilities emit ozone; ozone is formed by complex photochemical reactions among nitrogen oxides (NO_x) and VOCs. Sources contributing to nonattainment problems include large stationary emissions sources (e.g., petroleum refineries, etc.), area sources (e.g., small stationary emissions sources, such as automotive service stations, and ubiquitous sources such as consumer products), and mobile emissions sources (e.g., cars, trucks, busses, etc.).

To facilitate pollution control planning, the Clean Air Act authorizes the EPA Administrator to subdivide each State into Air Quality Control Regions (AQCRs); a State may then alter the boundaries of the AQCRs with the approval of the Administrator. Any State in which a nonattainment area is located must submit a State Implementation Plan (SIP) to reduce the concentration of all pollutants to the acceptable level in the AQCR containing the nonattainment area. The State must design the SIP to bring the area to attainment status within a statutorily established time frame.

One important facet of these designations is that in general ozone nonattainment areas include the entire consolidated metropolitan statistical area (CMSA), and the entire CMSA carries the design value associated with the highest monitor. For example, a facility may be located in a county that has a design value less than the design value of a neighboring county. If, however, the two counties are in the same CMSA, and the neighboring county has the highest design value in this region, the county in which the facility resides must meet the design value of the neighboring county. This design value determination method is necessary in order that appropriate area wide planning and emissions reductions may be accomplished to achieve the NAAQS. It should be noted that the Clean Air Act Amendments of 1990 require areas with high design values to implement more emissions reduction programs to attain the NAAQS, and are allowed more time to achieve the NAAQS.

With the exception of ozone, the air quality control regions influenced by the four SPR sites and the terminals receiving their oil are in attainment for all NAAQS criteria pollutants. Bryan Mound, Big Hill, and Bayou Choctaw are located in ozone nonattainment areas. The Houston-Galveston-Brazoria ozone nonattainment area, in which the Bryan Mound facility and its two receiving terminals are located, is classified as severe, with a current ozone design value of 0.22 parts per million (ppm) hourly average, as compared to the NAAQS of 0.12 ppm hourly average. The Beaumont-Port Arthur and Baton Rouge areas, which include the Big Hill and Bayou Choctaw facilities, respectively, and their receiving terminals, are serious ozone nonattainment areas. These two SPR sites and their terminals each have a design value of 0.16 ppm. The remaining facility, West Hackberry, and its receiving terminal in Lake Charles are in attainment for ozone as well as the other NAAQS pollutants. One of West Hackberry's terminals, however, is located in the Beaumont-Port Arthur ozone nonattainment area. Table 2 lists the pollutants, their NAAQS, and the current level of each pollutant within the air quality control region in which each of the four SPR sites and their receiving terminals are located.[1,2] Texas and Louisiana have adopted the federal NAAQS as the standards for their respective states.

Table 2
National Ambient Air Quality Standards and Current Pollutant Levels within Air Quality Control Regions in which SPR Sites and Receiving Terminals are Located

Pollutant (units) (concentration)	NAAQ Standard	Current Level			
		Bryan Mound	Big Hill	West Hackberry	Bayou Choctaw
Ozone (ppm) (2nd max, 1-hour)	0.12	0.22[1]	0.16[1]	<0.12	0.16[1]
CO (ppm) (8-hour)	9	7	2	ND	5
PM-10 (μg/m3) (2nd max, 24-hour)	150	108	58	52	70
PM-10 (μg/m3) (arithmetic mean)	50	37	26	23	28
SO_2 (ppm) (arithmetic mean)	0.03	0.007	0.008	0.004	0.008
SO_2 (ppm) (2nd max, 24-hour)	0.14	0.047	0.036	0.02	0.036
Lead ($\mu g/m^3$) (quarterly max)	1.5	0.03	0.03	ND	0.05
NO_2 (ppm) (arithmetic mean)	0.053	0.028	0.012	ND	0.019

[1] Design value.

Sources: U.S. Environmental Protection Agency, National Air Quality and Emissions Trends Report, 1991, Office of Air Quality Planning and Standards, October 1992, Document No.: 450-R-92-001; Thompson Publishing Group, Clean Air Permits: Manager's Guide to the 1990 Clean Air Act, 1993.

3.2 Floodplains

Construction of the oil degasification units at Bryan Mound, Big Hill, West Hackberry, and Bayou Choctaw would be within existing site boundaries of the respective storage facilities. Designated Zone X by the National Flood Insurance Program, the Bryan Mound facility, and hence the area of construction for the degasification unit, is protected from the 100-year floodplain because of its elevation (Figure 8).[3] Big Hill's elevation is 11 meters (37 feet) above mean sea level (msl) and would be located outside both the 100-year and the 500-year floodplain (Figure 9).[4] The Flood Insurance Rate Map for West Hackberry indicates that the degasification unit also would be located outside both the 100-year floodplain and the 500-year floodplain, and that there would be no elevation requirement for construction in this area (Figure 10).[5]

The Bayou Choctaw storage facility is situated within a 100-year floodplain directly east of Choctaw Bayou, an alternate route of the Intracoastal Waterway (Morgan City-Port Allen Route) (Figure 11). The ground elevation is one and a half to two meters (five to six feet) above msl and floods could reach three meters (ten feet) above msl should a 100-year flood occur. The proposed construction of an oil degasification unit at Bayou Choctaw would, therefore, be located in a 100-year floodplain. Levees in the vicinity are limited in extent and are intended primarily to deflect flows during common high-water periods; they would not provide sufficient protection from the 100-year flood.[6]

3.3 Other Environmental Resources

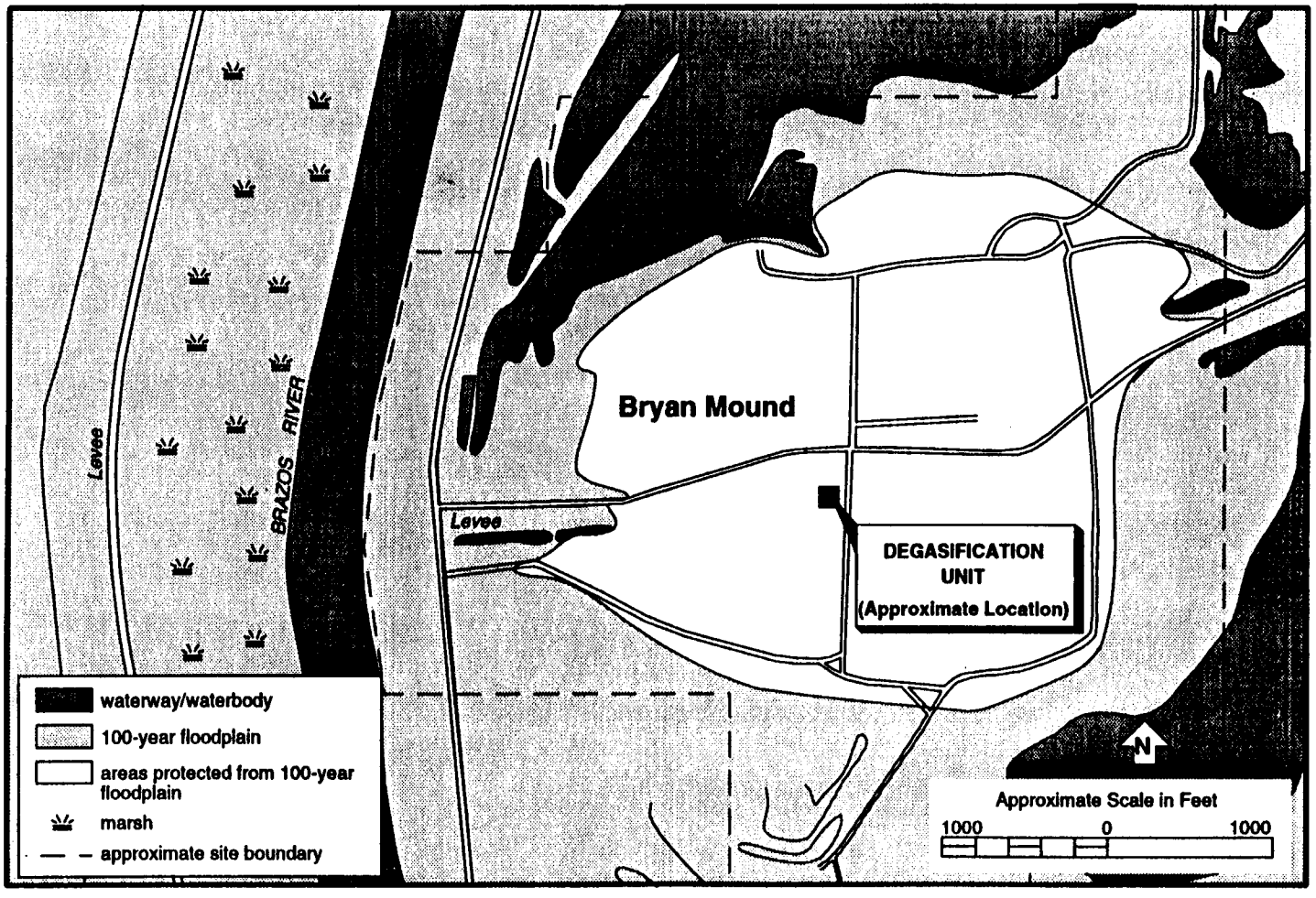
3.3.1 Bryan Mound

The existing Bryan Mound facility is located on the east bank of the Brazos River Diversion Channel, approximately five kilometers (three miles) southwest of Freeport, in Brazoria County, Texas. The Gulf of Mexico lies three kilometers (two miles) to the southeast. The site of the proposed degasification unit is in the disturbed central plant area of the Bryan Mound storage facility, which includes buildings, well pads, brine ponds, pump stations, headers, piping, roads, and landscaping. The area around the facility is humid Gulf Coastal Plain, which is characterized by a variety of subtropical plants and animals. Tidal ponds and brackish marsh surround the facility area (Figure 8). No wetlands, endangered species, or sensitive environments exist at the proposed Bryan Mound degasification unit site or elsewhere within the Bryan Mound facility.[7] A cultural resources study conducted at the Bryan Mound salt dome did not discover any archaeological, historical, or cultural resources. None of the property at the Bryan Mound site is listed or proposed for the National Register of Historic Places.[8] There are no Native American tribal lands or minority or low-income communities in the area of the proposed degasification unit.

3.3.2 Big Hill

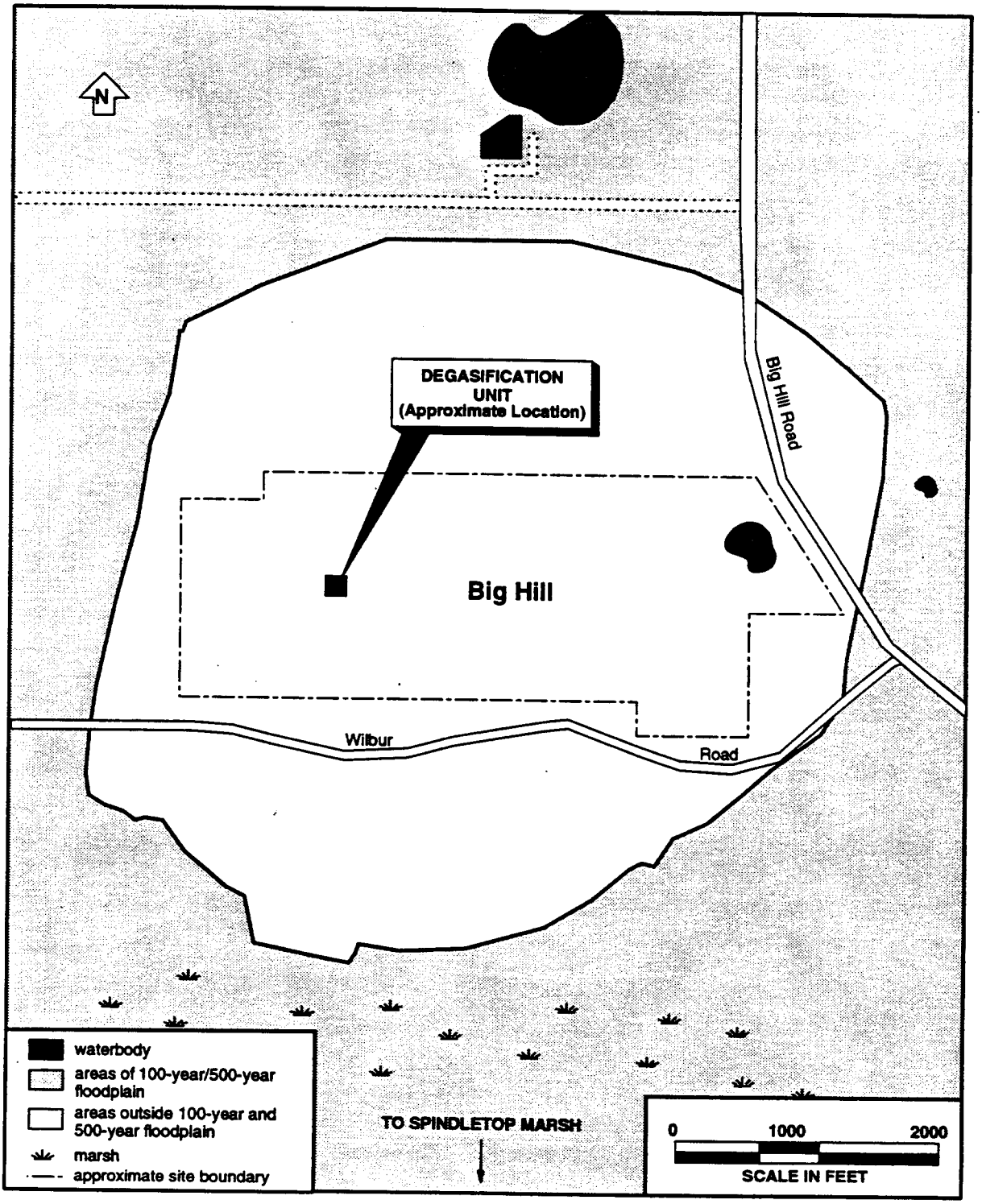
The Big Hill facility is located in Jefferson County, Texas, about 35 kilometers (22 miles) southwest of Port Arthur and several kilometers from the Gulf of Mexico. Only small unincorporated communities are located within a 24-kilometer (15-mile) radius of the facility. The site of the proposed degasification unit is in the disturbed central plant area of the Big Hill

Figure 8
Location of Degasification Unit Relative to
to Floodplains/Environmental Resources at Bryan Mound



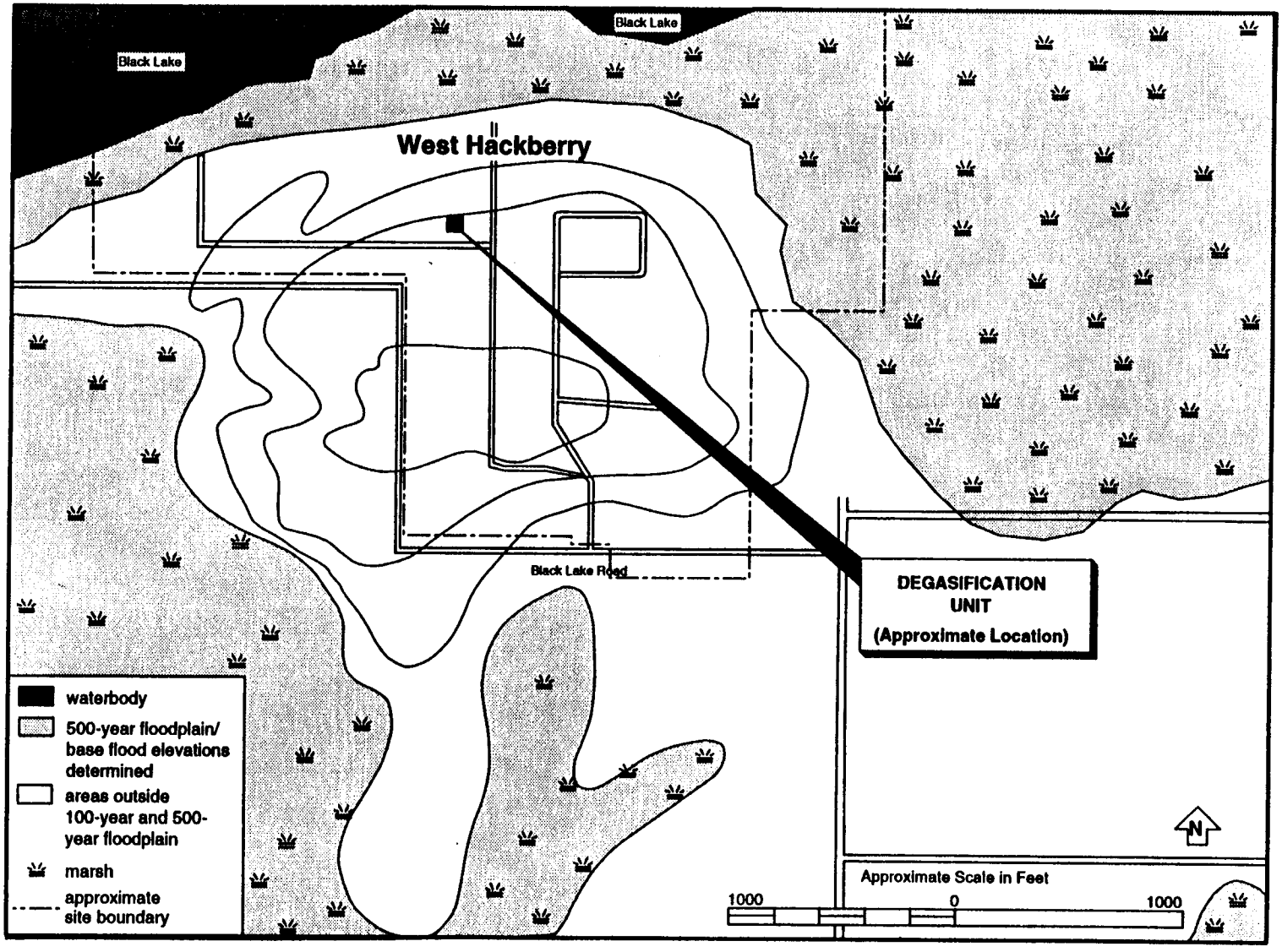
Source: Federal Emergency Management Agency, National Flood Insurance Program, Flood Insurance Rate Map, Brazoria County, Texas and Incorporated Areas, Panels 770 and 790 of 850, Map Numbers 48039C0770J and 48039C0790J, revised 11/17/93.

Figure 9
Location of Degasification Unit Relative to Floodplains/Environmental Resources at Big Hill



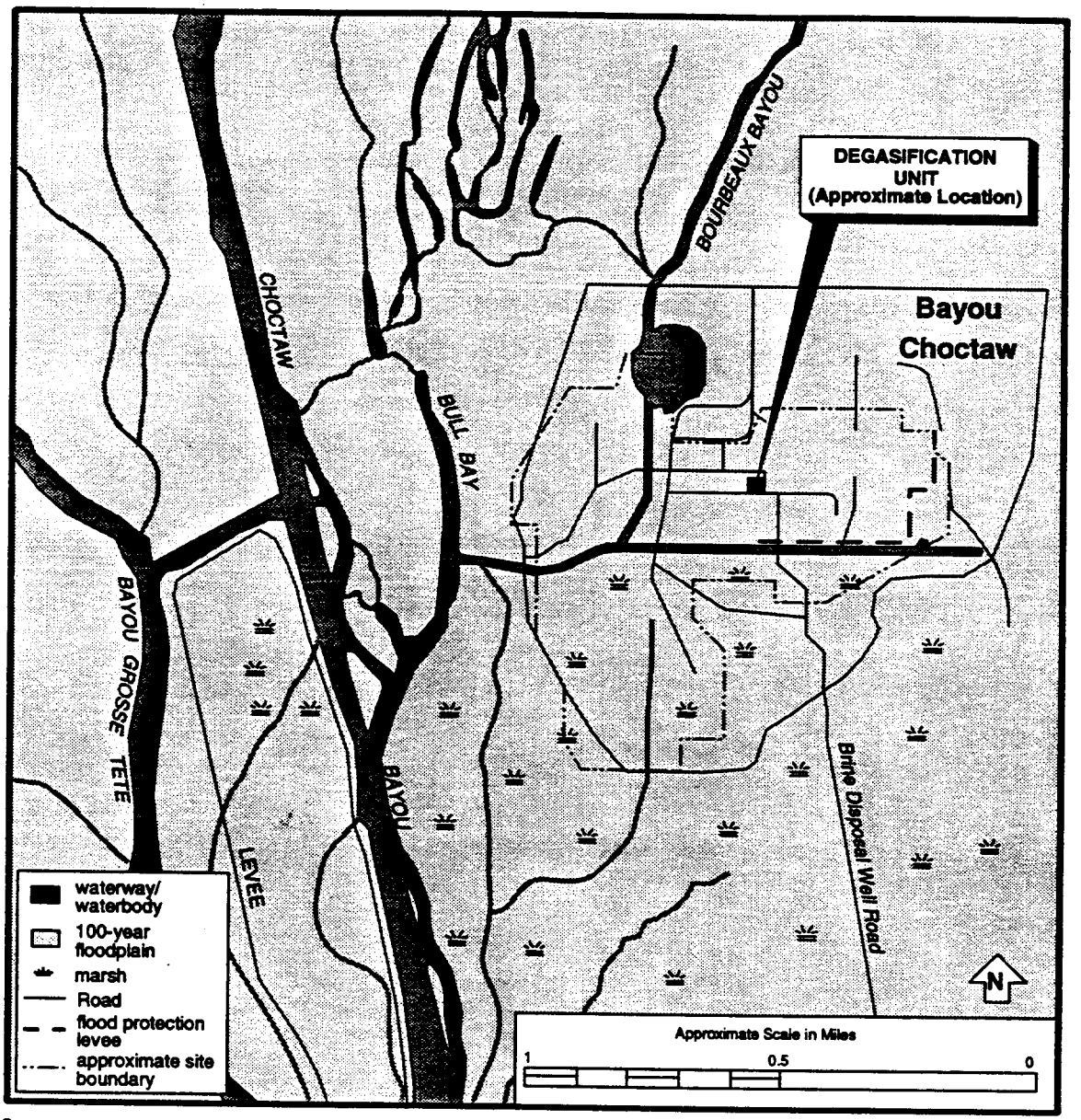
Source: Federal Emergency Management Agency, National Flood Insurance Program, Flood Insurance Rate Map, Jefferson County, Texas.

Figure 10
Location of Degasification Unit Relative to
to Floodplains/Environmental Resources at West Hackberry



Source: Federal Emergency Management Agency, National Flood Insurance Program, Flood Insurance Rate Map, Cameron Parish, Louisiana, Unincorporated Areas, Panel 325 of 875, Community Panel Number 225194 0325F, revised 4/16/91.

Figure 11
Location of Degasification Unit Relative to Floodpains/Environmental Resources at Bayou Choctaw



Source: Federal Emergency Management Agency, National Flood Insurance Program, Flood Insurance Rate Map, Iberville Parish, Louisana, Unincorporated Areas, Page 4 of 11, Community Panel Number 220083 0004 B, June 1, 1978.

storage facility, which includes buildings, well pads, brine ponds, pump stations, headers, piping, roads, and landscaping. The facility rises to an elevation of 11 meters (35 feet) above sea level. The surrounding area is typical of the agricultural land in the region. Marshland lies to the south of the site and several water bodies are located nearby containing water ranging from fresh to brackish (Figure 9). No wetlands, endangered species, or sensitive environments exist at the proposed Big Hill degasification unit site or elsewhere within the existing Big Hill facility. A cultural resources survey randomly sampled the Big Hill salt dome area and did not discover any archaeological, historical, or cultural resources. None of the property at the Big Hill site is listed or proposed for the National Register of Historic Places.[9] No Native American tribal lands or minority or low-income communities are in the area of the proposed degasification unit.

3.3.3 West Hackberry

The existing West Hackberry site is located in Cameron Parish, Louisiana, approximately 27 kilometers (17 miles) from the Gulf of Mexico. Lake Charles is approximately 24 kilometers (15 miles) from the facility, but the surrounding parish does not contain any incorporated areas. The site of the proposed degasification unit is in the disturbed central plant area of the 2.3-square kilometer (565-acre) West Hackberry storage facility, which includes buildings, well pads, brine ponds, pump stations, headers, piping, roads, and landscaping. Black Lake lies on the north side of the dome and marshlands dominate the south and west sides of the dome (Figure 10). Dredge spoil disposal areas have modified the topography.

The West Hackberry storage facility is located within the Louisiana Coastal Zone. There are no wetlands, endangered species, or sensitive environments within the existing West Hackberry site, including the proposed degasification unit site. Cultural resources surveys have not revealed any evidence of prehistoric or historically important resources in the project area. None of the property at the West Hackberry site is listed or proposed for the National Register of Historic Places.[10] No Native American tribal lands or minority or low-income communities are in the area of the proposed degasification unit.

3.3.4 Bayou Choctaw

The existing Bayou Choctaw facility is located in Iberville Parish, Louisiana, 21 kilometers (13 miles) southwest of Baton Rouge, and about six kilometers (four miles) west of the Mississippi River. The site of the proposed degasification unit is in the disturbed central plant area of the Bayou Choctaw storage facility, which includes buildings, well pads, brine ponds, pump stations, headers, piping, roads, and landscaping. Bottomland forest and deciduous swamp ecosystems dominate the area around the Bayou Choctaw facility (Figure 11). Although no wetlands exist on the proposed degasification unit site, freshwater wetlands in the area are part of a vast swamp connected by a canal-bayou-swamp complex to the Intracoastal Waterway. A 0.05-square kilometer (12-acre) lake is located onsite. Smaller surface water bodies in the immediate site vicinity include Bayou Bourbeaux and Bull Bay. No endangered species or sensitive environments other than the floodplain exist at the proposed Bayou Choctaw degasification unit site. No archaeological sites are located on the salt dome.[11] A Native American village is located approximately six kilometers (four miles) south of the dome, but there are no other minority or low-income communities in proximity to the site.

ENDNOTES

1. U.S. Environmental Protection Agency, *National Air Quality and Emissions Trends Report, 1991*, Office of Air Quality Planning and Standards, October 1992, Document No.: 450-R-92-001.

2. Thompson Publishing Group, *Clean Air Permits: Manager's Guide to the 1990 Clean Air Act*, October 1993, tab 400, p vi.

3. Personal Communication with P. Sturdivant, Floodplain Administrator, Brazoria County, Texas, February 7, 1994; Federal Emergency Management Agency, National Flood Insurance Program, Flood Insurance Rate Maps, Brazoria County, Texas and Incorporated Areas, Panels 770 and 790 of 850, Map Numbers 48039C0770J and 48039C0790J, revised November 17, 1993.

4. Personal Communication with V. Bateman, Environmental Control, Jefferson County, Texas, March 15, 1994.

5. Personal Communication with E. Mock, Permit Secretary, Flood Management Office, Cameron Parish, Louisiana, February 10, 1994; Federal Emergency Management Agency, National Flood Insurance Program, Flood Insurance Rate Maps, Cameron Parish, Louisiana, Unincorporated Areas, Panels 325 of 875, Community Panel Number 2251940325F, revised April 16, 1991.

6. Personal Communication with H. Blanchard, Planning Division, U.S. Army Corps of Engineers, Iberville Parish, Louisiana, February 18, 1994; U.S. Department of Housing and Urban Development, Federal Insurance Administration, National Flood Insurance Program, Flood Insurance Rate Map, Iberville Parish, Louisiana, Unincorporated Areas, Panel 4 of 11, Community Panel Number 220083 0004 B, effective June 1, 1978.

7. U.S. Department of Energy, *Strategic Petroleum Reserve Phase III Development, Texoma and Seaway Group Salt Domes, Final Supplement to Final Environmental Impact Statement*, Washington, DC, October 1981, DOE/EIS-0075.

8. U.S. Department of Energy, *Strategic Petroleum Reserve Phase III Development, Texoma and Seaway Group Salt Domes, Final Supplement to Final Environmental Impact Statement*, Washington, DC, October 1981, DOE/EIS-0075.

9. *Ibid.*

10. *Ibid.*

11. U.S. Department of Energy, *Capline Group Salt Domes, Final Environmental Impact Statement,* Volume 1, Strategic Petroleum Reserve, Washington, DC, July, 1978, DOE/EIS-0024.

4.0 POTENTIAL ACCIDENTAL RELEASES AND OCCUPATIONAL AND PUBLIC SAFETY AND HEALTH

This section examines the types of accidental releases that might have adverse impacts on the environment or pose health hazards to onsite workers or to the public from the operation of the proposed degasification systems. Potential accidental releases are considered for the degasification-with-incineration option, the degasification-with-recovery option, and the no action alternative. Accidents examined include potential air releases, oil spills, brine spills, and other hazardous substance releases. The potential environmental impacts of both accidental releases and hazards are discussed in Chapter 5. The SPR has developed applicable safety policies and procedures designed to reduce the probability of occurrence and to mitigate the possible consequences.[1]

Degasification is a commonly used petroleum industry process which has been designed and operated according to industry standards for safety and for the prevention of releases. The degasification units at the SPR sites would be owned and operated by a contractor experienced in all aspects of degasification operations. The process hazards and potential accidental releases from the degasification unit would be similar at all four sites because the degasification unit used at each site would be essentially the same. However, accidental releases of oil and brine are somewhat more probable at Bryan Mound and Big Hill because of the intercavern method used to move the oil at the site. Although the actual designs of the degasification-with-incineration or degasification-with-recovery systems have yet to be decided, generic process hazards can be summarized based on the general operations of a degasification unit. When specific equipment or process conditions associated with a degasification unit are needed to demonstrate a hazard or potential release, the "compression-condensation" degasification process will serve as the baseline process.

4.1 Potential Accidental Releases to Air

The degasification unit would require various process equipment including pumps, compressors, piping and connections, valves, hoses, process vessels, and storage vessels. Failure of this equipment or operator error could result in a release of toxic vapors and/or flammable gases to air. Most likely, a release would pose both a toxic and a flammable hazard because the substances processed and used in the degasification operation are toxic, flammable, or both (e.g., H_2S). Flammable gases could explode under certain conditions (i.e., in a confined space and with an ignition source). Air releases can occur either from leaks of gassy oil or from leaks in equipment in vapor service.

Pumps in liquid service can leak oil and gaseous components (e.g., VOCs and H_2S) through seals (between the moving shaft and the stationary casing). H_2S in the oil can corrode or embrittle steel. Failure of pressure reduction equipment could result in larger releases of oil and associated quantities of VOCs and H_2S (See section 4.2 Potential Oil Spills). However, leaks of crude oil from equipment (e.g., pumps) usually can be shut off from various locations.

In a compression-condensation degasification unit, failure of a cooler at the compressor discharge could create excessive pressure in the system which could result in a direct vapor release of H_2S and hydrocarbons. This overpressurization could cause a relief valve to open or could cause failure in downstream equipment, particularly at a flange. The flammable gases in a vapor

cloud could cause an explosion if the confined concentration of the gas is within flammability limits and if an ignition source is available. Propane, butane, H_2S, and methane have lower flammability limits of 2.1, 1.8, 4.3, and 5 percent by volume in air, respectively. Releases as a result of overpressurization are usually small and therefore represent a relatively minor health or environment hazard. If the pipeline carrying the off-gas stream failed during degasification at Bryan Mound, approximately 40 kilograms (90 pounds) of gas (assuming 100 percent propane) would be released in one minute, based on predictions of off-gas stream flow.[2] If a propane vapor cloud explosion resulted from this worst-case release, it would cause an overpressure level that could break glass at a distance of 150 meters (500 feet) from the unit and hurl a person within 30 meters (100 feet) of the unit to the ground.[3] To prevent system upset, SPR would require that pressures and process conditions of the degasification unit would be closely monitored and equipped with appropriate detectors and automatic shutoffs. The degasification unit could also be controlled and shut down from remote locations.

During the degasification operation, H_2S would be concentrated in the byproduct gas stream at levels posing toxic hazards. For example, in the compression-condensation degasification unit, H_2S could be concentrated in a byproduct gas stream to 34,000 ppm or 3.4 percent.[4] Toxic exposure guidelines for H_2S are much lower; the Immediately Dangerous to Life or Health (IDLH) is 300 ppm,[a] the Emergency Response Planning Guideline (ERPG-3) is 100 ppm,[b] and the OSHA Short Term Exposure Level (STEL) is 15 ppm).[c] However, the probability of a large release from equipment carrying an H_2S-rich stream would be remote. The SPR guidelines for working near H_2S specify appropriate operating, monitoring, and emergency procedures.[5] The degasification contractor would be required to follow extensive maintenance and inspection schedules specified by DOE to assure that process equipment operates properly.[6,7]

Under the gas recovery option, liquid hydrocarbons could be released accidentally through equipment failure or human error. Upon release, some of the liquid hydrocarbon components would vaporize and could ignite, resulting in a vapor cloud fire or explosion. Although remote, the probability of a large fire or explosion would be somewhat greater for the recovery option than for the incineration option because the recovery option would require transport, pressurized/refrigerated storage, and loading/unloading of potentially large quantities of liquefied hydrocarbons onsite: 105,000 total gallons at Bryan Mound; 70,000 gallons at Big Hill; 35,000 gallons at West Hackberry; and 70,000 gallons at Bayou Choctaw. Accident data indicate that the

---

[a] "Immediately Dangerous to Life or Health" ("IDLH") means an atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would interfere with an individual's ability to escape from a dangerous atmosphere. (Occupational Safety and Health regulations 29 CFR 1910.120 (a)(3))

[b] Emergency Response Planning Guidelines (ERPG-3) developed by American Industrial Hygiene Association is the maximum concentration in air below which nearly all people could be exposed for one hour without life-threatening health effects.

[c] Short Term Exposure Level (STEL) is developed by OSHA and defined as the employee's 15-minute time weighted average exposure which shall not be exceeded at any time during a work day unless another time limit is specified. (Occupational Safety and Health regulations 29 CFR 1910.1000 (5)(ii))

rate of hose failure and resulting accidental release is approximately 10^{-2} per hose per year for loading/unloading operations,[8] and releases from storage vessels occur at the rate of 10^{-4} per single-walled storage tank per year.[9] This means that one in every 10,000 single-walled storage tanks could be expected to fail in a single year.

Transport of liquefied hydrocarbons offsite could pose risk to the public from truck accidents. The probability of a release can be estimated by multiplying an average accident rate times the number of kilometers driven times an average accident release rate. API estimates that the accident rate for trucks in the petroleum industry is 3.0×10^{-6} per kilometer.[10] At Bryan Mound the average delivery distance would be 32 kilometers (20 miles).[11] The probability of an accident per truck shipment from Bryan Mound would be $1.0 \times 10.^{-4}$ Assuming 550 truck shipments per year (1.5 per day, 365 days per year), the annual probability of a truck accident would be 0.055 (5.5 percent). Assuming a release rate of 14 percent for accidents involving trucks carrying hazardous materials,[12] the likelihood of an accident with a release would be 7.7×10^{-3} (0.8 percent). The release probabilities at Big Hill, West Hackberry and Bayou Choctaw would be somewhat lower because the average delivery distances would be shorter.

During a full (design rate) drawdown under the no action alternative, excess gas released from the untreated gassy crude oil would create a foamy oil that could damage transfer and storage equipment. Because surge tanks provide an additional source of emissions of flammable and toxic chemicals, SPR sites that have surge tanks (Bryan Mound and Big Hill) would have higher emissions than the other sites. Because the SPR sites are not designed for a drawdown of gassy oil, the probability of a release is higher with a no action alternative than during degasification operations and subsequent drawdown of non-gassy oil. Currently, gassy oil is not used in SPR exercises because the gas could damage equipment and cause a release that could impact SPR workers. Additionally, terminal workers would be at increased risk for fire and explosion and toxic exposure because the flammable and toxic gases could escape from storage tanks. Consequently, terminal and ship operators may not accept the gassy oil.

Although a release of flammable and toxic chemicals at a degasification unit is highly unlikely, the size and concentration of the release could be greater than under the no action alternative because during degasification, flammable and/or toxic chemicals including methane, ethane, propane, and H_2S are concentrated in a vapor rich stream. Even small releases of flammable and toxic chemicals from the vapor rich stream could be of sufficient concentration to result in a fire/explosion or a large toxic cloud that impacts the health of nearby workers and the public.

4.2 Potential Oil Spills

Degasification accompanied by either incineration or gas recovery would have the same potential for accidental oil spills, because the movement of oil would be the same. At all four sites, some new piping and header connections would be required to move the oil to and from the degasification unit. The intercavern process used at Bryan Mound and Big Hill would have a higher oil spill potential than the intracavern method used at West Hackberry and Bayou Choctaw, because the oil would be transferred between caverns. Oil would move through a crude oil header, into the degasification plant, and then through a different oil header as it is reinjected to another cavern. The intracavern method would involve less oil movement, although a leak in the brine string could cause oil to enter the string and be discharged to the brine pond. If the

presence of oil in the line is detected, it could be flushed back into the cavern before it reaches the brine pond. The potential release points for the degasification units include connections to the cavern where the reinjection occurs, connection to the onsite petroleum piping network which services the caverns, and any process piping, valves, pumps, and vessels directly associated with the degasification unit. Relatively small oil leaks could occur through flange gaskets on process piping and from valves and pumps and, although remote, relatively large leaks could occur through pipeline or vessel rupture. At each site, 100,000 BPD of oil would be cycled through the degasification unit. Up to 110 million barrels of crude oil would be treated over a 27-month period at Bryan Mound; up to 90 million barrels over 24 months at West Hackberry; up to 38 million barrels over 6 months at Big Hill, and up to 30 million barrels over 10 months at Bayou Choctaw.[13]

During degasification, the gassy oil would be treated onsite and therefore, would not flow through extensive stretches of distribution pipeline. Because pipeline accident rates are a function of pipeline length, the probability of oil spills during degasification would be extremely low. The movement of oil onsite for the degassing operation is probably similar in magnitude to the normal pipeline transfers of oil onsite associated with internal cycling. Annual SPR environmental reports for the six-year period from 1987 through 1992 at the existing storage sites present brief descriptions of spills, including both contained and uncontained spills.[14] Most spills did not enter waterways and none have resulted in environmental damage. Only four spills exceeded 100 barrels and 33 of 43 spills at storage sites were less than ten barrels. For each of the years of SPR operation, the volume of oil spilled has been 0.0004 percent or less of total annual throughput.

As mentioned above, degasification would increase oil spill potential only at the storage sites and would not affect oil spill potential from pipelines, terminal or vessels. During the six-year period, five oil spills from storage sites were reportable, i.e., entered navigable waterways. The average volume of these spills was 21 barrels; three of the spills were less than one barrel, and only a fraction of the amount spilled in the other two events entered a waterway. This average spill amount may be conservative because prior to 1989, spills less than one barrel were not recorded in the annual environmental reports. The total amount of oil moved (received and transferred internally or sold) at the SPR sites during that period was 220.4 million barrels, resulting in a spill rate to navigable waterways of 2.3 spills per 100 million barrels moved, and an average spill size of 21 barrels each.[15]

At this spill rate, given that approximately 110 million barrels of gassy oil would be transferred internally at Bryan Mound during the life of the degasification operation, it could be expected that 2.5 spills to waterways would occur at Bryan Mound, with an average spill size of 21 barrels each. Given that approximately 90 million barrels of gassy oil would be transferred internally at West Hackberry during the life of the degasification operation, it could be expected that 2 spills to waterways would occur at West Hackberry, with an average spill size of 21 barrels each. At Big Hill, approximately 38 million barrels of gassy oil would be transferred internally, with 0.8 expected spills of 21 barrels each. At Bayou Choctaw, approximately 30 million barrels of gassy oil would be transferred, resulting in an expected 0.7 spills of 21 barrels each.[16] This amount of oil could be quickly contained and cleaned up through spill response capabilities and would thus pose little or no threat to the environment. Each SPR facility has a Spill Prevention, Control, and Countermeasure (SPCC) Plan to prevent and mitigate oil spills, which is required by the Clean Water Act, as amended by the Oil Pollution Act of 1990 (OPA). Each SPR facility will

also be developing facility response plans to respond to a worst case discharge of oil, as required by the OPA, if they have not done so already.

Leaks of crude oil from equipment failure present a potential fire hazard. Process equipment, valves, and flanges associated with the degasification unit would be protected with the degasification contractor's fire suppression systems. A water spray system would be automatically activated using thermal detectors, and have the capability for manual operation. When properly maintained, the fire suppression system would significantly reduce the possibility of a major oil fire. The fire suppression system would be both manually and automatically actuated. Foam deluge would quickly suppress, extinguish, and blanket pooled ground fire associated with a crude oil release. Foam deluge would contain but not extinguish three-dimensional fires associated with pump seals or piping. Fire protection, suppression, detection systems, and fire protection standards in SPR's Environmental Safety and Health Manual would be followed. The probability of a leak and fire from a degasification unit is extremely low.

Potential for a large oil release is associated with the process equipment used to reduce the pressure of the gassy crude oil supply (100-900 psig, pounds per square inch gauge) to a manageable design pressure for the degasification unit. Relief valves on the pressure reduction equipment must be prepared to allow emergency flow of 100,000 BPD in the event that the pressure reduction equipment fails to function. The relief valves would divert the flow of oil and prevent catastrophic damage to degasification equipment. In the event of a pressure reduction failure, the oil from the relief valve would flow into a holding tank. An automatic shut off valve would also be available to shut the oil flow to the degasification unit. If the problem is not detected rapidly, and if the automatic shut off valve fails, the holding tank would quickly overflow. As previously discussed, secondary containment around the degas unit would be designed to hold the maximum amount of oil that would be in the degas unit at any one time, as required by the facilities' SPCC Plans. The large oil spill would be accompanied by rapid degasification which could create flammable concentrations of light hydrocarbons in the air. The key to limiting the potential failure of the pressure reduction operation lies in the careful design of the pressure reduction process and equipment. DOE would scrutinize the design to assure the proper design and emergency shutoff and backup systems are implemented for the degasification unit, and that emergency shutoff would be coordinated with the SPR system. Efforts would also be made to reduce the time to identify that the pressure reduction equipment has failed. It is unlikely that a release of crude oil alone would significantly affect worker health unless the release sprays or is accompanied by a fire or vapor cloud explosion.

Under the no action alternative, gassy oil significantly increases the probability for equipment damage and operating problems along the distribution pipeline and at the terminals for all four sites. Many thousands of gallons of crude oil could be released as a result of a catastrophic offsite pipeline break or damage to terminal equipment.

4.3 Potential Brine Spills

Both degasification alternatives would have the same potential for accidental brine spills. Brine movement is the same whether incineration or recovery is used for the byproduct gases. Among the four sites, however, the degasification treatment processes would have differences in brine circulation and therefore spill potential. Accidental brine spills would be more likely at Bryan Mound and Big Hill which would use the intercavern method to move oil for treatment.

This method would require the circulation of brine onsite through existing piping and equipment as crude oil is moved in and out of caverns during degasification. The intracavern method, proposed for use at West Hackberry and Bayou Choctaw, would involve removing oil from a cavern, treating the oil and re-injecting it into the same cavern without any brine flow.

The intercavern treatment process would involve injecting brine (and raw water, if necessary) from onsite ponds to displace gassy oil from the first cavern, sending the oil through the degasification unit, and injecting the treated oil into other caverns at the site that are only partially filled. The first cavern treated would then be empty and could receive treated oil from the next cavern to be treated. Transferring oil into the partially filled caverns would displace equal volumes of brine back to the brine ponds. This process would not result in levels of brine disposal beyond those occurring under normal operations (i.e., intermittent diffusion of brine into the Gulf of Mexico at Bryan Mound and Big Hill). Brine could be accidentally released to the environment, particularly to surface water or ground water, from the piping and brine ponds located onsite. Accidental releases could occur from onsite piping as a result of corrosion/erosion of the piping, or failure at gaskets, flanges, valves, welds, or other components.

The intracavern treatment process creates "oil only" caverns by "shooting off" the brine string above the oil-brine interface at the cavern bottom. Once the brine string is shot off, the intracavern treatment process involves only flows of crude oil and byproduct gases; no brine is displaced or circulated.

4.4 Other Hazardous Substance Releases

Amine solutions, like methyldiethanolamine, would most likely be used to remove H_2S from the hydrocarbon gas stream before either hydrocarbon incineration or hydrocarbon recovery. The amine process is used for over 95 percent of all H_2S removal from gas in the United States, however, it may be uneconomical because of the relatively small operations at the SPR sites. Amine could leak from process piping, pumps, valves, or vessels and spill onto the ground. Amine solutions, as a class, are usually substances that exhibit high aquatic toxicity if spilled into water bodies. The design of the degasification system; the operating, inspection, and maintenance procedures; and operator training would help prevent equipment failure and human error that could lead to releases of amine.

In the no action alternative, there are no hazardous substance releases that would occur beyond those that could occur during normal operations.

ENDNOTES

1. Strategic Petroleum Reserve Project Management Office, *Environmental Safety and Health Manual*, U.S. Department Of Energy, July 1992.

2. The MITRE Corporation, *Estimated Gas Sales*, U.S. Department of Energy, Strategic Petroleum Reserve, December 2, 1993.

3. ICF Incorporated, *Flammable Gases and Liquids and Their Hazards*, U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics, September 30, 1993.

4. Fluor Daniel, Inc., *Draft Performance Specifications for Degasification Unit*, Part II, U.S. Department of Energy, Strategic Petroleum Reserve, Project Management Office, Revision, January 14, 1994.

5. Strategic Petroleum Reserve Project Management Office, *Environmental Safety and Health Manual*, U.S. Department Of Energy, July 1992.

6. Fluor Daniel, Inc., *Draft Performance Specifications for Degasification Unit*, Part II, U.S. Department of Energy, Strategic Petroleum Reserve, Project Management Office, Revision, January 14, 1994.

7. U.S. Department of Energy, *Order 5480.19: Conduct of Operations Requirements for DOE Facilities*, July 9, 1990.

8. U.S. Department of Transportation, U.S. Environmental Protection Agency, and Federal Emergency Management Agency, *Handbook of Chemical Hazard Analysis Procedures*, Undated, p F-18.

9. *Ibid.*

10. American Petroleum Institute, *Summary of Motor Vehicle Accidents in the Petroleum Industry for 1982*, June 1983.

11. Strategic Petroleum Reserve Project Management Office, *Vapor Pressure Committee Status Report*, U.S. Department of Energy, March 30, 1993.

12. U.S. Department of Transportation, Federal Highway Administration, *Present Practices of Highway Transportation of Hazardous Materials*, Publication No. FHWA-RD-89-013, May, 1990.

13. Fluor Daniel, Inc., *Performance Specifications for Degasification Unit*, Section C, U.S. Department of Energy, Strategic Petroleum Reserve, Project Management Office, February 28, 1994.

14. Boeing Petroleum Services, Inc., *1987 Annual Environmental Monitoring Report, U.S. Department of Energy, Strategic Petroleum Reserve,* U.S. Department of Energy, New Orleans, LA, April 1988, Document Number D506-01728-09.

Boeing Petroleum Services, Inc., *1988 Annual Environmental Monitoring Report, U.S. Department of Energy, Strategic Petroleum Reserve,* U.S. Department of Energy, New Orleans, LA, June 1989, Document Number D506-02197-09.

Boeing Petroleum Services, Inc., *1989 Annual Environmental Monitoring Report, U.S. Department of Energy, Strategic Petroleum Reserve,* U.S. Department of Energy, New Orleans, LA, June 1990, Document Number D506-02502-09.

Boeing Petroleum Services, Inc., *1990 Annual Environmental Monitoring Report, U.S. Department of Energy, Strategic Petroleum Reserve,* U.S. Department of Energy, New Orleans, LA, June 1991, Document Number D506-02799-09.

Boeing Petroleum Services, Inc., *1991 Annual Site Environmental Report, U.S. Department of Energy, Strategic Petroleum Reserve,* U.S. Department of Energy, New Orleans, LA, June 1992, Document Number D506-04003-09.

DynMcDermott Petroleum Operations Company, *1992 Annual Site Environmental Report, U.S. Department of Energy, Strategic Petroleum Reserve,* U.S. Department of Energy, New Orleans, LA, June 1993, Document Number ASE5400.1AO.

15. U.S. Department of Energy, *Draft Environmental Impact Statement on the Expansion of the Strategic Petroleum Reserve*, Volume 2, Washington, DC, October 1992, DOE/EIS-0165-D.

Boeing Petroleum Services, Inc., *1991 Annual Site Environmental Report, U.S. Department of Energy, Strategic Petroleum Reserve,* U.S. Department of Energy, New Orleans, LA, June 1992, Document Number D506-04003-09.

DynMcDermott Petroleum Operations Company, *1992 Annual Site Environmental Report, U.S. Department of Energy, Strategic Petroleum Reserve,* U.S. Department of Energy, New Orleans, LA, June 1993, Document Number ASE5400.1AO.

16. Fluor Daniel, Inc., *Draft Performance Specifications for Degasification Unit*, Part II, U.S. Department of Energy, Strategic Petroleum Reserve, Project Management Office, Revision, January 14, 1994, Table IIA.

5.0 ENVIRONMENTAL IMPACTS

5.1 Air Quality

5.1.1 Introduction

There would be minor air quality impacts resulting from the proposed action. The no action alternative, however, potentially could result in substantial adverse impacts. Thus, the overall impact of the proposed action would be positive because it would eliminate the potential to emit excessive air emissions during a drawdown which would violate the receiving terminals' air permits and further worsen the nonattainment status of the air quality control regions. This section describes the air quality impacts that could result from construction and operation of the degasification unit, and from the no action alternative. Air quality impacts include emissions from construction and degasification. The relevant facets of the project approach to permitting the new emissions sources from the proposed degasification, and air quality regulations that may be applicable to the degasification project are also discussed. Additional details on these regulations are contained in Appendix B.

5.1.2 Emissions from Degasification Units

Construction

There would be emissions from the construction of the degasification unit, including emissions from site clearing and construction, and emissions from employee traffic. Emissions from site clearing are a one time activity occurring prior to the construction of the concrete pad upon which the degasification unit would be placed. As discussed previously, the area in which the facilities are located are in attainment for the particulate matter NAAQS, and these extremely small emissions of short duration, would have no impact on the attainment status or air quality of the areas. These emissions would be primarily particulate matter and may be estimated as 1.2 tons of dust per acre of construction per month of activity. This factor was developed for a semiarid climate and, because less dust or particulate is emitted from disturbing moist soil than dry soil, this emissions factor may be considered as very conservative for the humid climate of the Gulf Coast. Taking the conservative assumptions of two acres disturbed (one acre for the degasification equipment pad plus one other acre for all other activities, such as for parking, trailer sites, new piping, etc.) during the two month construction phase; site clearing and construction total emissions would be about 4.8 tons per site. The two acres that would be disturbed would be centrally located within each SPR site, an area between 270 and 565 acres; therefore, fugitive dust would not adversely affect offsite air quality. In addition, the good engineering practices required of the contractor would include dust control measures such as surface stabilization, vegetation, and watering.

There would also be two types of emissions associated with vehicular traffic during the construction phase of the project: 1) particulate emissions associated with the vehicles moving over the roads; and 2) emissions from engines. Particulate emissions from unpaved roads may be estimated using the emissions factors contained in EPA publication AP-42 *Compilation of Air Emissions Factors*.[1] These particulate emissions would result from both the contractor employees driving on and off the site, and trucks making either deliveries or pick-ups. To estimate these particulate emissions from traffic, the following assumptions were made:

- The distance from the facility gate to the location of the degasification unit is about one-eighth of a kilometer (one-half mile). Thus, each vehicle trip consists of 1.6 kilometers (one mile).

- On average, 25 contractor employees would drive onto the site during each of the sixty days of construction.

- On average, 10 trucks weighing more than 4 tons would drive onto the site during each of the sixty construction days. These vehicles would have on average 14 wheels.

- Average vehicle speed would be 25 mph.

Table 3 presents the estimated resulting emissions factors, daily emissions, and total emissions attributable to vehicle traffic during the construction phase.[2] The particulate emissions due to vehicle traffic over the 60 day construction period would be approximately three tons. Because of the flexibility granted to the contractor constructing the unit, actual emissions may vary from these estimates. But again, these emissions are small compared to programmatic thresholds and occur over a short duration. Some of these emissions would reoccur when the unit is disassembled and transported to the next SPR facility requiring degasification, and would occur again when the unit is required to return to the facilities at some time in the future after the initial degasification is completed.

Vehicle engine emissions may be estimated using emissions factors developed by EPA. The same assumptions regarding number of employees, distance, and vehicle speed as used in the particulate analysis were used, with the additional assumption that two heavy duty diesel engines would operate 12 hours per day for each of the sixty construction days. Table 4 presents the resulting emissions. Emissions from light duty vehicles (cars) were estimated using MOBILE4, a model developed by EPA. MOBILE4 presents emissions factors as a range, and the high value of the range was used to estimate light duty vehicle emissions. Emissions from heavy duty off road vehicles (i.e., construction equipment) were estimated using emissions factors presented in EPA-21A-2001, Nonroad Engine and Vehicle Emissions Study Report (NEVES). The NEVES report presents emissions factors for various classes of equipment. In estimating emissions it was assumed that the engines were 200 hp, with emissions factors of 10 g/hp-hr, 0.8 g/hp-hr, and 2.5 g/hp-hr for NO_x, VOC, and CO, respectively. Emissions from heavy duty onroad vehicles were estimated using factors from EPA's model MOBILE5a of 2.72 g/mile, 12.61 g/mile, and 15.8 g/mile, for VOC, CO, and NO_x, respectively. Because of the flexibility granted to the contractor constructing the unit, actual emissions may vary from these estimates. These emissions occur over a short duration and are small compared to programmatic thresholds designed to maintain and attain the NAAQS.

Emissions from the construction of the degasification units are expected to be the same at Bryan Mound, Big Hill, West Hackberry, and Bayou Choctaw. Overall, these emissions would not impact local air quality appreciably.

Table 3
PM_{10} Emissions from Vehicles

	Cars	Trucks
Emissions Factor (tons/Vehicle Mile Traveled [VMT])	0.0003	0.004
Daily Vehicle Miles Traveled (VMT/day)	25	10
Tons per day	0.0075	0.04
Total Emissions (tons) (60-day construction period)	0.45	2.55
Assumptions: s = silt content of road surface material = 10% (~crushed limestone) S = mean vehicle speed = 25 mph W = mean vehicle weight = 1 T (car), 20 T (truck) w = mean number of wheels = 4 (car), 18 (truck) p = number of days with precipitation > 0.01 inches precipitation per year = 100 days		

Source: Midwest Research Institute, *Control of Open Fugitive Dust Sources*, Final Report, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, September 1988, Document Number EPA-450/3-88-008, p 3-2 to 3-5.

Table 4
Engine Emissions During Degasification Construction (60 day total)

Pollutant	Light Duty Vehicle Emissions (tons)	Heavy Duty On Road Vehicle Emissions (tons)	Heavy Duty Off Road Emissions (tons)
VOC	0.0015	0.002	0.25
CO	0.015	0.0085	0.8
NO_x	0.0015	0.01	3.15

Sources: Light Duty Vehicle Emissions: U.S. Environmental Protection Agency, *MOBILE4 (Mobile Source Emission Factor Model)*, Office of Mobile Sources, Ann Arbor, MI, 1990; Heavy Duty on Road Vehicle Emissions: U.S. Environmental Protection Agency, *MOBILE5 (Mobile Source Emission Factor Model)*, Office of Mobile Sources, Ann Arbor, MI, 1993; Heavy Duty Off Road Emissions: U.S. Environmental Protection Agency, *Nonroad Engine and Vehicle Emission Study Report*, Office of Mobile Sources, Office of Air and Radiation, November 1991.

Operation of the Degasification Unit

There are numerous programs authorized by either the 1977 or 1990 amendments to the Clean Air Act designed to assist states attain and/or maintain the NAAQS, and many of these major programs contain emissions quantities triggering the applicability of the program. These programmatic trigger or threshold emissions levels are first presented, then threshold applicability levels are compared to emissions from the degasification unit so that the significance of emissions from the degasification unit may be judged. Clean Air Act programs with threshold emissions levels include: 1) the New Source Review (NSR) and Prevention of Significant Deterioration (PSD) permitting programs; 2) the Title V Operating Permit program; and 3) the Conformity Analysis Regulations.

Table 5 presents the emissions requirements for the degasification unit, and the potential emissions increase from operation of brine ponds assuming the intercavern mode of degasification. Brine that passes through the ponds would contain trace quantities (approximately 2 ppm) of crude oil, which would contribute to VOC emissions.[3] The overall project approach for the alternatives involving degasification would be to contract the degasification project to a private firm, and allow the successful bidder flexibility in the design and operation of the degasification unit. However, the successful offerer must agree that the combination of emissions from the operation of degasification unit and emissions from the routine operation of the facility must not exceed Federal and State regulatory requirements given in Chapter 3.0, and the limits stated in the EISs for the sites, which were referenced in Chapter 1.0.

The largest source of VOC emissions associated with degasification would be the increase in VOC emissions from the brine pond at facilities where the intercavern process is used. The intercavern process would probably be used at Bryan Mound and Big Hill, and it is possible that it would be used at Bayou Choctaw. These emissions may be estimated as:

VOC (lbs/day) = VOC Concentration in Brine (ppm x 10^{-6}) x Pumping Rate (bbls per day) x (42 gal/bbl) x Brine Density (lb/gal).[4]

Assuming that the concentration of VOC in the brine is 2 ppm,[5] a brine density of 10 lbs per gallon,[6] and that 100,000 bbl of brine would pass through the brine pond per day, VOC emissions would be about 84 lbs per day. These emissions would be an ongoing component of a degasification unit of any design, and total about 15.4 tons per year. Under current, routine operation, however, the brine ponds at these facilities emit about 5 tons of VOC per year. Thus the overall VOC emissions increase from the brine ponds attributable to degasification would be about 10 tons per year. Adding this amount to 2 tons of VOC emissions from degasification unit operations yields a total estimated increase of 12 tons per year.

There would be some increase in emissions associated with vehicles from up to approximately 16 contractor employees at each site, who would be operating the degasification unit.[7] These emissions would be negligible.

Table 5
Degasification Plant Air Quality Permit Requirements
(Emission Limits)

Pollutant	Degasification Unit Emissions Specification (TPY)[1]	Brine Pond Emissions (Tons per Year)	Total Emissions Increase (Tons Per Year)
VOC	2	15	12[2]
NO_2	11	NA[3]	11
CO	25	NA[3]	25
SO_2	20	NA[3]	20
PM_{10}	7	NA[3]	7

1. Requirements for incinerator: 1600°F; 0.5 Second residence time; 99.98% VOC destruction efficiency; monitoring equipment for exhaust gas temperature immediately downstream of a direct-flame incinerator.

2. Total VOC emissions from the brine pond are estimated to be about 15 tons per year. Under current operation the brine pond emits about 5 tons per year. Therefore, the increase in VOC emissions from the brine pond is about 10 tons per year. Adding this with 2 tons from degasification unit operations yields a total increase of 12 tons per year.

3. NA = Not Applicable.

Source: Fluor Daniel, Inc., Draft Performance Specifications for Degasification Units, Part II, U.S. Department of Energy, Strategic Petroleum Reserve, Project Management Office, Revision, January 14, 1994, Table IIB; and, communication from T. Bird, March 3, 1994.

Stationary source emissions and emissions sources would vary among degasification units of varying design. For example, a unit recovering byproduct gases would emit no NO_x while a fume incinerator would have some NO_x emissions. In the byproduct gas recovery option, extra trucks needed to haul the recovered gas to sale points would create additional emissions. The additional number of trucks at each site depends on the amount and composition of gas recovered, and ranges from 1.5 to 3. However, the emissions from either degasification option would not have a serious impact on air quality within the area.

Emissions from routine operation of the degasification alternatives at Bryan Mound, Big Hill, West Hackberry, and Bayou Choctaw would be minor because, although emissions from routine operation vary by site, they are far below the levels at each site that would trigger the applicability of programs (i.e., PSD, NSR, and Conformity to SIPs) designed to protect air quality and attain and maintain the NAAQS. In particular, the emissions from the proposed action are below the thresholds that would require a conformity analysis under the regulations found at 40

CFR 51 Subpart W; therefore, no conformity analysis is required (see Appendix B). Additionally, while there might be some differences in emissions among the alternatives comprising the proposed action (e.g., fume incineration versus recovery), these differences in emissions are minor. Because of the flexibility granted to the contractor constructing the unit, actual emissions may vary from these estimates. These emissions are small compared to programmatic thresholds designed to attain the ozone NAAQS. Therefore, this action would not contribute to the frequency or severity of ozone violations.

5.1.3 Air Quality Impacts of the No Action Alternative

Under the no action alternative no degasification of the oil would occur, and no emissions from the construction or operation of the degasification unit would occur. However, the vapor pressure of the gassy crude oil would be above atmospheric pressure, and gases from the crude oil would come out of solution during drawdown. Commercial terminals might not accept the oil if the oil violates the contractual specifications for delivery. One terminal requires a TVP of 10.5 psia or less; the others require a TVP of 11.0 psia or less. If, however, the gassy oil were shipped, the VOC emissions from both the DOE facilities and terminals receiving the oil would be substantial. The level of emissions would violate the conditions of the commercial terminals' air permits, as well as any applicable State and Federal regulations pertaining to storage tanks (e.g., new source performance regulations). For example, VOC emissions from the four aboveground storage tanks at Bryan Mound and the commercial or DOE terminals receiving oil are estimated to exceed 19,000 tons during a 180-day drawdown.[8] These emissions may pose a problem for the attainment status of the areas in which the facilities and terminals are located and may contribute to further violations of the ozone NAAQS, both in terms of the frequency and severity of violations.

There would be additional air toxics released during a full, design-rate drawdown without degasification. For example, at Bryan Mound and its terminals approximately 370 tons of H_2S, and about 145 tons of aromatic compounds (BTX) would be emitted.[9] These emissions, which are compounds designated as Hazardous Air Pollutants (HAPs) by the Clean Air Act Amendments of 1990, may pose a substantial health risk to employees or any nearby residents.

The accumulation of gas in the oil has resulted in increased VOC emissions during routine operations at the sites, in particular Bryan Mound. This increase in VOC emissions results from the increased vapor pressure of oil stored or moved during routine operations such as readiness and systems tests. At Bryan Mound the increased VOC emissions during routine operations of the site would be about 6.5 tons per year if the oil were not degassed or if no steps were taken to offset these emissions increases. It should be noted that the emissions increase would be offset by changing operations, such as changes in onsite oil storage tank usage, so that the actual increase in emissions during routine operations from the gassy oil are only 0.35 TPY of VOC.[10]

5.2 Floodplains

The proposed action would not involve the 100-year floodplain at the Bryan Mound, Big Hill, or West Hackberry storage facilities. However, the Bayou Choctaw storage facility, which is situated one and one-half to two meters (five to six feet) above msl, is located within the 100-year floodplain. Accordingly, any construction within the plant property would be located in the 100-year floodplain.

Impacts from construction and operation of the oil degasification unit at Bayou Choctaw would have negligible effects on the 100-year floodplain. All construction and development would occur on an existing laydown yard that is centrally located in the physical plant of the existing storage facility. The location of the proposed development within a previously disturbed area indicates that impacts to floodplains from construction and operation activities would be short-term, and none of these impacts would be serious enough to alter the natural beneficial floodplain values. SPR facilities have established procedures to prepare for hurricanes, thunderstorms, storm surge, and flooding. To date these hazards have not contributed significantly to environmental risks at existing SPR sites. SPR site personnel monitor weather conditions and in the event of potential flooding, the degas operation would cease and hazardous chemicals such as amine would be secured. This would prevent the release of oil or hazardous chemicals to the environment.[11] In keeping with standard engineering practices the degas contractor would be required to design and build the unit and associated equipment to withstand high winds and flooding as is the case for all SPR facilities. See Appendix C, Floodplain Assessment, for details on floodplain effects at Bayou Choctaw.

5.3 Other Environmental Resources

At Bryan Mound, Big Hill, West Hackberry, and Bayou Choctaw, all construction and operation activities for the degasification unit would occur onsite in a previously disturbed area and, therefore, would not directly impact the environmental resources surrounding the facility. Soil erosion from construction activities would be contained onsite and consequently, would not cause an increase in sediment loads in surrounding surface waters or marshes.

Each SPR site has a current National Pollutant Discharge Elimination System (NPDES) permit to control discharges to surface water bodies, as required by the Clean Water Act. If the contractor proposes a new discharge point, it would be incorporated in the site's permit by a permit modification. For each site, oil spill prevention and mitigation are addressed in a SPCC Plan and a Facility Response Plan. The prevention and mitigation of brine spills are addressed in a Spill Contingency Plan which is incorporated as an appendix to each Facility Response Plan.

Because the intracavern method would be used at West Hackberry and Bayou Choctaw, brine would not be circulated and, therefore, spills from brine piping would not occur. In the unlikely case of a brine spill from the onsite piping, attributable to the intercavern method at Bryan Mound and Big Hill, the freshwater aquifers are too deep and their recharge zones are too far from the sites for potable groundwater supplies to be at risk from brine spills.[12,13] Adequate and appropriate training of site personnel in the Emergency Response Procedures manual (Boeing Petroleum Services, Inc., 1992) would assure that harm would be minimized in the event of an oil or brine spill. The emergency response manual referenced above addresses spill detection and response procedures, cleanup equipment, and available contractor specialists and emergency support services.

Amines are the only hazardous chemical associated with the operation of the degas unit. While amines are toxic to aquatic life, they would likely be stored in amounts small enough to be contained in secure 55-gallon drums. The existing SPR facilities use and store hazardous chemicals and have Spill Contingency Plans and training programs to ensure the proper handling and storage of these chemicals and the proper response in the event of a spill. Consequently, in

the unlikely event of an amine spill, the chances of the amines reaching a water body are remote.[14,15]

Operation of the degasification unit would create up to approximately 16 new temporary jobs at both Bryan Mound and West Hackberry, for a total of up to approximately 32 new positions for the duration of degasification operations. These jobs would be relocated to Big Hill and Bayou Choctaw, respectively, when degasification operations are complete and the units are moved. At each site, approximately 15 to 25 construction workers would be employed for two months during site preparation and construction of the degasification unit. These jobs would likely be filled by the local workforce. Any in-migration would be minimal and would be easily absorbed without impacts on the housing market or municipal services and infrastructure. Worker occupational health and safety would be assured by appropriate administration of DOE's Construction Contractor Safety Program pursuant to DOE Order 5480.9, Construction Safety and Health Program.

There would be no impacts from transporting the degasification unit to and from Bryan Mound, Big Hill, West Hackberry, or Bayou Choctaw. The degasification units may or may not be transported to the facilities in components, depending on whether truck loads exceed the standard highway maximum legal load of 80,000 pounds. Road widths should not present a problem because transportation routes would be selected based on their ability to accommodate wide loads. Existing highways, bridges, and site access roads appear to be adequate at all four sites. Traffic volume would increase slightly during construction activities. Some additional traffic could result from truck transportation under the gas recovery option. Impacts from increased traffic are expected to be negligible given the essentially rural nature of the four SPR sites.

Construction and operation of the degasification unit at any of the four SPR sites would not cause any adverse impacts to natural and scenic resources, cultural, historical, and archaeological sites, Native American land, minority or low-income communities, or ambient noise levels. No wetlands or endangered species would be impacted by the proposed action at any of the four sites. The proposed action at West Hackberry would not directly affect the Louisiana Coastal Zone, because the construction and operation of the degasification unit would not: alter surface water quality or quantity in the coastal watershed or coastal zone; result in dredge fill, development, construction or waste discharge in or into coastal waters; or impact air quality in the coastal zone. Additionally, no other sensitive environments would be involved other than the floodplain at Bayou Choctaw.

5.4 Cumulative Impacts

No cumulative or long-term impacts of the proposed action have been identified. Air impacts at each site combined with existing emissions from the storage facilities would not exceed levels specified in each site's air quality permit. There is no risk of cumulative impacts from a synergistic effect of emissions or releases from multiple sources because air impacts from Bryan Mound, Big Hill, West Hackberry, and Bayou Choctaw would occur in different airsheds and would have no cumulative effect. It is immaterial whether the construction and operation of the proposed units at Bryan Mound, Big Hill, West Hackberry, and Bayou Choctaw occur sequentially or concurrently. Furthermore, there is no risk of cumulative impacts to occupational and public safety and health or to floodplains or other environmental resources from construction or operation at any of the four sites.

ENDNOTES

1. U.S. Environmental Protection Agency, *Compilation of Air Emissions Factors (electronic).*

2. Midwest Research Institute, *Control of Open Fugitive Dust Sources*, Final Report, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, September 1988, Document Number EPA-450/3-88-008, pp 3-2 to 3-5.

3. *Ibid.*

4. U.S. Department of Energy, *Draft Environmental Impact Statement on the Expansion of the Strategic Petroleum Reserve*, Washington, DC, October 1992, DOE/EIS-0165-D, p 7-18.

5. *Ibid.*

6. *Ibid.*

7. Fluor Daniel, Inc., *Draft Performance Specifications for Degasification Unit*, Part II, U.S. Department of Energy, Strategic Petroleum Reserve, Project Management Office, Revision, January 14, 1994, Table IIB.

8. Fluor Daniel, Inc., Draft report on gas emissions at Bryan Mound, Draft, U.S. Department of Energy, Strategic Petroleum Reserve, November 24, 1993, Table 2.

9. *Ibid.*

10. Personal Communication with T. Bird, U.S. Department of Energy, Strategic Petroleum Reserve Project Management Office, New Orleans, Louisiana, May 23, 1994.

11. Boeing Petroleum Services, Inc., *Big Hill Emergency Response Procedures*, U.S. Department of Energy, Strategic Petroleum Reserve, New Orleans, LA, June 1988, Document Number D506-01150-08, pp 5.1-5.4.

12. Federal Energy Administration, *Strategic Petroleum Reserve, Bryan Mound Salt Dome, Final Environmental Impact Statement*, Washington, D.C., 1977, Document Number FEA/S-76/502.

13. U.S. Department of Energy, *Draft Environmental Impact Statement on the Expansion of the Strategic Petroleum Reserve*, Washington, DC, October 1992, DOE/EIS-0165-D.

14. Boeing Petroleum Services, Inc., *1990 Annual Site Environmental Report, U.S. Strategic Petroleum Reserve*, U.S. Department of Energy, Strategic Petroleum Reserve Project Management Office, New Orleans, LA, June 1991, Document Number D506-02799-09.

15. Boeing Petroleum Services, Inc., *Spill Contingency Plan: Bayou Choctaw, St. James Terminal, and Weeks Island*, U.S. Department of Energy, Office of Strategic Petroleum Reserve, December 1986, Document Number D506-01026-04/0705.

This page intentionally left blank.

6.0 CONCLUSIONS

- Minor air quality impacts would occur over the 6- to 27-month performance period of any action alternative at Bryan Mound, Big Hill, West Hackberry, and Bayou Choctaw.

  -- The particulate emissions during the brief construction period would be extremely low and would have no impact on the attainment status or air quality of the areas of all four sites.

  -- The overall VOC emissions increase attributable to degasification would be about 12 tons per year at each site. The largest source of VOC emissions associated with degasification operations would be the increase in VOC emissions from the brine ponds at facilities where the intercavern process would be used.

  -- Although emissions would vary by site and by off-gas handling alternative, the differences would be minor; in all cases, they would be far below the levels that would trigger the applicability of programs designed to protect air quality and attain and maintain the NAAQS.

  -- There would be a negligible increase in emissions from vehicles associated with construction and operation of the degasification unit or truck transport for the gas recovery alternative.

- The no action alternative would result in the following impacts associated with a full scale drawdown during a national emergency:

  -- VOC emissions from the Bryan Mound, Big Hill and Bayou Choctaw sites and from the terminals receiving oil from these sites and from the West Hackberry site that could exacerbate the ozone nonattainment of their respective areas, both in terms of the frequency and severity of violations.

  -- Substantial increase in risk of worker exposure to vapor clouds of flammable and toxic gases.

  -- Substantial increase in risks to the operational capability of transfer and storage equipment that would indirectly increase safety hazards and air emissions.

- Compared to the no action alternative, any of the action alternatives would be beneficial in reducing emissions; reducing hazards to worker and public health and safety; and eliminating the potential for excessive air emissions during a drawdown. Consequently, none of the action alternatives would require a new source review.

- Because pipeline accident rates are a function of pipeline length, and degasification would involve only onsite oil movement, the proposed action would not measurably affect the site's oil spill risk relative to a drawdown event.

- Accidental releases of oil and brine are somewhat more likely at Bryan Mound and Big Hill because of the intercavern method that would be used to move the oil at these sites.

- Although a release at a degasification unit is highly unlikely, the size and concentration of the release of flammable and toxic chemicals could be greater than under the no action alternative because during degasification, flammable and/or toxic chemicals including methane, ethane, propane, and H_2S are concentrated in a vapor rich stream.

- Although remote, the probability of a large fire or explosion would be somewhat greater for the recovery option than for the incineration option because the recovery option would require transport, pressurized/refrigerated storage, and loading/unloading of potentially large quantities of liquefied hydrocarbons on site.

- Any action alternative would involve a floodplain only at Bayou Choctaw, where construction and operations would conform to applicable procedures and standards. Impacts would not affect the natural and beneficial values served by the 100-year floodplain.

- Since the proposed action at West Hackberry would not result in offsite impacts, it would not directly affect the Louisiana Coastal Zone and therefore, a Federal agency consistency determination would not be required.

- Construction and operation of the degasification unit at any of the four SPR sites would not cause any adverse impacts to natural and scenic resources, cultural, historical, and archaeological sites, Native American tribal land, other minority or low-income communities, or ambient noise levels. No wetlands or endangered species would be impacted by the proposed action at any of the four sites.

- No cumulative or long-term impacts of the proposed action have been identified.

APPENDIX A

CALCULATION OF AVERAGE NUMBER OF TRUCKS NEEDED TO TRANSPORT LIQUEFIED HYDROCARBON BYPRODUCTS FROM SPR DEGASIFICATION UNITS

Average Number of Trucks to Transport Liquefied Methane and Ethane Byproducts From SPR Degasification Units

	Bryan Mound		West Hackberry		Bayou Choctaw		Big Hill	
	Sweet	Sour	Sweet	Sour	Sweet	Sour	Sweet	Sour
Total Volume[1] of Liquefied Ethane (barrels/day)	44	63	37	37	53	36	65	41
Total Volume[2] of Liquefied Methane (barrels/day)	28	175	19	30	45	29	71	66
Total Volume (barrels/day)	72	238	56	67	98	65	136	107
Total of Sweet & Sour (barrels/day)	310		123		163		243	
Total of Sweet & Sour (gallons/day)	13,020		5,166		6,846		10,206	
Average Number of Trucks Per Day with Capacity 10,000 gallons (rounded)	1.5		0.5		1		1	

1 Based on Mitre Study on the calculation of off-gas sales volumes from degasification of oil.

2 Calculation of barrels of methane was calculated as:

$$\textit{methane barrels} = (\textit{mole fraction})\ (\textit{CF/day})\ \left(\frac{28.3l}{CF}\right)\left(\frac{mole}{22.4l}\right)$$
$$\left(\frac{16gm\ methane}{mole}\right)\left(\frac{lb}{454gm}\right)\left(\frac{gallon}{1.5lb\ methane}\right)\frac{barrel}{42gal}$$

Mitre study provided mole fraction of methane and total volume flow.

APPENDIX B

AIR QUALITY REGULATORY PROGRAMS

Air Quality Regulatory Programs

The New Source Review (NSR) and Prevention of Significant Deterioration (PSD) permitting programs apply to new, modified and reconstructed emissions sources. PSD applies to the pollutants emitted by the facility for which the area is in attainment, while NSR applies to those emitted pollutants for which the area has been designated nonattainment. Table B-1 presents the applicability levels for the PSD program.

The applicability limits for NSR are those limits that define "major source" for the purposes of title V operating permits, which are presented later. That is, if the new degasification emissions would be a major source, NSR applies.[1] Many states have implemented NSR applicable levels using the Title V definition of major source. Emissions from the degasification project are below the applicability levels for either the PSD or NSR programs.

Table B-1
PSD Applicability Criteria

Pollutant	Threshold Emissions for New Sources (Tons Per Year)	Threshold Emissions (TPY) for Expansion of Existing Sources
SO_x	250[1]	40
VOC	250[1]	40
NO_x	250[1]	40
CO	250[1]	100
PM_{10}	250[1]	15

[1] The threshold is reduced to 100 TPY if the source is one of the 28 classes of facility; e.g., power plant, etc. The degasification unit is not within any of the 28 classes.

Source: U.S. Environmental Protection Agency, *New Source Review Workshop Manual: Prevention of Significant Deterioration and Nonattainment Area Permitting*, Office of Air Quality Planning and Standards, Draft, October 1990.

The Title V operating permit program requires "major sources" to obtain an operating permit, and this program is a critical component of attaining the NAAQS for many states. The definition of "major source" is a function of the degree of nonattainment status, in particular, ozone nonattainment status, with the emissions level defining a "major source" being reduced as severity of the nonattainment of the area increases. The definition of major source, which is quite complex, is presented below, and contains five different types of emissions triggers:

1. Potential or actual emissions of any one hazardous air pollutant (HAP) of 10 tons per year (TPY) or 25 tons of all HAPs in combination.

2. In attainment areas, potential or actual emissions of 100 TPY of any criteria pollutant.

3. In ozone nonattainment, potential or actual areas VOC or NO_x emissions exceeding the following:

Marginal/Moderate Areas	100 TPY
Serious Areas	50 TPY
Severe Areas	25 TPY
Extreme Areas	10 TPY

4. In Serious PM_{10} Nonattainment areas, potential or actual PM_{10} emissions of 70 TPY.

5. In Serious CO Nonattainment Areas, potential or actual CO emissions of 50 TPY.

The conformity regulations for non-transportation Federal projects apply to Federal projects in nonattainment areas. The objective of the program is to assure that emissions from federal projects and programs do not hinder a State's progress toward attaining the NAAQS. A conformity analysis is required for projects that might significantly impact air quality. The regulations require analyses for projects exceeding the emissions levels for major sources in nonattainment areas. The thresholds for conformity analysis are the same as the definition of major source under Title V operating permits.

ENDNOTES

1. Personal Communication with D. Crumpler, U.S. Environmental Protection Agency, Office of Air and Radiation, Office of Air Quality Planning and Standards, March 3, 1994.

APPENDIX C

FLOODPLAIN ASSESSMENT
Bayou Choctaw, Iberville Parish, Louisiana

FLOODPLAIN ASSESSMENT
Bayou Choctaw, Iberville Parish, Louisiana

Project Description

The U.S Department of Energy (DOE) proposes to construct an oil degasification unit at the existing Strategic Petroleum Reserve (SPR) storage facility at Bayou Choctaw in Iberville Parish, Louisiana. Bayou Choctaw is one of four SPR storage facilities for which degasification is planned, but it is the only one that is located in a floodplain. The other facilities are Bryan Mound, Texas, West Hackberry, Louisiana, and Big Hill, Texas. Degasification units would be used to remove excess gas from the stored petroleum to allow for safe distribution of the oil in the event of a drawdown.

At Bayou Choctaw, DOE would treat approximately half of the 52 million-barrel inventory of crude oil by temporarily removing oil from three caverns (accessed at well pads 17, 18, and 20). This oil would be treated by extracting excess hydrocarbon gases that are dissolved in the petroleum liquids and then reinjecting the oil into the storage caverns. The degasification process would take two to three years, after which the unit would be either transported to a storage location or returned to another site that requires degasification. Gas intrusion from domal salt may be recurring and the degasification process may need to be repeated periodically throughout the life of the Reserve. All processing associated with the proposed action at Bayou Choctaw would occur within existing site boundaries. The degasification unit and associated facilities would occupy approximately two acres of an area already disturbed and developed with buildings, well pads, brine ponds, piping and headers, pump stations, electric substations, roads, and landscaping.

Amines are the only hazardous chemical associated with the operation of the degas unit. While amines are toxic to aquatic life, they would likely be stored in amounts small enough to be contained in secure 55-gallon drums. The existing SPR facilities use and store hazardous chemicals and have Spill Contingency Plans and training programs to ensure the proper handling and storage of these chemicals and the proper response in the event of a spill. consequently, in the unlikely event of an amine spill, the chances of the amines reaching a water body are remote.[1,2]

The proposed action would occur within the existing site which is entirely within the 100-year floodplain (Figure C-1). The site is located directly east of Choctaw Bayou, an alternate route of the Intracoastal Waterway (Morgan City-Port Allen Route), and approximately four miles west of the Mississippi River. The elevation of the site is five to six feet above mean sea level (msl). Although the Federal Emergency Management Agency's National Flood Insurance Program has not determined base flood elevations and flood hazard factors for this area, the nature and extent of the potential flood hazard could cause temporary onsite flooding. Such flooding would not be severe, thus the floodplain is not considered a high hazard area. A high hazard area, as defined in 10 CFR Part 1022, means "those portions of riverine . . . floodplains nearest the source of flooding which are frequently flooded and where the likelihood of flood losses and adverse impacts on the natural and beneficial values served by floodplains is greatest." The water surface flood elevation at the proposed oil degasification unit location could be approximately ten feet above msl should a 100-year flood occur.[3]

Levees exist at some areas of the site, but they primarily deflect storm water and do not completely surround the site or protect the site from flooding.[4,5] There also are several agricultural levees built to protect adjacent sugar cane fields from low frequency flood events; however, these levees would not influence the effect of 100-year floods on the facility. Some farmland is located east of the site, but swamp stretches for at least four miles without interruption in all other directions.

Pursuant to Executive Order 11988 (Floodplain Management), DOE is required to "consider alternatives to avoid adverse effects and incompatible development in a floodplain." In the event there is no "practicable alternative" to locating the project in a floodplain, DOE is to "design or modify its action in order to minimize potential harm to or within the floodplain." Potential harm to floodplains might include impacts to the natural moderation of floods; water quality maintenance; groundwater recharge; support of living resources (marshes, fishes, and wildlife); cultural resources (archaeological, historical, recreational, scientific); and agricultural, aquacultural, and forestry production.

Floodplain Effects

Potential impacts of the proposed action at Bayou Choctaw on the 100-year floodplain would be direct, minor, and short-term. All construction and development would occur on an existing laydown yard that is centrally located in the physical plant of the existing storage facility. The yard is a previously disturbed area of compacted soil.

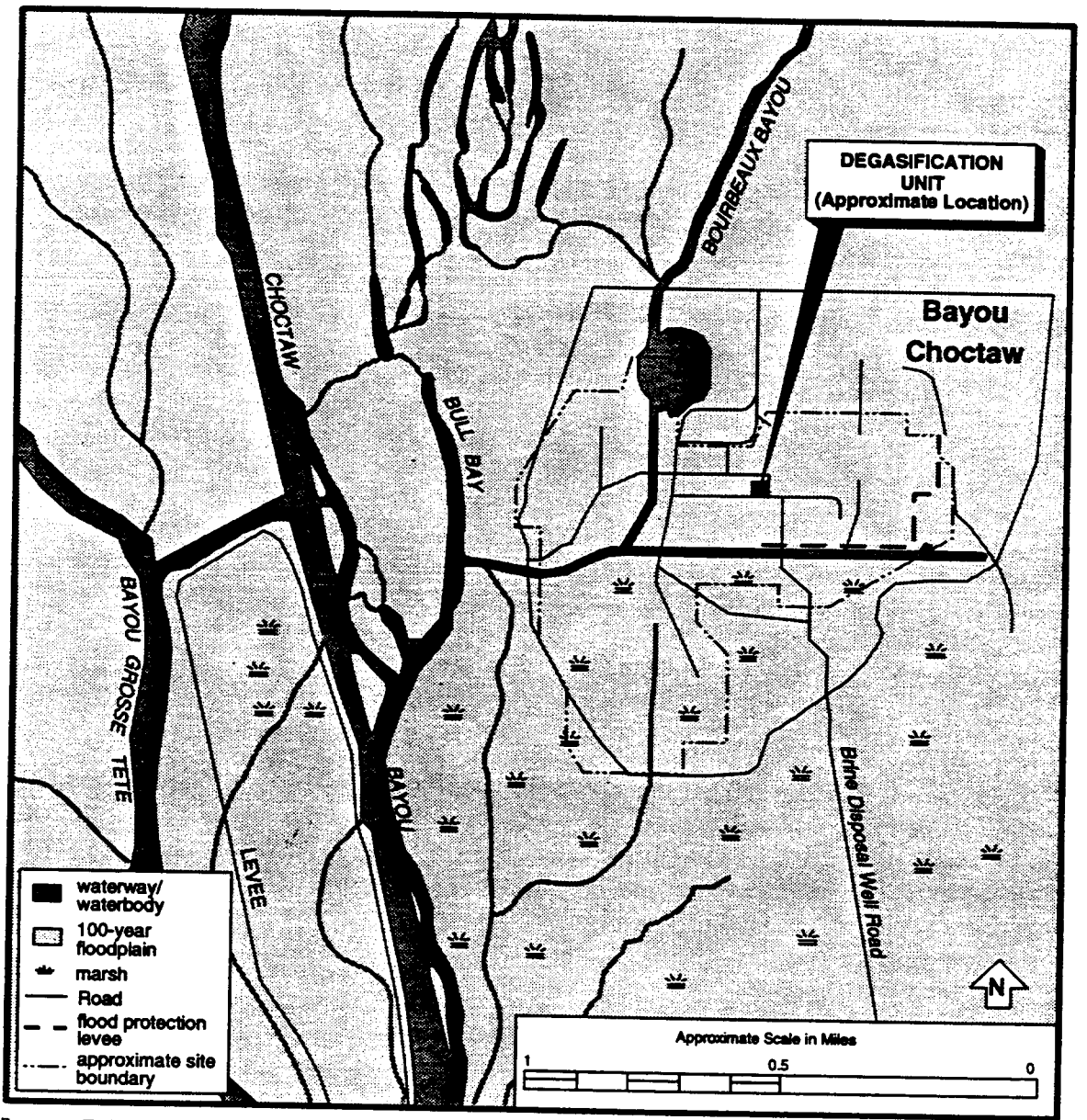
Sedimentation from the project would be controlled by approved standard methods and would not affect lives or property or alter the natural beneficial floodplain values. Construction of all structures would conform to all applicable standards and criteria and would not impact the natural moderation of floods, water quality, or groundwater recharge. No impacts are expected from the operation of the oil degasification unit at Bayou Choctaw.

Alternatives

The proposed action is a feasible corrective action for a situation that could potentially present both environmental and safety hazards. There are no practicable alternatives at the Bayou Choctaw site that would avoid construction in the floodplain; caverns containing gassy oil must be accessed from within the Bayou Choctaw site boundaries, and the entire site is within the 100-year floodplain.

The no action alternative would be unacceptable because the untreated gassy crude oil could not be safely transferred from the SPR during a drawdown. It would release gas that could damage transfer equipment and cause a leak, potentially leading to personnel exposure, fire, or explosion. Because the oil at Bayou Choctaw is gassy enough to be considered unacceptable to the receiving terminals, a large portion of the total Reserve would not be available for pumping to terminals during an emergency drawdown. This would impair the effectiveness of the SPR and severely limit the availability of oil in a national emergency.

Figure C-1
Bayou Choctaw Floodplain Assessment



Source: Federal Emergency Management Agency, National Flood Insurance Program, Flood Insurance Rate Map, Iberville Parish, Louisana, Unincorporated Areas, Page 4 of 11, Community Panel Number 220083 0004 B, June 1, 1978.

ENDNOTES

1. Boeing Petroleum Services, Inc., *1990 Annual Site Environmental Report, U.S. Strategic Petroleum Reserve*, U.S. Department of Energy, Strategic Petroleum Reserve Project Management Office, New Orleans, LA, June 1991, Document Number D506-02799-09.

2. Boeing Petroleum Services, Inc., *Spill Contingency Plan: Bayou Choctaw, St. James Terminal, and Weeks Island*, U.S. Department of Energy, Office of Strategic Petroleum Reserve, December 1986, Document Number D506-01026-04/0705.

3. Personal Communication with H. Blanchard, Planning Division, U.S. Army Corps of Engineers, Iberville Parish, Louisiana, 2/18/94.

4. Personal Communication with S. Evans, Department of Energy, Strategic Petroleum Reserve, Project Management Office, New Orleans, Louisiana, March 11, 1994.

5. Boeing Petroleum Services, *Spill Contingency Plan for Bayou Choctaw, St. James Terminal, and Weeks Island*, December 1986, D506 01026-0410705.

APPENDIX D

AGENCIES AND PERSONS CONSULTED

AGENCIES AND PERSONS CONSULTED

A list of Federal, State and local agencies and private groups and parties contacted is given below. No Native American tribes were consulted since the proposed action would not affect a reservation. DOE is providing this Environmental Assessment to them.

		Jurisdiction/Expertise
A.	Federal Agencies	
	U.S. Environmental Protection Agency Tank Emission Calculations Coordinator Research Triangle Park, North Carolina	Applicability of AP-42 to gassy oil
	U.S. Army Corps of Engineers Planning Division Iberville Parish, Louisiana	Floodplains
B.	State Agencies	
	Texas Air Control Board Air Permit Division Austin, Texas	Air Quality Air Quality Regulations Permit Coordination
	Louisiana Department of Environmental Quality Air Quality Division Coordinator Baton Rouge, Louisiana	Air Quality Air Quality Regulations
C.	Local Agencies	
	Floodplain Administrator Office of Brazoria County Engineer Angleton, Texas	Floodplains
	Flood Management Office Cameron Parish, Louisiana	Floodplains
	Environmental Control Jefferson County, Texas	Floodplains

D. Private Groups and Parties

American Society for Testing and Materials Chairman Corpus Christi, Texas	Applicability of ASTM 323 Reid Vapor Pressure
Midwest Research Institute Research Triangle Park, North Carolina	Applicability of AP-42 to gassy oil
American Petroleum Institute "2519" Coordinator Washington, D.C.	Definition of Boiling Stocks

APPENDIX E

COORDINATION WITH THE STATES OF LOUISIANA AND TEXAS

COORDINATION WITH THE STATES OF LOUISIANA AND TEXAS

This EA was coordinated with the States of Louisiana and Texas. Written comments were received from the Louisiana Department of Natural Resources, the Louisiana Department of Environmental Quality, and the Texas Office of State-Federal Relations (Houston-Galveston Area Council). Their comments are addressed below followed by copies of their letters.

E.1 Responses to comments from the Texas Office of State-Federal Relations (Houston-Galveston Area Council)

E.1.1 "...Because of the Houston-Galveston area designation as a severe ozone-nonattainment area any potential for an extremely large purge emission of volatile organic compounds is significant..."

Response: The proposed action for this EA is to treat gassy oil at existing SPR facilities to help ensure a safe drawdown and enable delivery of crude oil within industry transportation specifications. The proposed action does not include an extremely large purge emission of volatile organic compounds. The proposed action would reduce the potential to emit large quantities of VOCs and H_2S during a drawdown.

E.1.2 "...A clearly stated and defined worst case scenario for each of the proposed alternatives would increase the usefulness of the environmental assessment as a decision making tool for assessing potential environmental impacts of proposed activities...."

Response: The regulations for implementing the National Environmental Policy Act (40 CFR Parts 1500 - 1508) do not require a worst case scenario and in fact such requirements were expressly removed from the original implementing regulations. In addition, DOE believes that an analysis of highly improbable events is unwarranted.

E.1.3 "...If the construction activities are not covered by specific NPDES permit requirements for Strategic Petroleum Reserve activities, DOE should at least comply with EPA general permit for construction activities..."

Response: The EA has been revised to reflect that the existing facilities have NPDES permits and that the proposed action would not trigger the need for new permits.

E.1.4 "...If brine spills are not covered by an oil spill contingency plan then brine spill should be addressed..."

Response: The EA has been revised to reflect that brine spills are covered by a spill contingency plan.

E.2 Responses to comments from the Louisiana Department of Environmental Quality

E.2.1 "...The U.S. Department of Energy should apply for an air permit to install and operate the degasification unit as required by LAC 33:III.501.C...."

Response: DOE is aware that an air permit to install and operate the degasification unit is necessary, and will apply to the states of Louisiana and Texas for such a permit.

E.3 Responses to comments from the Louisiana Department of Natural Resources

E.3.1 "...only the West Hackberry site is within the Louisiana Coastal Zone...The proposed work is unlikely to result in any adverse impacts to coastal waters and appears to be consistent with the Louisiana Coastal Resources Program. However, a formal consistency determination will be required for the proposed construction..."

Response: The West Hackberry site is Federal property which is excluded from the Coastal Zone pursuant to Section 304(1) of the Coastal Zone Management Act of 1972.

After further consultation, DOE and the Louisiana Department of Natural Resources (LDNR) agree that, based on the analysis in the EA, the construction and operation of the degasification unit at West Hackberry would not: alter surface water quality or quantity in the coastal watershed and the coastal zone; result in dredge, fill, development, construction, or waste discharge in or into coastal waters; or impact air quality in the coastal zone. Therefore, the proposed project would not directly affect the coastal zone and pursuant to 15 CFR 930.35(d), a Federal agency consistency determination is not required.

DOE and LDNR further agree that the inclusion of this negative determination in the EA is sufficient coordination and that an additional notification period is not required.

Text has been added to Section 3.3 of the EA to clarify that the West Hackberry site is located within the Louisiana Coastal Zone. Also, text has been added to Section 5.3 to reflect the lack of effects on the coastal zone and a negative determination has been added to the Summary and Conclusions.

Houston-Galveston Area Council
P.O. Box 22777 • 3555 Timmons • Houston, Texas 77227-2777 • 713/627-3200

Memorandum

To: Tom Adams, Texas Office of State-Federal Relations
From: Steve Howard, Director of Program Operations
Subj: Environmental Assessment of Oil Degasification at Strategic Petroleum Reserve Facilities--SAI#TX-R-94-06-07-0001-50
Date: June 16, 1994

The Houston-Galveston Area Council offers the following staff comments on the referenced environmental assessment report.

1. Because of the Houston-Galveston area designation as a severe ozone non-attainment area any potential for an extremely large purge emission of volatile organic compounds is significant.

2. A clearly stated and defined worst case scenario for each of the proposed alternatives would increase the usefulness of the environmental assessment as a decision making tool for assessing potential environmental impacts of proposed activities. The worst impacts for each alternative were not identified or quantified in the affected area impact section. Items that would be useful include assessing the maximum accidental spill/release/explosion that might occur and identify the area and population most likely to be affected by this occurrence.

3. If the construction activities are not covered by specific NPDES permit requirements for Strategic Petroleum Reserve activities, DOE should at least comply with EPA general permit for construction activities.

4. We did not see a reference to a contingency plan for dealing with brine spills. If brine spills are not covered by an oil spill contingency plan then brine spill should be addressed.

State of Louisiana

Department of Environmental Quality

Edwin W. Edwards
Governor

William A. Kucharski
Secretary

June 20, 1994

MEMORANDUM

To: Ms. Martha Madden
Governor's Office of Permits

From: Gustave A. Von Bodungen
Assistant Secretary

Re: Proposed Oil Degasification Project

The Department of Environmental Quality, Air Quality Division has reviewed the referenced submittal. The U.S. Department of Energy should apply for an air permit to install and operate the degasification unit as required by LAC 33:III.501.C.

An Application for Approval of Emissions and an Emissions Inventory Questionnaire is attached. Please let us know if we can further assist you.

GVB:TDC

State of Louisiana

EDWIN W. EDWARDS
GOVERNOR

JOHN F. ALES
SECRETARY

DEPARTMENT OF NATURAL RESOURCES

Certified Mail
No. 248754

June 20, 1994

State of Louisiana
Office of the Governor
Attn: Martha Madden
P.O. Box 94004
Baton Rouge, LA 70804-9004

Dear Ms. Madden Maestri

Personnel of my staff have reviewed the document entitled, "Draft Environmental Assessment of Oil Degasification at Four Strategic Petroleum Reserve Facilities in Texas and Louisiana" submitted by the Department of Energy. It appears that of the two Louisiana Strategic Oil Reserve (SPR) sites, only the West Hackberry site is within the Louisiana Coastal Zone. The proposed work involves construction of a degasification unit on an existing, previously disturbed site within the confines of the existing facility. No dredging or discharge into coastal wetlands is proposed as part of the construction. Therefore, the proposed work is unlikely to result in any adverse impacts to coastal waters and appears to be consistent with the Louisiana Coastal Resources Program. However, a formal consistency determination will be required for the proposed construction.

The Consistency Section of my Coastal Management Division will prepare a letter notifying the Department of Energy that a Consistency determination will be required for the proposed work. If you have any additional questions, please contact Paul Clifton of the Consistency Section at 342-7591.

Sincerely,

David M. Soileau

OFFICE OF COASTAL RESTORATION AND MANAGEMENT P.O. BOX 44487 BATON ROUGE, LOUISIANA 70804-4487
TELEPHONE (504) 342-1375 FAX NO. (504) 342-1377

Department of Energy
Washington, DC 20585

AUG 2 6 1994

Mr. Paul Clifton
Coastal Management Division
State of Louisiana
Department of Natural Resources
P.O. Box 44487
Baton Rouge, LA 70804-4487

Dear Mr. Clifton:

This is to document our mutual understanding of our discussion on June 29, 1994, regarding the Department of Natural Resources letter of June 20, 1994, commenting on our draft Environmental Assessment (EA) of Oil Degasification at Four Strategic Petroleum Reserve Facilities in Texas and Louisiana. I propose to include in the EA the following response to your comment to reflect that understanding.

LDNR: "...only the West Hackberry site is within the Louisiana Coastal Zone...The proposed work is unlikely to result in any adverse impacts to coastal waters and appears to be consistent with the Louisiana Coastal Resources Program. However, a formal consistency determination will be required for the proposed construction..."

Response: The West Hackberry site is Federal property which is excluded from the coastal zone pursuant to Section 304(1) of the Coastal Zone Management Act of 1972.

After further consultation, DOE and the Louisiana Department of Natural Resources (LDNR) agree that, based on the analysis in the EA, the construction and operation of the degasification unit at West Hackberry would not: alter surface water quality or quantity in the coastal watershed and the coastal zone; result in dredge, fill development, construction, or waste discharge in or into coastal waters; or impact air quality in the coastal zone. Therefore, the proposed project would not directly affect the coastal zone and pursuant to 15 CFR Part 930.35(d), a Federal agency consistency determination is not required.

DOE and LDNR further agree that the inclusion of this negative determination in the EA is sufficient coordination and that an additional notification period is not required.

Text has been added to Section 3.3 of the EA to clarify that the West Hackberry site is located within the Louisiana Coastal Zone. Also, text has been added to Section 5.3 to reflect the lack of effects on the coastal zone and a negative determination has been added to the Conclusions and the Summary.

Please indicate your concurrence or nonconcurrence below and return to me. If you have any questions, please call me at (202)586-4730. I appreciate your assistance in this matter.

Sincerely,

Hal Delaplane

Hal Delaplane
Senior Environmental Officer
Strategic Petroleum Reserve

cc: Martha Madden, Office of the Governor

CONCUR: Paul Clifton CRC

NONCONCUR: _____

DATE: 7-26-94

DATE: _____