DOE/EIS-0034

Final Supplement to
Final Environmental Impact Statement
FEA-FES-76-2

STRATEGIC PETROLEUM RESERVE

Expansion of Reserve

U.S. DEPARTMENT OF ENERGY

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U.S. DEPARTMENT OF ENERGY

Washington, D.C, 20545

January 1979

Responsible Official

Ruth C. Clusen
Assistant Secretary for Environment

SUMMARY

STATEMENT TYPE: ( ) Draft ( ) Final Environmental Statement
(X) Final Supplement to Final Environmental Statement

PREPARED BY: The Strategic Petroleum Reserve Office, Federal Energy Administration, Washington, D.C. 20461

1. Type of Action: ( ) Legislative (X) Administrative

2. Brief Description of the Proposed Action:

The Department of Energy Administration proposes to implement the Strategic Petroleum Reserve, Title I, Part B of the Energy Policy and Conservation Act of 1975 (P.L. 94-163). The purpose of the Reserve is to mitigate the economic impacts of any future interruptions of petroleum imports. The impacts of storing one hundred fifty million barrels (MMB) of oil by 1978 and five hundred MMB by 1982 were addressed in the final programmatic EIS and the SPR Plan. It is now proposed that the SPR be expanded to store a total of 1,000 MMB. This supplement addresses the environmental impacts of this proposed expansion.

3. Summary of Environmental Impacts and Adverse Environmental Effects:

This supplement to the final programmatic EIS has identified which environmental parameters would be particularly sensitive to an increase in the amount of oil stored. The expanded SPR also causes cumulative impacts (those impacts that are additive because of the location of two or more facilities in the same geographical area, and those which result from two or more operations at the same facility) to become more important. The most sensitive parameters appear to be water quality and geology. The adverse impacts that could result from the expanded program include the degradation of surface water quality from construction runoff, increased dredging, and more frequent oil spills. In addition, brine disposal associated with solution mining salt cavities will increase the salinity of the receiving waters, whether underground saline aquifers or small portions of the Gulf of Mexico. Changes in water quality will have a short-term impact on aquatic organisms in local areas. Use of large quantities of ground water for developing salt cavities could cause some surface subsidence over water storage areas, slow salt water encroachment, and movement of near-surface geologic faults. The expanded program would also increase hydrocarbon emissions from the use of above ground tanks and fill and withdrawal operations which may cause temporary localized violations of the Federal standard, but no long-term adverse impact on air quality would result.

4. Alternative Considered:

The following alternatives were addressed in the final EIS.

Non-Structural Alternatives to the Strategic Petroleum Reserve
- Increase Domestic Energy Supplies
- Reduce Energy Demand by Conservation
- No Action
- Shut-in Capacity

Alternative Methods of Acquiring the Oil
- Naval Petroleum Reserve Oil
- Royalty Oil
- Old Oil
- Open Market Purchase of Oil
- Imported Oil

Implementing the industrial Petroleum Reserve

Structural Alternatives
- Solution-Mined Cavities in Salt
- Conversion of Salt and Other Mines
- Aboveground Tanks
- Laid-Up Tankers

5. Comments on the Supplement have been received from the following:

Federal Agencies

Department of Commerce
Department of Interior
Environmental Protection Agency

State Agencies

Arizona Solar Energy Research
Kentucky Bureau of Environmental Protection
North Dakota Geological Survey
Texas Parks and Wildlife Department
Texas Department of Agriculture
Texas Department of Water Resources

Other Organizations

National Wildlife Federation

6. Date made available to CEQ and the Public:

The Final Environmental Impact Statement was made available to Council on Environmental Quality and to the Public on December 17 1976.

The draft supplement was made available to the Council on Environmental Quality and the Public in September 1977.

This final supplement was made available to the Environmental Protection Agency and the public in January 1979.

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I. INTRODUCTION AND SUMMARY

All agencies of the Federal Government are required by the National Environmental Policy Act of 1969 (NEPA), 16 U.S.C. 4321 et seq., as implemented by Executive Order 11514 of March 5, 1970, the Council on Environmental Quality (CEQ) Guidelines of August 1, 1973, to prepare a detailed environmental impact statement (EIS) on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment. The objectives of the NEPA are to (1) build into the agency decision-making processes an appropriate and careful consideration of all environmental aspects of proposed actions, (2) explain potential environmental effects of proposed actions and their alternatives for public understanding, (3) avoid or minimize adverse effects of proposed actions, and (4) restore or enhance environmental quality as much as possible.

The Energy Policy and Conservation Act of 1975 (EPCA), Title I, Part B, Strategic Petroleum Reserve, provided for the creation of necessary strategic reserves. The impact of this action on the environment was investigated and the results published as the Final Environmental Impact Statement, Volume I, Strategic Petroleum Reserve, FES 76-2, December, 1976 by the Strategic Petroleum Reserve Office of the Federal Energy Administration (FEA). The responsibility for implementing the Strategic Petroleum Reserve (SPR) which was originally vested in FEA by EPCA was assumed by the U.S. Department of Energy (DOE) on October 1, 1977, with the inception of the new department.

The schedule for development of the SPR established in the EPCA and addressed in the SPR Plan, which became effective on April 18, 1977, and was assessed in the FEIS, was to st 150 million barrels (MMB) of oil by December 1978 and 500 MM by December 1982. However, as part of the National Energy Plan, the President recommended a 1 billion barrel reserve, which is the maximum size authorized under the EPCA. This increase provides greater insurance against the effects of a petroleum supply interruption. An SPR Plan Amendment, which became effective on June 13, 1978, increased the approved reserve size to 1 billion barrels.

Impacts of the expansion to 1,000 MMB have been assessed in this supplement by using the cumulative impacts and assuming worst case scenarios of critical areas. Table I-1 outlines scenarios for an enlarged reserve. These scenarios are similar to those used in FES 76-2.

Three alternative storage systems for satisfying the objectives of the program were identified. These alternatives, which remain valid, were specified in the final environmental impact statement (FES) for SPR. These alternatives were solution-mined cavities in salt, conventional mines and above-ground tankage. Prototype "worst case" facilities were developed to characterize these systems and to provide a basis for determining potential program impacts and resource requirements. These facilities will provide the basis for determining impacts in this supplement with the factors of an accelerated schedule and a proposed larger quantity being integrated into the basic program to establish new "worst case" conditions for examining the environmental impacts.

TABLE I-1
SCENARIOS FOR AN ENLARGED
STRATEGIC PETROLEUM RESERVE

Facility Type	Scenario No. 1 (in MMB)	Scenario No. 2 (Expect (in MMB)
	SPR Composition Assuming Maximum Local Storage of Product	
Product		
Conventional tanks	95	15
New Rock Mines		80
Crude Oil		
New solution salt dome cavities	605	530
Existing solution salt dome cavities	210	235
Existing salt mines	90	120
Existing rock mines 1/	-	20
Total	1,000	1,000

Facility Type	Scenario No. 1 (in MMB)	Scenario No. 2 (in MMB)
	SPR Composition Assuming Maximum Substitutions of Crude Oil	
Crude Oil		
New solution salt dome cavities	700	625
Existing solution salt dome cavities	210	235
Existing salt mines	90	120
Existing rock mines 1/	-	20
Total	1,000	1,000

Analytic efforts were focused on the impacts expected at the national and regional levels, particularly in the Gulf and East Coast Regions. Although this supplement considers only programmatic level impacts, the names and locations of specific sites under consideration are not identified herein. Site-specific EIS's evaluate each candidate storage location for the sensitivities of each of the proposed sites with respect to the characteristics of a particular storage system

Of the first nine candidate sites for which final EIS's have been prepared five have been selected for development. These sites are: Bayou Choctaw, West Hackberry, Weeks Island, and Sulphur Mines in Louisiana and Bryan Mound in Texas. Additional candidate sites are clustered into groups around the major crude oil pipelines that lead into the interior: Seaway, Texoma, and Capline. Final EIS's for these three groups of salt dome have been published.

A. Overview of Program Objectives

The EPCA provided for the creation of four distinct but overlapping reserves:

- o Strategic Petroleum Reserve (SPR)
- o Early Storage Reserve (ESR)
- o Industrial Petroleum Reserve (IPR)
- o Regional Petroleum Reserve (RPR)

When the SPR plan became effective on April 18, 1977 the ESR was no longer a separate reserve but became part of the initial phase of the SPR. In the EPCA, the manner of implementation of the RPR and whether an IPR would be established were left to the discretion of the FEA administrator.

The option of requiring importers and refiners to maintain Industrial Petroleum Reserves as part of a 500 MMB Reserve was investigated, and it was decided not to implement such a requirement. The SPR Plan Amendment which increased the size of the Reserve to 1,000 MMB proposes the storage of 750 MMB in underground storage facilities. Decisions have not been made regarding the type of storage facilities for the remaining 250 MMB, or the extent of Government and industry involvement in such storage.

Previous analysis of the RPR and storage in noncontiguous areas of the United States indicated that centralized storage of crude oil would provide adequate protection for all regions. It is planned that all regions of the country will be protected from SPR storage sites, including those sites to be chosen in the future. A use plan will be proposed in the summer of 1979 that will address this protection. No in-region product storage is contempleted at this time. However, since the storage of product in tanks was addressed in FES 76-2, it is also addressed in this supplement to provide an updated analysis of the air emissions which would occur. The new analysis reflects the more standard use of floating roof tanks, as opposed to the originally assumed fixed roof tanks. The updated analysis also uses more recent emission factor data than was available for the analysis in FES 76-2.

B. Major Types of Storage Facilities

DOE investigated many types of storage facilities, and limited the final consideration to three. These facilities were described in FES 76-2 on pages I-5 through I-8.

Prototype storage facilities were devised in an attempt to identify any particularly sensitive environmental parameters. These prototypes represented a "worst case" situation, since they were the largest facilities contemplated. These prototypes consisted of:

- o An existing 90 MMB solution-mined cavity in salt,
- o A new 200 MMB solution-mined cavity in salt,
- o An existing 90 MMB conventional salt mine,
- o An existing 15 MMB rock mine,
- o A new 30 MMB rock mine, and
- o A new 10 MMB tankage facility.

Because the expansion of the SPR to 1,000 MMB does not mean storing more oil at any single site larger than these prototypes, the prototype facilities remain valid for this supplement.

C. Description of The Environment

Two major regions of the United States described in FES 76-2 were the Gulf Coast region and the Atlantic or East

Coast region. The Gulf Coast was chosen because of its extensive natural salt dome formations which provide existing and potential storage capacity, and because of the significant petroleum refinery and distribution facilities located there. In addition increased emphasis has been placed on examination of the possibility of storage in salt domes further inland from those previously addressed for the Gulf Coast Region. This supplement addresses inland dome storage in Louisiana and Mississippi. The East Coast region was included in FES 76-2 because refined products could be stored there under EPCA. Although no in-region product storage is contempleted at this time, this supplement also updates the analysis of predicted emissions which would result if that program alternative were implemented.

D. Environmental Impacts of the Gulf and East Coasts

1. General

The environmental parameters of geology, hydrology, water quality, meteorology, climatology, air quality, noise, history, archaeology, land use, demography and economics were broadly described in the FES 76-2. These descriptions, with the exception of I.D.4, Air Quality, provided the baseline data against which the impacts were measured in the FES 76-2. This data base is still valid and is used for this supplement. However, additional examination of the impact in the inland salt dome areas of the Gulf Coast Region is indicated and is necessary to determine feasibility, impact, major problem areas, and limitations that may be imposed. There appears to be probable serious problems with brine disposal by injection into deep wells, as well as with economic tradeoffs involved in inland dome storage in Louisiana and Mississippi. These factors as well as other conventional environmental disciplines have been addressed in this Supplement.

2. Air Quality

Increase of the SPR from 500 to 1,000 MMB is not anticipated to significantly alter regional air quality. FES 76-2 indicates that there will be some short-term and localized dust problems during construction of on-site facilities. The expanded SPR will probably intensify the fugitive dust problems as more construction activities will be required. However, the dust emissions can be effectively minimized by taking precautions such as timely watering of construction areas and unpaved roads.

The same major air quality problem of hydrocarbon vapor losses during marine tanker unloading and loading, as identified for the original SPR, would be associated with the accelerated and expanded SPR. It is anticipated that some Federal hydrocarbon standards would be exceeded by increased tanker loading/unloadings for the expanded SPR. Any site specific impacts associated with crude oil transfer would be temporary in nature and occur during construction and fill and withdrawal of oil from the site. Once fill is complete, the site would be in a standby situation until the need for drawdown arose during a supply interruption. Because the double-sealed floating roof tanks being used for the SPR will have much less vapor loss than the fixed roof tanks previously assessed in FES 76-2, the predicted on-site and terminal hydrocarbon emissions are significantly lower. Likewise, based on the assumptions used in the analysis, no significant impact on air quality would result from tank storage of residual fuel oil or distillate oil in the East Coast Region.

E. Measures to Mitigate Adverse Impacts

FES 76-2 noted that for each area of environmental concern, certain policies and measures exist that at least partially attenuate the environmental impacts. Details are contained in Chapters II and VI.

F. Irreversible and Irretrievable Commitments of Resources

Resource factors were contained in FES 76-2 and remain applicable to this supplement. These are described in more detail in Chapter VII.

G. Program Alternatives

FES 76-2 addressed possible non-structural program alternatives. These alternatives included:

1. Alternatives to the Proposed Action

- Increase Domestic Energy Supplies
- Reduce Energy Demand by Conservation
- No Action
- Shut-In Capacity

2. Alternative Methods for Acquiring the Oil

- Using (or exchanging) Naval Petroleum Reserve oil
- Using (or exchanging) royalty oil
- Purchasing "old" oil
- Purchasing oil on the open market
- Importing oil

3. Industrial Petroleum Reserve (IPR)

FES 76-2 stated that the DOE's conclusion was not to implement an IPR. This conclusion has not changed.

H. Environmental Impact Statement Content

FES 76-2 was structured to comply with the requirements of NEPA, and to enable the reviewer to examine the various influences and the resulting impacts associated with the program. It was organized into eight major chapters, each having a relationship to the impact of the proposed program. To simplify cross-referencing and to permit ready comparison of FES 76-2 with this supplement, the same format and chapter organization has been maintained. The chapters, for both FES 76-2 and this supplement are as follows:

I. Introduction and Summary

II. Program Description

III. Alternatives

IV. Description of the Environment

V. Environmental Impact of the Proposed Program

VI. Unavoidable Environmental Impacts and Mitigating Measures

VII. Irreversible and Irretrievable Commitments of Resources

VIII. The Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity.

II. PROGRAM DESCRIPTION

This chapter describes the changes to the basic Strategic Petroleum Reserve Program, as modified from the description contained in the FES 76-2. The need for a stand-by energy supply was well documented therein, and is reinforced by the current increases in U.S. energy demand and the equally critical increases in imported petroleum to meet those energy requirements. The major types of storage facilities and distribution systems were discussed in detail in FES 76-2, and need little reexamination, except to examine what impact the increases in total petroleum storage could have on the existing facilities.

A. Need for Strategic Petroleum Reserve

The need for the SPR program is well documented in the President's National Energy Plan and will not be considered further at this time.

B. Authorization for the Strategic Petroleum Reserve

The 1973 petroleum embargo highlighted the perceived requirement for a petroleum reserve for the United States in the event of interruption of the flow of petroleum to the United States from any cause. This need was met with legislation in the Energy Policy and Conservation Act of 1975 (PL 94-163), which created the Strategic Petroleum Reserve, and also provided for the Early Storage Reserve, the Industrial Petroleum Reserve, and the Regional Petroleum Reserve.

C. Requirements for Storage Capacity

The 500 million barrel Strategic Petroleum Reserve Program provided for petroleum storage reserves based on 1974 and 1975 U.S. petroleum import data. The expansion of the reserve size was the result of a continuing assessment of the program, and will ensure maximum energy supply protection for the United States consistent with the President's National Energy Plan goal of providing one billion barrels of SPR storage of 1985.

1. Strategic Petroleum Reserve

The Energy Policy and Conservation Act provided for the amount of the reserve to be equal to the total volume of oil imported over a three consecutive month period in 1974-1975 during which average monthly import levels were highest. Accordingly, 1974 and 1975 crude oil import data were examin[illegible] Included in these data were imports to the Virgin Islands, Puerto Rico, and Guam. The three consecutive months in which crude oil imports were highest were August through October of 1975.

Based on imports in these months, the SPR Plan recommended a Reserve size of 500 MMB. The Plan stated that if subsequent estimates of national vulnerability showed a need for a larger or smaller Reserve, this requirement would be presented to the Congress as a Plan Amendment.

Daily average U.S. petroleum imports have increased from approximately 6 MMB per day during 1974, to approximately 9 MMB per day during 1977. Total U.S. petroleum imports (direct and indirect) from the Arab OPEC states have also increased. These Arab OPEC imports have risen from 22 percent of total imports in 1973 to over 40 percent in 1977. The United States is far more dependent on imported oil today than it was prior to the 1973-74 embargo. While disrupting world petroleum markets poses risks for producing countries, nevertheless, based on recent vulnerability assessments, simple prudence dictates that this country prepare to deal with the possibility that another interruption will occur. Therefore, SPR Plan Amendment #2 increased the size of the SPR to 1,000 million barrels.

2. Early Storage Program

As stated in Section I, the Early Storage Reserve is no longer in effect.

3. Regional Petroleum Reserve (RPR)

No product storage within specific regions or in non-contiguous areas is contemplated at this time. However, it is planned that all regions of the country will be protected from SPR storage sites, including those sites to be chosen in the future. A use plan will be proposed in the summer of 1979 that will address this protection.

D. Summary of Major Storage and Distribution Facilities

As a result of preliminary feasibility studies conducted by DOE, emphasis has been placed on underground storage facilities. The advantages of underground storage include low cost in comparison to surface tankage, large capacity and minimal environmental impact. Aboveground facilities were also considered and continue to offer a practical, if less desirable, alternative.

For analysis, prototype facilities have included a facility using existing solution mined cavities in salt with a storage capacity of 90 MMB; an existing salt mine with a storage capacity of 90 MMB, facilities using new solution mined cavities in salt with a storage capacity of 200 MMB; an existing rock mine with a storage capacity of 15 MMB; a new conventional mine with a capacity of 30 MMB; and a 10 MMB tank facility. These prototypes have been continued for analytical purposes. It should be noted that some of the analysis done for specific sites, published separately, offers more precise capacities for specific geographic locations.

E. Candidate Storage Sites

Candidate storage sites for both underground and aboveground storage were surveyed and identified by DOE. The types of facilities under consideration included solution cavities in salt domes, conventional mines, and tank farms. Sites were considered with respect to existing and potential capacity, availability schedules, accessibility to the distribution network, technical feasibility and suitability for storage, the extent of environmental impacts, the feasibility of acquiring the sites, economic impacts, relative costs, security, and safety. In addition DOE is currently soliciting from industry offers to provide a completed "storage package" on a turnkey basis.

The three market areas most dependent on oil imports that are likely to be interrupted are: the interior of the country served by the major crude oil pipelines fed from the Gulf Coast; the Gulf Coast refinery complexes; and the East Coast and Caribbean refineries.

Because locating the bulk of the Reserve storage in the Gulf Coast area will maximize the flexibility of the Reserve, storage sites in this area have been the first to be selected. Candidate sites identified by DOE are clustered into three groups around the major crude oil pipelines that lead into the interior: Seaway, Texoma, and Capline.

1. Seaway

Five salt dome sites have been assessed in the Seaway Group EIS. One salt dome site, Bryan Mound, has already been selected because solution cavities that could contain 60 million barrels of oil are available there. If the proposed development plans for all five salt domes were developed to their assessed capacities, 560 million barrels of oil could be stored in this area. However, for purpose of this assessment the capacity of the Seaway area was limited to 200 million barrels.

2. Texoma

The Texoma Group EIS includes four salt dome sites. Existing solution cavities at the West Hackberry dome have already been acquired and could hold 51 million barrels of oil. The Sulphur Mines site has also been selected and has a capacity of 22 million barrels. If all sites were used, 522 million barrels of oil could be stored in the Texoma area. However, for purposes of this assessment the capacity of the Texoma area was limited to approximately 350 million barrels of oil.

3. Capline

Five salt dome sites have been assessed in the Capline Group EIS. Two of these sites with existing capacity have already been selected for storage facilities: Bayou Choctaw and Weeks Island. A total of 710 million barrels of oil could be stored in this area if all candidate sites were fully developed. However, for purposes of this assessment the capacity of the Capline area was limited to 500 million barrels of oil.

4. Other Sites

In addition to those candidate sites identified by DOE and assessed to date by DOE, it is anticipated that other sites will be identified and offered to the DOE on a turnkey basis by industry. Additional site specific environmental analysis in accordance with the requirements of NEPA, will be conducted for these sites as appropriate during the selection process.

F. Considerations for System Flexibility

To be efficient, the SPR Program must be designed and built to insure flexibility that facilitates transportation of oil to the storage site, and distribution of oil during a withdrawal phase. Efficiency also calls for providing storage in locations of anticipated need in amounts that are proportional to the requirements.

Facilitating transportation means not only minimizing the length of the route, but also providing for alternate modes of transportation. This consideration suggests that the storage sites be located in coastal areas, that they should be near marine terminals for the offloading or loading of tanker ships, near waterways for further transport by barge, and near major crude oil distribution systems that exist, such as major pipelines.

Although much of the nation's oil refinery capacity is located near the Gulf Coast (6.2 MMB per day) and near the East Coast (1.6 MMB per day), important capacity exists in the northern Midwest (2.5 MMB per day). Storage facilities located in these areas not only could serve these refineries directly, but could also provide surge capacity at the end of a transportation route, from the Gulf Coast area (whether pipeline, barge, or tankship).

1. Terminal Locations

Flexibility of the system depends in a large part on the flexibility of the oil transportation network. To the extent practicable, marine terminals should have access to the inland waterways that support barge transport, and be near the terminals of major pipeline systems. Thus, Gulf Coast locations appear to be well suited, and adequate or easily expanded terminal capacity already exists there. East Coast terminal capacity could be used to receive petroleum for the Gulf Storage Region, but because of the distances involved, these Eastern terminals would be less desirable than those located on the Gulf.

2. Pipeline Lengths

Because of the anticipated high filling and withdrawal rates, it will be necessary to connect the storage sites and marine terminals by pipelines. Wherever possible, the new pipelines would also connect with existing pipelines and be routed to connect as many storage sites as possible with a minimum of new construction. The length of new pipelines is a function of the types of transport selected, and combinations of these modes (e.g. barge/pipeline), as outlined in III.B.

G. Implementation of the Strategic Petroleum Reserve

Facility acquisition and development has begun. Petroleum procurement and actual filling operations began in mid-1977. The expansion of the Strategic Petroleum Reserve (SPR) will require aquisition and development of additional facilities and the procurement of additional crude oil.

Actions taken to implement the expanded program will follow the policy and procedures established for the SPR. All actions will be in compliance with the National Environmental Policy Act, other Federal laws and regulations, and to the extent applicable, state and local laws and regulations, established to protect the quality of human life and the environment.

DOE has followed and will continue to follow a two-step environmental process inclusive of Environmental Impact Statement preparation and environmental planning. Programmatic and site-specific Environmental Impact Statements (EIS) are prepared as required. These statements identify probable impacts associated with development and operation of the SPR. Environmental planning follows the preparation of an EIS and is the mechanism for insuring that environmental issues associated with the SPR as well as with each site, are either avoided or minimized to the extent practical, consistent with the Congressional directives for the SPR.

Environmental planning as shown in Figure II-1, covers all phases of SPR development from the acquisition and operation of storage sites through oil purchase and transport. Individual plans for the SPR Program, the design, construction and operation of storage sites, and the transport of crude oil will be prepared and implemented. Site environmental planning is documented in Environmental Action Reports. Oil transport environmental planning will be documented in procurement contracts. Planning for the prevention of, as well as the containment and clean-up of oil spills, is accomplished through the preparation of Spill Prevention Control and Countermeasure (SPCC) plans. A separate plan will be prepared for each storage site. Each contains a Contingency Plan to be implemented in emergency conditions.

1. Environmental Action Reports

Environmental Action Reports translate environmental impacts identified by the Environmental Impact Statements into site development and operational requirements. These requirements include design criteria, construction practices and operational procedures which, when implemented at each site, will minimize or avoid impacts. These requirements will be implemented by engineering contractors developing and operating each site.

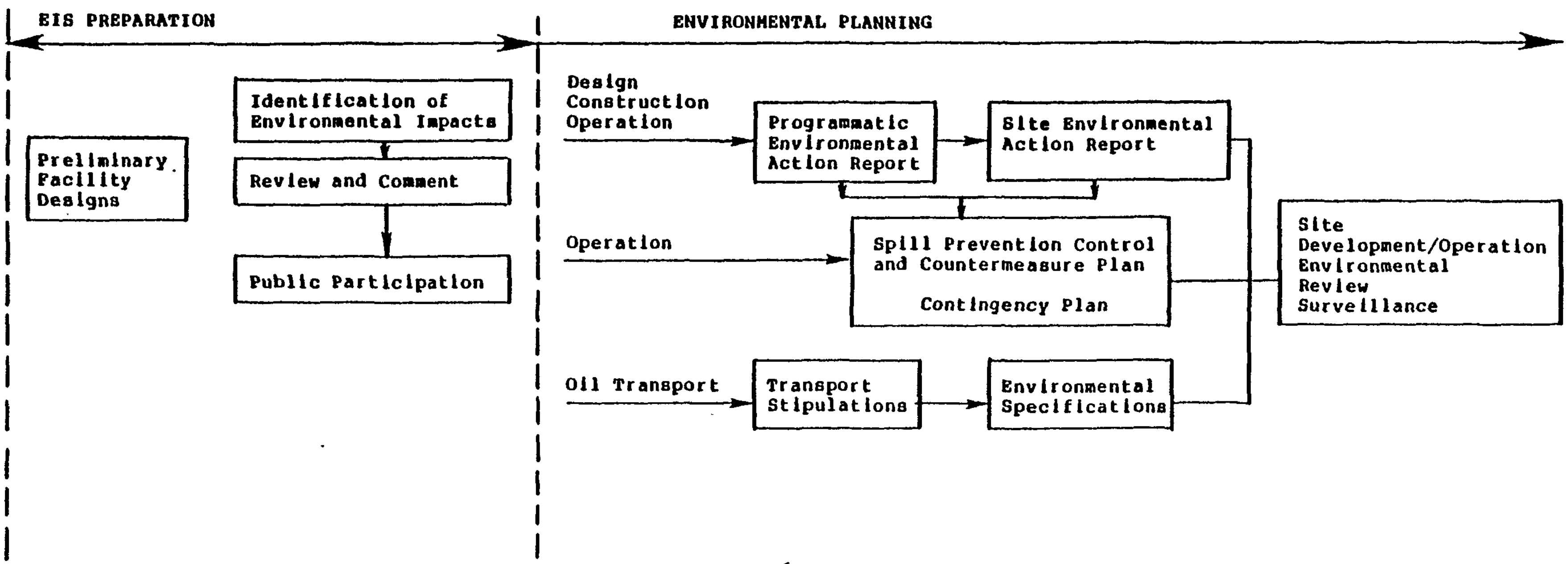

Figure II-1. The SPR Environmental Process.

Preparation of environmental requirements is initiated through a review and analysis of each component of SPR design, construction, and operation. This review and analysis includes a detailed environmental assessment of meteorology and air quality, hydrology and water quality, noise, geology and land use, species and ecosystems, socioeconomics and unique features. The result of these assessments is a summary of environmental impacts or concerns which have probability of occurrence.

Current facility design and development specifications are then analyzed to determine those aspects of site design, construction, and operation, which, if guided by alternative criteria, will avoid or minimize identified environmental impacts. This analysis includes the assignment of realistic environmental goals to be achieved and an identification of design, construction and operation specifications or alternative development methods that can satisfy these goals. The development of alternative specifications and recommendations includes an analysis of engineering practicality, economic cost, and environmental effectiveness.

Environmental requirements are documented for the overall SPR program in the Programmatic Envrionmental Action Report (PEAR). Site environmental specifications are documented in individual Site Environmental Action Reports (SEAR). These documented environmental requirements are made part of all Architect/Engineer and Construction contracts. Compliance is monitured by subjecting their designs and development specifications to a detailed environmental review. Individual site environmental inspectors document actual implementation.

2. Environmental Planning for Oil Transport

Although the oil spill risks associated with the ocean transport of oil are not severe, DOE has taken measures to ensure that these risks are minimized. DOE is requiring that each offeror who submits a proposal for the sale and/or transport of oil to SPR storage sites comply with a set of transport stipulations developed by DOE as a condition of the contract, and that the offeror submit an environmental plan of how he will minimize oil pollution.

Transport stipulations may include: specifications for the use of certain oil spill prevention devices; for the use of certain types of tankers; requirements for adequate liability coverage; and the right of DOE to inspect vessels prior to charter and to monitor offloading procedures. Criteria for precharter inspection have been developed by DOE and the Coast Guard.

The environmental plan required to be submitted with offers must detail the procedures and equipment, over and above those required by stipulation, which the offeror proposes to use for preventing or mitigating the effects of oil spills. DOE is in the process of developing a procedure whereby, in future oil purchases, each offer will be evaluated, in part, on the basis of the efficacy of the environmental plan.

3. Spill Prevention Control and Countermeasure Plan

Spill Prevention Control and Countermeasure (SPCC) Plans are being developed in accordance with Title 40, Part 112 of the Code of Fedeal Regulations (40 CFR 112) for all facilities in the SPR Program. The objective of an SPCC is to prevent discharged oil from reaching both the surface and navigable waters of the United States. The Plan will contain a description of the facility and its operation, the control and alarm systems for leak detection, the security measures against unauthorized entry into the facility, the spill prevention systems (dikes, retention basins, drip pans) at on-shore and non-production systems, record keeping and inspection procedures, and training of operating maintenance personnel.

An oil spill contingency plan, developed in accordance with Federal law, is an integral part of an SPCC Plan. Oil Spill Contingency Plans comprise a predetermined sequence of instructions for communication and actions in the event of an oil spill. The objective of such a plan is to prevent an on-land spill from reaching water, or in the case of a water-based spill, to contain, remove and minimize contamination of the water body.

The Spill Prevention Control and Countermeasure Plan for each site will be filed with appropriate Federal Agencies within six months after the site begins operating, and will be fully implemented within a year after the start of operations. The SPCC and included Contingency Plan will be made part of the operational procedures to be implemented at each site. Surveillance for compliance will be performed by

III. ALTERNATIVES

The data in FES 76-2 remains valid, and only minor change is required by the programmatic increase from 500 to 1,000 MMB in the SPR.

A. Non-Structural Alternatives

Alternatives to the Strategic Petroleum Reserve, such as an increase in domestic energy supplies or reduction in energy demands through conservation are considered nonstructural alternatives. Nuclear power and synthetic fuels are in this category, as are alternative methods of acquiring petroleum. The methods and impacts of such acquisition have already been examined. The information presented below supplements that in FES 76-2.

The acquisition methods examined in the 1976 EIS are still applicable for the SPR Program; however, due to the increased volume of petroleum to be stored, the economic impacts will vary from the original estimates. DOE is using the authority granted by the Emergency Petroleum Allocation Act (EPAA) to allow the Government to obtain the benefit of price controlled crude oils for fill in the SPR, at least until the mandatory allocation authority of EPAA expires.

Increased costs will occur in the form of higher prices for crude oil and petroleum products. These higher prices are estimated to be less than 2/10 of a cent per gallon on average over that portion of the acquisition period for the expanded program during which EPAA allocation authority will be effective. Under the new scope for the SPR Program, this price change would be greater than the original estimate, only if the amount of SPR crude oil purchased under the EPAA allocation authority is increased. This would be dependent on the development schedule for the program as a whole.

Based on November 1978 prices for imported oil and old domestic crude, the value of an entitlement is approximately $1.35-$1.45 a barrel. Therefore, budget costs should be reduced by this amount per barrel compared with Government procurement at world market prices. This reflects the estimated average differential between imported prices and national average prices until price controls end.

As noted in the FES 76-2, there was certainty that oil imports would rise under any of the alternatives for the 500 MMB SPR. The increase to a 1000 MMB program over a slightly longer period of time than was previously planned for storage of 500 MMB, only serves to increase these import requirements.

1. Industrial Petroleum Reserve (IPR)

FES 76-2 stated that the DOE's conclusion was not to implement an IPR. This conclusion has not changed.

2. Shut-In Storage - Elk Hills

The possibility of shutting in the Elk Hills reserve indefinitely as part of the SPR has been studied by DOE and the Office of Naval Petroleum Reserves. There are a number of problems with the use of Elk Hills oil as a strategic reserve. First, the withdrawal rate would be far less than necessary; it is estimated that the maximum sustained production rate for NPR-1 will be approximately 260,000 barrels per day, as contrasted to the rapid withdrawal rates designed for the SPR, which is over six million barrels per day for the one billion barrels to be stored. Second, there would be delays in starting up production from a shut-in field. For example, unless full crews are maintained on a standby basis, there may be difficulty in quickly obtaining adequate numbers of trained personnel to operate the facilities. The SPR is being designed to reach its full withdrawal rate within one week of a drawdown decision, whereas it would take an estimated 90 days for the first drop of oil to be available from a shut-in NPR. The limited daily production rate and the slow start-up time is likely to limit Elk Hills production to a total of about 25 million barrels during a six month interruption. This would represent only about 2 1/2 percent of the one billion barrel SPR.

3. Noncontiguous Areas

No product storage in non-contiguous areas is contemplated at this time. It is planned that all regions of the country will be protected from SPR storage sites, including those sites to to be chosen in the future. A use plan will be proposed in the summer of 1979 that will address this protection.

B. Structural Alternatives

The structural alternatives include solution-mined cavities in salt, mines, tank farms and tankships used for storage. In addition to assessing the impacts of additional storage development in the Gulf Coast this supplement will focus on the feasibility of oil storage in salt domes of the inland Gulf Region, and the impacts associated with the use of these domes. The programmatic increase will result in some additional impact and the introduction of factors not examined in FES 76-2. Fundamentally, the changes reflect a marked increase in thoughput requirements at terminals, and increases in usage of pipeline and barge transport from marine terminals to inland sites.

Inherent in consideration of structural alternatives is consideration of the transport modes available or feasible for construction to serve the storage sites. Two pipelines of a greater than 15 inches are located near inland domes, these are the Exxon 22 which runs northwest from Baton Rouge, and the 40 inch Capline line which runs north from St. James, Louisiana through Mississippi. Trunk lines from these pipelines could serve approximately 75 percent of the dome locations if capacity were available. However, many of the domes are very small, and only a limited amount of storage capacity could be developed there.

Oil can be feasibly transported in large quantities to the domes in northern Louisiana and southern Mississippi by lightering to smaller tankers or barges in the Gulf or at the ports of New Orleans, Baton Rouge or St. James area, and transporting the crude further on navigable waterways to convenient staging points for constructing pipelines of reasonable lengths to the domes. Tankers having drafts of 20 to 25 feet can make the voyage up the Mississippi to

Natchez; such vessels range from 5,000 to 10,000 DWT. Somewhat smaller tankers can even make the voyage up to Vicksburg; seasonal variations of river level limit the tanker size more severely for this alternative, however. It is concluded that small tanker (5000 to 10,000 DWT) transport of crude to Natchez is a feasible alternative, but that transport to Vicksburg lacks the requisite program flexibility. A pipeline of length 80 miles or less can be constructed from Natchez to 26 of the domes in southern Mississippi. Alternatively, a similar pipeline from Vidalia on the Louisiana side of the Mississippi across from Natchez, could be used to fill 19 of the domes in northern Louisiana. The range of such pipelines are shown by dashed areas on Figure III-1.

Lightering to barges for transport by barge tow should also be considered. Such lightering can be accomplished at New Orleans, St. James or Baton Rouge for barge tow transport up the Mississippi, up the Old River to the Red River, and thence to the Ouachita Black River. Shipment by barge can feasibly continue up the Ouachita Black all the way to Monroe, Louisiana, at which point a pipeline of length less than 80 miles can be constructed to fill any of the domes located in northern Louisiana. Another dashed area, centered on Monroe, Louisiana on Figure III-1 illustrates this.

Lightering to barges can also be accomplished at New Orleans for further shipment by barge tow east along the Gulf Intracoastal Waterway to the Pearl River, and up the Pearl River to Bogalusa, Louisiana. A pipeline of 80 miles or less could be constructed from Bogalusa to transport the crude to a large number of the domes in southern Mississippi. The dashed area centered on Bogalusa, Louisiana in Figure III-1 shows this.

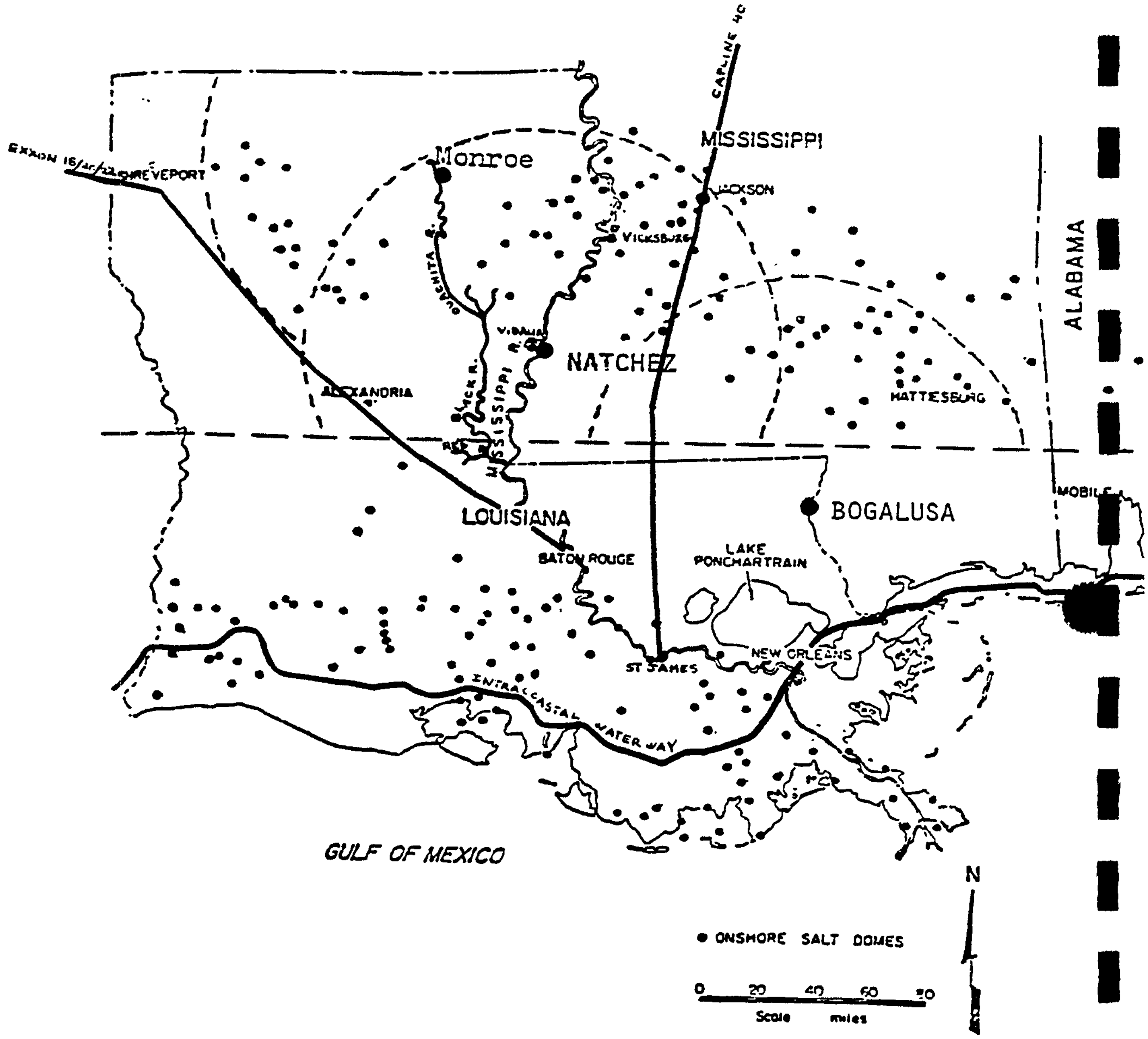

Figure III-1. Feasible Staging Points for Transfer of Crude From Small Tankers or Barge Tows to Pipelines of 80 Miles in Length or Less.

The barge transits mentioned are sufficiently lengthy (at least 90 to 195 miles in length) that the risk of oil spills for these transits is probably greater than for the lesser number of vessel transits that might be required to Natchez. Vessel transport to Natchez or Vidalia, and pipeline shipment to domes within a reasonable distance, may therefore be preferable to the use of barges.

As the volume of petroleum handled in a given period of time increases, so does the chance of an accident occurring with resulting emissions into the atmosphere. Thus, while the alternatives remain valid, the impact of the programmatic increase to one billion barrels of storage is examined in this supplement.

IV. DESCRIPTION OF THE ENVIRONMENT

The description of the environment contained in FES 76-2 contains the background environmental, cultural, and socioeconomic data for the geographic areas under consideration. This data includes the hydrology, geology, meteorology and climatology, historical and archaelogical, socioeconomic and similar factors against which any analysis of environmental impacts must be conducted. The majority of the data in the FES 76-2 analysis and description remain adequate and was used as a basis for this supplemental study.

The Gulf Coast Region has been supplemented with information relevant to potential Northern Louisiana and Mississippi sites. The use of salt domes to store oil in the Gulf Coast Region will require substantial quantities of water and produce equal volumes of brine. For this reason the regional water supply system is a critical factor in the development of storage sites, and the description of the hydrology of the inland region has been emphasized.

A. Gulf Coast Storage Region

The Gulf Coast Storage Region encompasses southern Mississippi, Louisiana, and portions of southeastern Texas along the coast of the Gulf of Mexico, adjacent to the Louisiana border.

The region is located entirely within the Western Gulf Coastal Plains Province. The inner coastal plain, including most of the embayments, is characterized by distinctly belted topography and rolling hills. The subaerial portion of the outer coastal plain is chiefly broad, nearly flat prairie, sloping very gradually toward the Gulf at the rate of about five feet per mile. The coastal features include laterally extensive coastal marshes, extending as much as twenty miles inland, bay estuaries and offshore bars near major streams. Some relief elevation is provided by the onshore salt domes which result in increased localized elevations of several tens of feet. From the Gulf coast, the subaerial coastal plain surface extends under the sea for more than a hundred miles, with very even topography resulting from the blanketing by marine sediments.

1. Geology

The Gulf Coast salt dome basin of the United States and Mexico is one of the most extensive salt basins in the world. It underlies most of the Gulf of Mexico, Mississippi, Louisiana, Texas; Southeastern Veracruz and Western Tabasco, Mexico; a Cuba. The United States portion has five sub-basins. These include the Texas-Louisiana Coastal Basin, the Northern Louisiana Interior Basin, the East-Central Louisiana-Mississippi Interior Basin, the East Texas Interior Basin, and the Rio Grande Basin.

The basins and uplifts which separate them predate the period of salt deposition so that the greatest accumulation of salt occurred in these basins. It is postulated that the interior domes were formed before the coastal ones. As the ancient Mississippi River Delta progressed farther south, relatively more sediment was deposited in the coastal dome area than in the interior region. Without continued sedimentation, the growth rate of the interior salt domes decreased while the coastal domes continued to rise.

The inland salt domes currently being considered for oil storage sites are in the Northern Louisiana Interior Basin and the East-Central Louisiana Mississippi Interior Basin (the Mississippi Basin). The subsurface ridge that separates the interior salt domes from those along the coast is about 100 miles wide. The surrounding rock is older at the inland domes, and generally more consolidated than at the coastal domes.

There are significant differences between the two inland salt dome basins. The Northern Louisiana Basin is small and has only 19 known salt domes, whereas the Mississippi Basin has about 60 domes. Furthermore, the domes in the Northern Louisiana Basin have generally not produced petroleum around the perimeter although petroleum is usually found around the Mississippi Basin domes and the Coastal domes. Because of the lack of oil, relatively little geologic exploration has been conducted, therefore the surface area and vertical configurations of the Northern Louisiana domes are not as well known as the domes in the coastal basins.

Unlike some of the coastal domes, there is generally no topographic rise above the inland domes. A number of them are under lakes and low, swampy areas which may have resulted from partial subsidence due to dissolution of the salt. The land over the inland domes is sometimes in pasture, but more often it is woodland.

2. Hydrology

The hydrology of the Gulf Coast Region is discussed in general terms in FES 76-2. However, additional consideration must be directed toward the northern Louisiana and Mississippi salt-dome basins.

a. Surface-Water Hydrology

The surface drainage of the area of interest in the northern Louisiana Salt Dome Basin is shown in Figure IV-1, and pertinent hydrologic data on these streams are summarized in Table IV-1. The largest discharges are by the Mississippi River and the Red River. The smallest discharge is the Dugdemona River.

Within the Red River Basin, both the Red and Ouachita River flows are regulated; the Red River by Lake Texoma and the Ouachita River by Lake Hamilton and other upstream lakes as well as a series of locks and dams. High flows usually occur in February to May and low flows in August and September.

Development of facilities in Madison, Franklin or Tensas parishes would most probably rely on the Mississippi River or its back waters as a raw water source. Facilities in Webster, Bienville, Jackson, Winn or Natchitoches parishes would most likely rely on the Red and Ouachita Rivers or their tributaries as a source of raw water.

These streams have relatively high amounts of suspended materials and as a consequence are usually turbid. Overall, the water quality of streams in Red River Basin is good during the greatest part of the year. Poor water quality has occurred during times of low flow when depression of dissolved oxygen levels, especially near municipal discharges, has been a problem. Streams within the Red River Basin are generally classified as being suitable for all uses except as public drinking water supplies. Smaller tributaries are often classified as unsuitable for primary

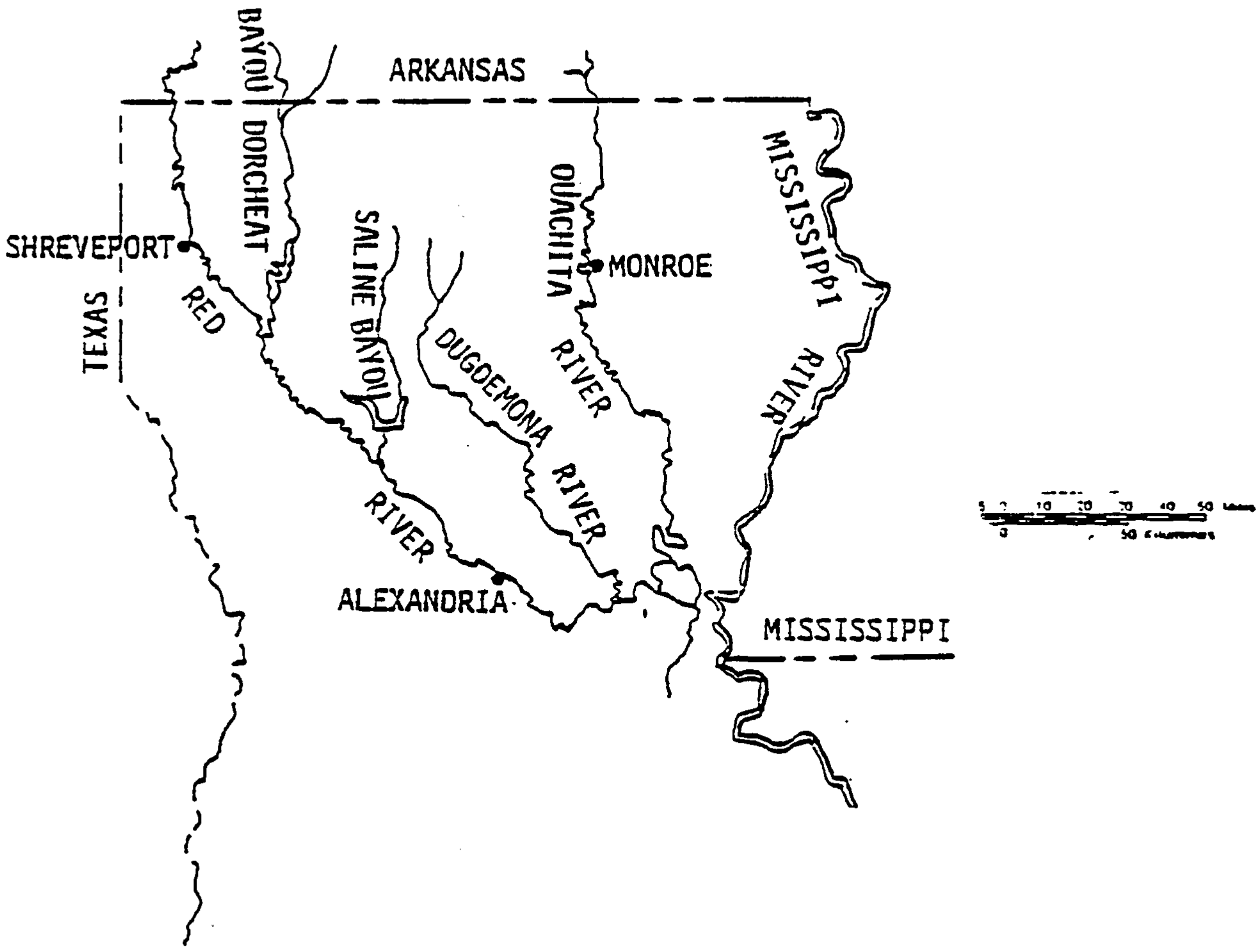

Figure IV-1 Surface Drainage Area - Northern Louisiana

Table IV-1. Flow Data for North Louisiana Streams

Stream	Station Location	Drainage Area (mi^2)	Volumetric Flow (CFS) Mean	Maximum	Minimum
Mississippi River	Vicksburg, Miss.	1,140,500	573,600	2,080,000	99,400
Red River	Alexandria, La.	67,000	31,870	233,000	873
Ouachita River	Monroe, La.	15,298	18,220	101,000	ND
Bayou Dorcheat	near Minden, La.	1,097	1,134	44,800	0
Saline Bayou	near Clarence, La.	1,386	1,182	14,200	0.75
Dugdemona River	near Winnfield, La.	654	484	27,100	0*
Boeuf River	near Girand, La.	1,226	392	3,070	9.9

* Result of temporary regulation.

(US-120; US-121)

contact recreation due to high bacteria levels, which are particularly excessive during low-flow periods. The Mississippi River in this area is classified as suitable only for secondary contact recreation and propagation of fish and wildlife. The primary water quality problems consist of heavy industrial pollution in the Mississippi River and problems associated with agricultural runoff in smaller tributaries of the Red River Basin.

The water quality problems presently existing in the area are likely to persist for a relatively long period of time. As older industrial and municipal facilities become outmoded and are replaced with plants meeting new discharge limitations industrial and municipal pollution problems should begin to decline. Problems associated with water quality degradation from agricultural runoff into the smaller tributaries is likely to continue for some time.

The surface drainage of the area of interest in the Mississippi Salt Dome Basin is shown in the Figure IV-2, and pertinent hydrologic data on these streams are summarized in Table IV-2. The largest discharge is by the Mississippi River followed by the Yazoo and Pascagoula Rivers.

Except for regulation of the Pearl River by Ross Barnett Reservoir these streams are largely unregulated thus great differences between high and low flows are observed. High flows are generally observed in August to October for these streams.

Development of facilities in the western part of the Mississippi Salt Dome Basin would probably utilize water from the Mississippi River or the Pearl River. A facility in the eastern portion of the basin would probably draw from

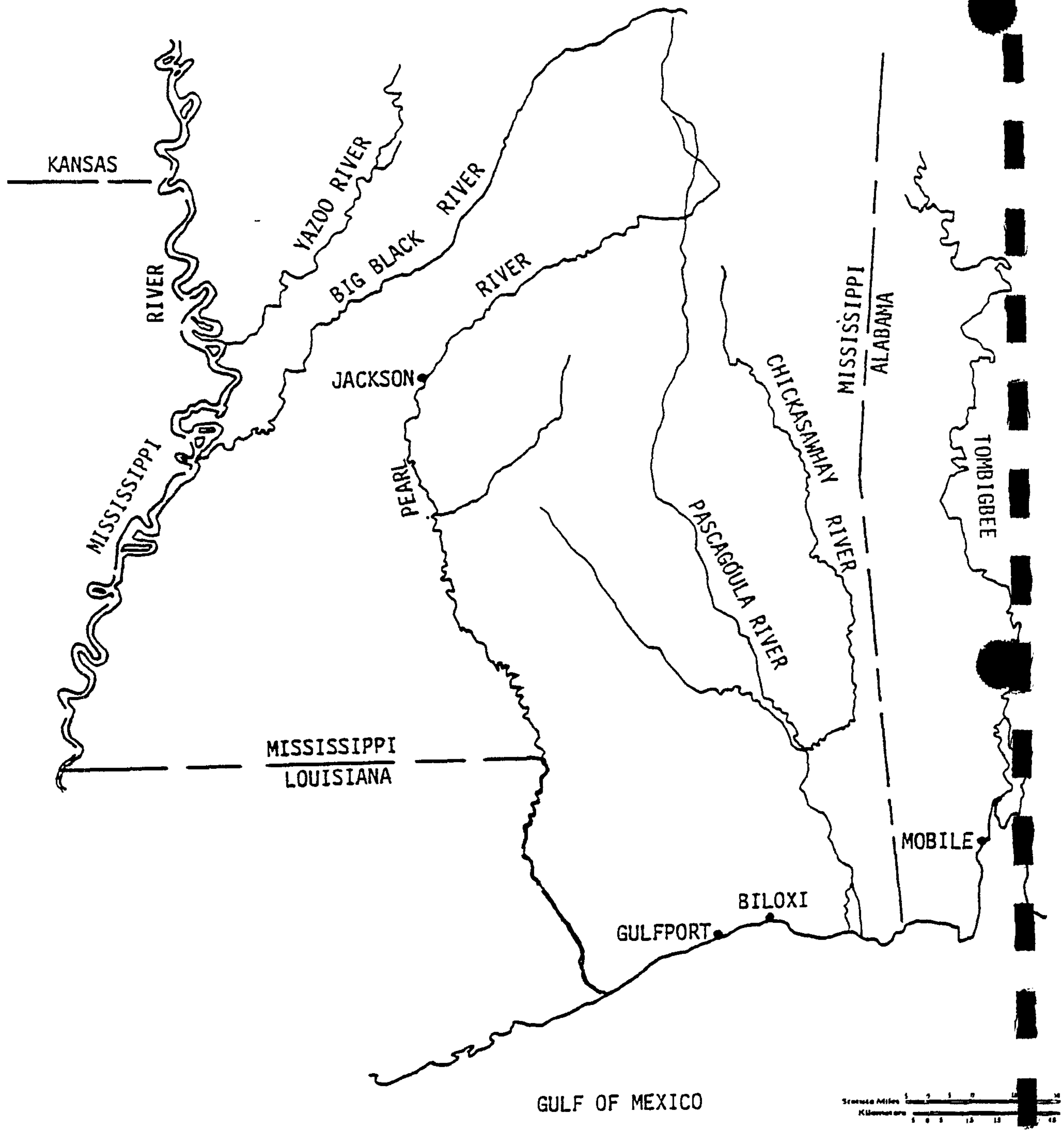

Figure IV-2 Surface Drainage Pattern in the Mississippi Salt Dome Field Area

Table IV-2. Flow Data for Mississippi Streams

			Volumetric Flow (CFS)		
Stream	Station Location	Drainage Area (mi^2)	Mean	Maximum	Minimum
Mississippi River	Vicksburg, Miss.	1,140,500	573,600	2,080,000	99,400
Yazoo River	Greenwood, Miss.	7,450	10,247	72,900	536
Pascagoula River	Merrill, Miss.	6,600	9,667	178,000	696
Pearl, River	near Columbia, Miss.	5,690	7,384	72,600	705
Tombigbee	Columbia, Miss.	4,490	6,451	194,000	138
Chickasawhay River	Leaksville, Miss.	2 680	3,769	73,600	160

(US-145)

one of three principal sources, the Pearl River, the Pascagoula River or the Tombigbee River.

Water quality data for the Mississippi River, from the discussion under the northern Louisiana area, are applicable to eastern Mississippi as well. The other streams mentioned above and in Table IV-2 are turbid but less so than rivers in Louisiana. Although the occurrence of chemical pollution is not a particularly serious problem in these Mississippi streams, runoff agricultural pollutants such as nutrients and bacteria is a problem similar to that in Louisiana. This type of pollution is likely to continue.

b. Ground Water Hydrology

The fresh water-salt water interface in northern Louisiana normally lies 300 to 600 feet beneath the surface. In the vicinity of salt domes, however, the interface may actually reach the surface, as shown in Figure IV-3. Throughout much of the region the interface lies in the Sparta sands. To the extreme northwest it passes through the Wilcox formation while to the northeast it rises up into the Cockfield sand.

In northern Louisiana in 1970 approximately 40 million gallons of fresh ground water was pumped per day (DI - 097). By comparison 356 million gallons of fresh water was pumped from surface water sources. Thus the ground water system represents the secondary source of fresh water in the region of interest.

The subsurface strata on the western end of the Mississippi Salt Dome Field is generally similar to that in northern

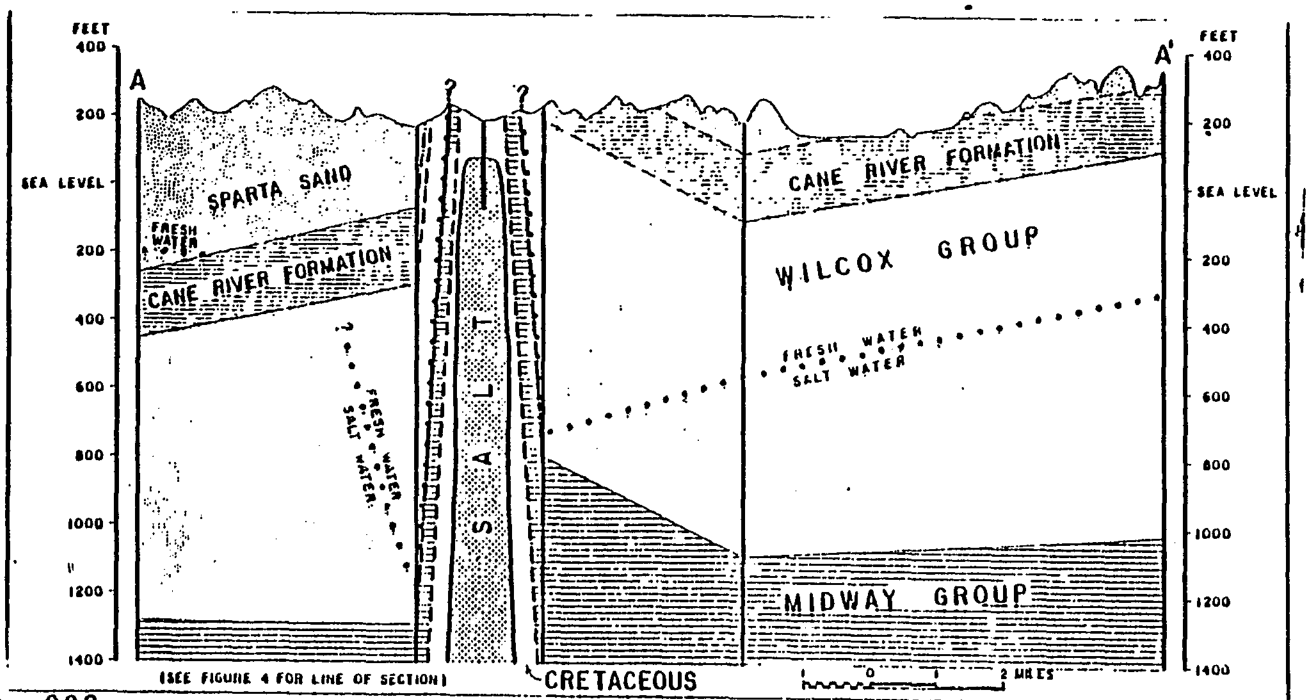

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Figure IV-3

Geologic Section of Rayburns Salt Dome
Bienville Parish

Louisiana. As one moves towards the eastern end of the field (southeast towards the Mississippi-Alabama coast) the subsurface strata changes, becoming more similar to that in coastal Louisiana than that in northern Louisiana.

The principle aquifers in this region which serve as sources of potable-quality ground water include:

- Sands of Vicksburg Group of Oligocene age
- Sands of Catahoula Sandstone of Miocene age
- Sands of Clairborne Group of Middle Eocene age
- Mississippi River Valey Alluvium of Pleistocene and Holocene age
- Meridian Sand of Tallahatta Formation, Clairborne Group of Middle Eocene age.

The extent of aquifer sands suitable for underground brine injection increases as one traverses the Mississippi salt-dome field from northwest to southeast. In general the situation at the western end of the field is very similar to that of northern Louisiana while the eastern end of the field is more like the coastal Louisiana case.

3. Meteorology, Climatology, and Air Quality

Severe local storms, including tornadoes, have a fairly high frequency of occurrence in the Gulf Coast region. In most cases, tornadoes moving through the region are small and short lived. Storms producing large hailstones (larger than two inches in diameter) are also quite rare in the area. Severe local storms, including those which produce tornadoes, are most common in May, June, August and September

The baseline (1973) air quality levels of the Gulf Coast storage region described in the FES 76-2 are still valid for this supplement. As noted, all three air quality control regions (AQCR's), e.g., Corpus Christi-Victoria, Metropolitan Houston-Galveston, and Southern Louisiana-Southeast Texas, had at least one monitoring site reporting violation of the primary standards for suspended particulates and ozone in 1973.

The recently available air quality report indicates that the photochemical oxidant and particulate problems still existed in the Gulf Coast region in 1974. The National ambient photochemical oxidant and particulates standards were exceeded on several occasions in each of the three AQCR's. In addition, the Southern Louisiana-Southeast Texas and Metropolitan Houston-Galveston regions had 8-hr. carbon monoxide concentrations exceeding the Federal standards. The 1974 air quality levels will provide a basis against which the potential impacts of the expanded SPR will be measured.

4. <u>Noise</u>

Noise consideration were summarized in FES 76-2.

5. <u>Biology</u>

The biological data contained in FES 76-2 remains valid. One additional species the Bayou Darter, <u>Etheostoma rubrum</u>, should be considered as an endangered species in Mississippi.

The more inland parts of the study area, in east Texas, northeast central Louisiana, and south central Mississippi, are largely mixtures of managed forest areas and croplands. Prevalent types of trees in the forests include longleaf, slash, loblolly, and shortleaf pine, oaks, gum, and cypress. The extensive bottomlands in Louisiana and Mississippi are planted in crops to a high degree. Cotton and soybeans are especially important. Beef cattle are widely raised outside the bottomland areas. Except where habitat has been severely reduced or eliminated due to agricultural development or other causes, typical woodland animals are present. They include representative mammals such as the Virginia opossum, the American beaver, the common muskrat, the nutria, the coyote, the red fox, the gray fox, the northern raccoon, the North American mink, the striped skunk, the white-tailed deer, the nearctic river otter, squirrels, and the bobcat. Birds, reptiles, amphibians, fish, and invertebrates in the region include large numbers of species along with the mammals. The number of individuals within species generally are largely due to the especially favorable conditions of habitat and climate. Game birds and mammals are abundant.

6. Land Use Patterns

The states of the Gulf Storage Region experienced approximately a 13.6 percent increase in population between 1960 and 1970, as compared to about 13.3 percent for the nation. Most of this growth has been consolidated in the existing urban areas. Approximately 40 percent of the people living in the states of Texas, Louisiana and Mississippi lived in the Gulf Storage Region in 1970, with a total population of about 6.8 million.

In 1970 approximately 70.5 percent of the Gulf Storage Region population lived in urban areas. However, the urban-rural characteristics of each area within the region varies to a marked degree. Only 45 percent of the population in the Mississippi region lived in urban areas, while almost 82 percent of the Texas population in the region lived in an urban environment. There were approximately 131 persons per square mile in the affected areas of Texas compared to 45 per square mile in Louisiana.

State land use planning for Louisiana and Texas is described in FES 76-2. Since the volume of oil is to be increased, potential sites in Mississippi will be under consideration, and land use planning in this State must also be examined.

a. <u>Mississippi: State Land Use Planning</u>

Advisory agencies function in land use planning in Mississippi at both the Statewide and district level. The State is partitioned into 10 area planning and development districts which provide planning recommendations to city and county governments. A research and development arm of the Mississippi Education and Development Center in Jackson generally deals with questions of broader scope Direct regulatory powers over land use are mainly exercised through city and county zoning ordinances.

Other agencies indirectly regulate or influence land use in the parts of Mississippi in the Gulf Coast Storage Region. These include the Mississippi Air and Water Pollution Control Commission, the Mississippi Game and Fish Commission, and the Division of Solid Waste Management and Vector Control of the Mississippi Board of Health's Bureau of Environmental Health. The Air and Water Pollution Control Commission will influence land use planning because of large-scale air and water quality management programs to be implemented under provisions of the Clean Air Act and Federal Water Pollution Control Act, respectively. The Air and Water Pollution Control Commission undertakes to control water pollution by both technical and management practices; including research for the development of farming practices which preserve water quality, and the issuance and enforcement of discharge permits.

7. Population and Economic Factors

The Gulf storage region encompasses most of the Gulf Coast areas of Texas and Louisiana, northern Louisiana, and southern Mississippi. In Texas, this region includes the counties from Corpus Christi, around the coast to Houston, to the Beaumont-Port Arthur area. In Louisiana, the coastal parishes as well as those of Lake Charles, Baton Rouge, New Orleans, Lafayette, and Monroe are included. The Jackson SMSA is the primary population center affected in Mississippi. These regions in both Texas and Louisiana contain large population centers and a large percentage of the population of both states. The Gulf Coast region is rich in minerals and is a highly productive agricultural area.

The 1975 population of the Gulf storage region was approximately 6.9 million people. Three million persons lived in the Texas portion of the region, three million in Louisiana, and 900,000 in Mississippi. These totals represented approximately 25% of Texas' population; 80% of the population of Louisana, and 40% of the population of Mississippi, respectively. Included in the region are the population centers in Texas of Corpus Christi, Houston, and Beaumont; in Louisana those of Lake Charles, Baton Rouge, New Orleans, Lafayette and Monroe; and in Mississippi the Jackson area. These centers and the immediate areas surrounding them are heavily populated, while the other areas of the region are relatively sparsely populated.

Population projections for the United States and various regions have been made based on various assumptions regarding cohorts. Four of these projections, titled Series C, Series D, Series E, and Series F, are presented in Table IV-3, and all show a continued increase in population to the year 2000. The predicted increase for 1970 to 1980 ranges from 8.3% to 12.7%, resulting in a difference of over eighteen million people.

On a regional basis, the population of the states in the Gulf storage region is projected to increase 0.64% per year for Series E from 1970 to 1980. These values are lower than the 0.97% per year increase projected for the overall U.S.

TABLE IV-3
PROJECTED PERCENT INCREASE IN TOTAL
POPULATION OF UNITED STATES

	Series C	Series D	Series E	Series F
1970-1980	12.7	11.6	9.4	8.3
1970-1985	21.4	19.1	15.0	12.7
1975(est)-1980	7.0	6.2	4.8	4.0
1975(est)-1985	15.2	13.0	9.2	7.0

Source: US-178 (Supercedes Figure IV-2 in FES 76-2) (US-178)

The Office of Business and Economic Research Service (OBERS) projections for the Gulf storage region population show a percentage increase of 9.2% for 1970 to 1980, which is slightly less than the national average. This area is projected to grow at a faster rate than the U.S. in the years from 1980 to 1985. Table IV-4 summarizes the percentages and projected rates of growth of the U.S. and the Gulf storage region.

TABLE IV-4
PROJECTED POPULATION PERCENTAGE INCREASE
(PERCENT INCREASE PER YEAR)

	United States	Salt Dome Storage Region States
1970-1980	9.6 (0.93)	9.2 (0.88)
1970-1985	15.0 (0.94)	15.2 (0.95)
1980-1985	4.9 (0.96)	4.4 (1.07)

A regional study conducted by the Houston-Galveston Area Council produced projections for population and employment in the Texas portion of the Gulf storage region. These projections show a large increases in population in the area, in contrast to the Census Bureau projections as well as the OBERS projections. The Houston-Galveston Area Council has predicted population increases of 3.54% per year from 1970 to 1980 or a total increase of 47%. An increase of 72% from 1970 to 1985 has been projected with the growth rate per year for 1980 to 1985 escalating to 3.96%.

The Midwest Research Institute recently published its Quality of Life Indicators in the U.S. Metropolitan areas, 1970. This study was an effort to assess the quality of life in Standard Metropolitan Statistical Areas according to the following components: (1) economic concerns, (2) political concerns, (3) environmental concerns, (4) health and education, and (5) social concerns. One hundred and twenty variables were selected and described in connection with the five components. All SMSA's were ranked on bases of data collected. None of the cities in the Gulf storage region received a particularly high rating in the quality of life items. Only Houston (ranked twenty-seventh out of sixty-five cities) was in the top half of the rankings. New Orleans, Jackson, Lafayette, Monroe, and Lake Charles were rated very low. Table IV-5 lists "Quality of Life" rankings for SMSA's in the Gulf storage region.

TABLE IV-5
QUALITY-OF-LIFE RANKINGS FOR
SMSA'S IN SALT DOME REGION

Large SMSA's (Total number=65)	Medium SMSA's (Total number=83)	Small SMSA's (Total number=95)
Houston 27	Baton Rouge 44	Galveston - Texas City 52
New Orleans 63	Corpus Christi 55	Lafayette, La. 79
	Beaumont 57	Monroe, La. 80
	Jackson, Miss. 71	Lake Charles 83

Source: MI-203 (Supercedes Table IV-4 in FES 76-2)

The highly industrialized and labor-intensive manufacturing industries in the Gulf storage region generate many jobs in the area. In 1970, the civilian labor force totaled approximately 2.5 million workers, with about 93.6% being employed. In all three states - Texas, Louisiana, and Mississippi - the number of people employed expressed as a percentage of total state employment exceeded the percentage of population attributable to the portion of the State within the Gulf storage region. In Texas, the storage region portion included approximately 24% of the state population and slightly over 25% of the employment. Similar figures for Louisiana and Mississippi are, 82% of the population with 83% of the employment; and 40% of the population with 41% of the employment, respectively.

In 1970 the manufacturing sector of industry generated 19.2% of the total earnings in the Gulf storage region. Wholesale and retail trade accounted for 17.7% of the earnings, followed by governmental employment with 16.1% and services with 14.6%. Mining and agriculture were small contributors to total earnings accounting for 4.7% and 2.5%, respectively. Percentages for other sectors of the economy are given in Table IV-6.

TABLE IV-6
PERCENT OF TOTAL EARNINGS BY INDUSTRY 1971

	United States	Gulf Storage Region
Manufacturing	26.8	21.1
Wholesale and retail trade	16.7	18.4
Government	18.0	15.1
Services	15.3	14.8
Transportation, communication and public utilities	7.2	8.9
Contract construction	6.3	8.7
Mining	1.0	5.5
Finance, insurance and real estate	5.4	5.0
Agriculture	3.4	2.6

B. East Coast Storage Region

The material presented in FES 76-2, contained in pages IV-88 through IV-147 remains valid. The proposed increase from 500 MMB to 1,000 MMB requires minor additional consideration or modification as follows.

In the FES 76-2, air quality of the East Coast Region was described on the basis of twenty (20) geographical air quality control regions (AQCR's) defined by the U.S. Environmental Protection Agency. The baseline (1973) air quality levels and the reported violations of the National ambient air quality standards in those twenty AQCR's were discussed in that FES.

The recently available 1974 air quality report indicates that there were also air quality problems in this region in 1974. Seventeen of the twenty AQCR's in the East Coast region reported at least one violation of the primary particulates standard; seven had a violation of the primary sulfur dioxide standard, and nearly all AQCR's monitoring carbon monoxide (CO) and photochemical oxidant concentrations reported frequent violations of 8-hr CO standards and 1-hr photochemical oxidant standard. However, there was no violation of the nitrogen dioxide standard in 1974 as opposed to one violation reported in 1973. The proposed SPR source will contribute significant levels of hydrocarbon to the baseline air quality of the region. (See Table V-1 for major hydrocarbon emissions sources.) The principal source of these emissions involves the terminal crude oil transferring activities, and will likely result in excesses of the three-hour NMHC standard. The recent ambient monitoring data indicates that a relationship exists between the NMHC concentration and the ambient photochemical oxidant level for a given region. Thus, it is also anticipated that the increased levels of hydrocarbon on a short-term basis will have an impact on ambient levels of photochemical oxident.

The above-mentioned 1974 air quality levels and the 1973 air quality levels described in the FES 76-2 form the baseline condition against which the potential impacts associated with the expanded SPR will be assessed.

V. ENVIRONMENTAL IMPACTS

Increasing the Strategic Petroleum Reserve from 500 MMB to 1,000 MMB alters the extent of probable environmental, social and economic impacts originally associated with the development of the SPR Program. The background material presented in FES 76-2 remains applicable, but it must be reassessed in terms of the proposed programmatic change to double the SPR capacity.

For this reexamination, "worst case" prototype facilities, retaining the same capacities used in FES 76-2, were used for comparisons. In general, the increase from 500 to 1,000 MMB does not mean an increase in the amount of petroleum to be stored at any specific site, but rather indicates the addition of more geographical sites. However, the increased number of sites will result in major increases in: the movement of petroleum from the marine terminals inland; the throughput of the marine terminals; the handling processes; and in the tanker traffic transporting the imported oil to U.S. terminals.

The increased volume of petroleum being moved from ocean going tankers to storage sites increases the risks and normal impacts associated with this activity. Emphasis in this chapter will reflect those increased risks and impacts.

The prototype facilities noted in FES 76-2, and used herein for comparative analytical purposes, are a 90 MMB existing salt cavern facility, a 90 MMB existing salt mine and a 200 MMB new salt cavern facility for the Gulf Coast Region. For the East Coast region, the prototypes are an existing 15 MMB rock mine, a new 30 MMB rock mine and 10 MMB in conventional tankage.

A. Gulf Coast Storage Region

1. Coastal Subregion

a. Geology

Important generic geological concerns are: halokinesis, subsidence, seismic stability and engineering suitability. These were discussed in detail in FES 76-2.

b. Hydrology and Water Quality

A serious problem which may become critical for new storage sites selected further away from the Gulf of Mexico is that of brine disposal. In constructing and operating any solution-mined cavity in salt, very large amounts of brine will be generated for disposal. The construction phase is by far the most sensitive, because the quantity of brine generated by solution mining exceeds by approximately a factor of seven, that produced by the displacement of brine by petroleum during cavern fill operations.

Disposal has been addressed in terms of three alternatives: usage by local industry, deep-well injection, and disposal to the Gulf of Mexico. The most favorable use would be consumption by local industry, and this will be adopted where feasible. The increase in brine production for the development of new sites will exceed the amounts which local industry can accept; and in some regions there may not be a local market for the brine. For such situations, only deep-well injection or disposal in the Gulf of Mexico is the feasible alternative. Determination of a particular method will be based on the location of the site with respect to the Gulf of Mexico; the proximity of saline aquifers; and the relative costs of the alternatives.

Subsurface injection is currently used to dispose of saltwater from oil and gas fields, and for the disposal of other commercial liquid waste products. The technology is well understood, and the absolute capacity of the aquifers underlying even a small geographic area is immense. The main risk is in exceeding the hydrofracturing pressures of adjacent rock strata, but at the depths under consideration this would not present a limitation to the disposal of the amounts of brine that would be generated by the creation of the SPR cavities. Site-specific analyses will include a precise determination of capacities and tolerances such that the number and location of deep-injection facilities required at a particular site can be determined.

A discussion of the analyses performed to determine the impacts of brine disposal in the Gulf of Mexico was included in FES 76-2. This work has recently been supplemented with modeling efforts performed by NOAA for DOE. The results of these additional analyses support the results reported in FES 76-2.

The primary impacts on surface water from terminal construction and operation are in two general areas: effects of dredging and effects of oil spills. These were discussed in FES 76-2.

The large quantities of surface water required for the construction and operation of storage caverns in salt domes is a significant concern. The development of additional solution-mined storage volume, and consequent increased demands on surface water resources, may restrict the choice of storage sites. At this time there are few undedicated fresh surface water supplies in the Gulf Coast region, except for the Mississippi River. Other major rivers such as the Brazos and Sabine Rivers, may be adequate sources.

Additionally, ground water resources can supplement surface water supply. Potential impacts associated with the use of ground water include subsidence in the vicinity of the well and impacts on adjacent producing wells.

c. Meteorology, Climatology, and Air Quality

The creation of the SPR, whether it is 500 MMB or 1,000 MMB, will have no adverse effect on the meteorological or climatological characteristics of the Gulf Coast region. However, weather effects on the surface elements of the SPR could be substantial under exceptional conditions. These effects were discussed in FES 76-2. The air quality impact resulting from various SPR sources will be governed by the national, state, and local ambient air quality standards. The 1970 National Ambient Air Quality Standards (NAAQS) established primary and secondary standards for six pollutants, including particulate matter, sulfur dioxide, carbon monoxide, photochemical oxidants, non-methane, hydrocarbon, and nitrogen dioxide. The primary standards have been set to protect the public health, while the secondary standards were established to protect the public welfare from any known or anticipated adverse effects of a pollutant. The newly enacted 1977 Clean Air Act Amendments have also included provisions to establish additional national primary standards for nitrogen dioxide. (See Table V-1 for the existing National Ambient Air Quality Standards.)

In 1974,USEPA also developed standards for the prevention of significant deterioration (PSD). These standards regulate SO_2, and total suspended particulates in a manner dependent upon existing levels of ambient air quality. The area classifications are as follows:

Table V-1 National Ambient Air Quality Standards (a)

Pollutant	Averaging Time	Primary Standards	Secondary Standards
Particulate Matter (b)	Annual (Geometric mean)	75 $\mu g/m^3$	60 $\mu g/m^3$
	24-hour	260 $\mu g/m^3$	150 $\mu g/m^3$
Sulfur Dioxide	Annual (Arithmetic mean)	80 $\mu g/m^3$ (0.03ppm)	
	24-hour	365 $\mu g/m^3$ (0.14 ppm)	
	3-hour	---	1300 $\mu g/m^3$ (0.5 ppm)
Carbon Monoxide	8-hour	10 $\mu g/m^3$ (9 ppm)	Same as Primary
	1-hour	40 $\mu g/m^3$ (35 ppm)	
Photochemical Oxidants (c)	1-hour	160 $\mu g/m^3$ (0.08 ppm)	Same as Primary
Hydrocarbons (d) (nonmethane)	3-hour	160 $\mu g/m^3$ (0.24 ppm)	Same as Primary
Nitrogen Dioxide	Annual (Arithmetic mean)	100 $\mu g/m^3$ (0.05 ppm)	Same as Primary

(a) All standards (other than annual standards) are specified as not to be exceeded more than once per year. The measurement methods are also specified as Federal Reference Methods. The air quality standards and a description of the reference methods were published on April 30, 1971 in 42 CFR 210, recodified to 40 CFR 50 on November 25, 1972.

(b) The secondary annual standard (60 $\mu g/m^3$) is a guide to be used in assessing implementation plans to achieve the 24-hour secondary standard.

(c) Expressed as ozone by the Federal Reference Method.

(d) This NAAQS is for use as a guide in devising implementation plans to achieve oxidant standards.

Class I:	Any change in air quality would be considered significant.
Class II:	Deterioration normally accompanying moderate well-controled growth would be considered insignificant.
Class III:	Deterioration up to the National Standards would be considered insignificant.

In August 1977, the Clear Air Act Amendments made provisions in the significant deterioration standards. The changes that have significant impacts to the SPR development are: a) that PSD regulations no longer apply only to particulate and sulfur dioxide emissions, but to all criteria pollutants, [i.e., Sulfur Dioxide (SO_2), Total Suspended Particulate (TSP), Non-Methane Hydrocarbon (NMHC), Nitrous Oxides (NO_x), Carbon Monoxide (CO), and Photochemical Oxidants (O_3), and b) that PSD designated source categories have been expanded from 19 to 28 sources, one of which is petroleum storage and transfer facilities. The effect of these changes will definitely require SPR sources to apply available control technology to ensure the proper emission reduction measures. As the result, the SPR development would employ double seal floating roofs on all storage tanks, in compliance with above regulation. In addition, the application of hydrocarbon vapor emission collection and control systems to terminal operation will be studied. However, the extent of installing this vapor emission control system is difficult to determine, since this technology is relatively new to the industry and also presents a unique set of safety and design problems.

(1) Onshore Strategic Petroleum Reserve

As the majority of the expanded SPR will be stored in salt domes, this supplement assesses the air quality impact of salt dome storage in the Gulf region for both the construction and the operational phases. The assessment is based on the cumulative impacts, and assuming worst case scenarios in critical areas. During the construction/drilling phase for onshore salt domes, fugitive dust emissions will occur from the activity around the site and along the pipeline right-of-way. Construction dust emissions cannot be quantified at the programmatic level. In general, construction dust emissions are influenced by a number of factors including soil characteristics, climate, amount of construction activity, and dust suppression measures. An expanded SPR would increase the fugitive dust emissions, since more construction activities will be required. However, most of the dust impacts will be localized and short-term, and can be minimized if adequate dust control measures are employed.

An expanded SPR would also increase combustion product emissions from construction vehicles and equipment. This includes primarily particulates, sulfur oxides, carbon monoxide, hydrocarbons, and nitrogen oxides. In addition, particulate and hydrocarbon emissions will result from the sandblasting and painting of surge and storage tanks. Approximately 1 percent of the applied abrasive material used in sandblasting will be emitted as fugitive dust. Tank painting will generate approximately 1,120 pounds of hydrocarbon emissions per ton of paint applied (EN-071). The air quality impact of these construction-related activities is anticipated to be short-term and minor.

Substantial amounts of evaporative hydrocarbon emissions will result from transport and transfer operations of the expanded SPR. Emissions will occur during marine tanker ballasting and loading. These emissions depend upon throughputs, vapor control/disposal systems used and other factors.

An expansion of the SPR from 500 MMB to 1,000 MMB would essentially double hydrocarbon emissions from these operations.

During tanker loading and unloading, ship and tug engines will generate small amounts of combustion pollutants at terminals. Hydrocarbon vapor loss to the atmosphere is also anticipated to occur from pump seals, connecting joints and valves in the oil pipeline, surge and storage tanks and ballast water separation tanks.

The amount of hydrocarbon vapor released from these sources is affected by a number of factors and can only be determined at the site-specific level. The expansion of the SPR would increase emissions from the above-mentioned sources with the highest increase in hydrocarbon emissions occurring in the Capline area. Texoma and Seaway areas would have less of an increase in hydrocarbon emissions.

In order to quantify the potential impact of the expanded SPR, two typical salt dome facilities (one with a 200 MMB capacity; another with a 60 MMB capacity) were selected for emissions analysis. These represent the largest proposed facility and a typical small-size storage facility in the Gulf Coast storage region, respectively. Estimated emissions have been computed and are presented in Table V-2. For comparative purposes this table also presents published estimates of 1973 hydrocarbon emissions from all sources in each of the three Air Quality Control Regions (ACQR). Considering the Gulf Coast region as a whole, estimated worst-case emissions for a single 200 MMB salt dome facility would be less than 0.3 percent of total emissions in 1973. If both SPR facilities are in the AQCR with the lowest ambient level of hydrocarbon emissions, the maximum additional emissions would not exceed 2.4 percent of total 1973 hydrocarbon emissions in that AQCR. During vessel loading of stored oil (withdrawal),

TABLE V-2

COMPARISON OF MAJOR FUGITIVE HYDROCARBON EMISSIONS FROM TWO EXAMPLE SALT DOME FACILITIES TO AQCR EMISSIONS FROM ALL SOURCES

Major Emission Source[1]	Example Facilities: 60 MMB Facility	Example Facilities: 200 MMB Facility
Tanker Loading	693 tons/year	2,310 tons/year
Tanker Ballasting	529 tons/year	1,763 tons/year
Surge Storage Tanks	59 tons/year[2]	65 tons/year[3]
Pump Seals, Pipeline Valves	19 tons/year	38 tons/year
TOTAL	1,300 tons/year	4,176 tons/year

AQCR	NAME	1973 ANNUAL HYDROCARBON EMISSIONS* (4)
106	S. Louisiana, SE Texas	941,473 tons
214	Corpus Christi	225,389 tons
216	Houston-Galveston	608,376 tons
	GULF COAST REGION TOTAL	1,775,238 tons

1 Based on a hypothetical conservative annual cycle, consisting of tanker unloading and filling of the facilities over a 6-month period and loading the stored oil in tankers over a 5-month period.

2 Based on three 200,000 bbl tanks and one 1,000 bbl tank.

3 Based on two 400,000 bbl tanks and one 5,000 bbl tank.

4 Based on an incomplete inventory of hydrocarbon sources.

any emissions that would occur would be in lieu of and traded off by those emissions which would normally occur as a result of crude oil handling in the area.

The air quality impact of an expanded SPR must be determined at the site-specific level. This is because ambient air quality is affected not only by emission strength, but also by geographical distribution of emissions, topographic condition, meteorological factors and chemical characteristics of the pollutants. The impact of an expanded SPR at specific sites and under typical meteorological conditions would be less than this worst case.

As indicated in Table V-2, the highest HC emissions would result from tanker loading operations. For the proposed expanded SPR, a peak loading rate of 40,000 barrels per hour was assumed. (The loading rate of 10,000 barrels per hour was used in FES 76-2.) This yields a maximum emission rate of 924 lbs/hr. The U.S. EPA's air quality model PTMAX was used to estimate the maximum downwind concentrations and the associated meteorological conditions. Another EPA model, PTDIS, was used to calculate the downwind concentrations at various distances under worst-case dispersion conditions. With these parameters, the areas within 16 kilometers downwind from the tanker will have 3-hour hydrocarbon concentrations exceeding the 160 g/m^3 standard. This violation of the Federal standard, under the assumed conditions, would occur only during a tanker loading period.

It has been assumed that the emissions from tanker operations are 100 percent reactive hydrocarbons. Additionally, the models used do not consider any chemical reactions occurring during transport of the hydrocarbons. As a result, the models PTMAX and PTDIS could seriously overestimate the hydrocarbon concentrations. It should also be noted that the worst meteorlogical conditions (meteorological stability D and wind speed at 1 meter per second) assumed in the analysis would occur only during a very small portion of the time. Under typical meteorological conditions, the extent of the temporary violation of the hydrocarbon standard would be less. The air quality impact of other emission sources such as tanker ballasting, pump seal and pipeline valve leaks, etc. would be much less than that of tanker loading.

(2) Offshore Strategic Petroleum Reserve

One possible scenario of the expanded SPR program includes 200 MMB offshore storage. For offshore salt domes, the onsite production of power will contribute combustion product emissions from the diesel generators used. The hydrocarbon vapor loss from salt dome storage will be minimal. However, major hydrocarbon emissions will result from tanker loading and unloading operations. It is estimated that the total emissions from loading and unloading of 200 MMB will be 2,310 and 1,764 tons, respectively.

The air quality impact of offshore storage will be relatively insignificant as compared to that of coastal storage, because the emission sources are far from populated areas, and there are better dispersions of pollutants offshore. Under the worst-case dispersion condition (meteorological stability D and wind speed at 1 meter per second), the areas within 14 kilometers downwind from the site will have 3-hour HC concentrations exceeding the Federal HC standards, during the tanker loading periods. The extent of this temporary air quality violation would be less during the period of tanker unloading. During more normal dispersion conditions, the ground-level HC concentrations resulting from tanker loading and unloading operations would be much less than those during "worst case" conditions.

It is anticipated that Seaway, St. James and Sun Terminal will be the three major terminals to be used for the expanded SPR in the Gulf Coast region. The potential air quality impact of the expanded SPR at these terminal areas is discussed below.

As noted previously, construction of new DOE docks and surge tanks at the terminal will have short-term and localized fugitive dust impact. During the operation phase of the expanded SPR program, minor pollutant emissions from surge tanks, pumps, and tug and ship engines will occur. The major air quality impact will be created by the hydrocarbon emissions from tanker loading and unloading operations. In order to analyze the "worst case" impact; the maximum crude oil transfer rates for each of the three terminals were extracted from the Capline, Seaway, and Texoma draft EIS's (See Table V-3). Based on these maximum oil transfer rates, the "worst case" emissions were estimated using updated emission factors. The updated emission factors for oil transfer operations are less than those used in some of the earlier DOE EIS's. This is because the emission factors previously used were based on the data obtained from gasoline transfer, while the revised emission factors have been based on the more recent testing data on crude oil transfer. Hydrocarbon emissions will also result from VLCC-tanker transfer operations. However, as these emissions will occur off-shore, their air quality impact will not be as significant as those occurring at the docks.

The 3-hour hydrocarbon concentrations from the tanker transfer operations were estimated using the U.S. EPA's air quality simulation models PTDIS and PTMAX. Under the "worst case" dispersion conditions ("D" stability and wind speed at 1 meter per second), the tanker transfer operations will generate downwind hydrocarbon concentrations higher

TABLE V-3

THROUGHPUTS AND SCENARIOS FOR THE CRUDE OIL TRANSPORT AND TRANSFER OPERATIONS AT TERMINAL AREAS*

Terminal	Seaway	St. James	Sun
Throughputs (daily)			
Filling Phase	175,000 BPD	490,000 BPD	175,000 BPD
Withdrawal Phase	1,100,000 BPD	2,000,000 BPD	1,100,000 BPD
Maximum Hourly Transfer Rates Filling Operation			
o VLCC to Tanker	100,000 BPH	100,000 BPH	100,000 BPH**
o Tanker to Pipeline	30,000 BPH	(55,200 BPH)	30,000 BPH**
Withdrawal Operation			
o Pipeline to Tanker	30,000 BPH	(55,200 BPH)	30,000 BPH

* Derived from the Seaway, Capline, and Texoma draft EIS's, the Bayou Choctaw, Bryan Mound, West Hackberry, and Weeks Island FES's, and their supplements.

** Assumed rate

( ) Alternative Dist. System

BPD = Barrels per Day

BPH = Barrels per Hour

than the Federal standard of 160 $\mu g/m^3$. Table V-4 presents the distance downstream of each source for which a violation of the hydrocarbon standard for each of the three terminals would occur. The downwind hydrocarbon concentration during typical meteorological conditions will be less than that shown in Table V-4. These hydrocarbon impacts can be alleviated by reducing oil transfer rates, particularly during air stagnation periods.

If salt mines are used, construction activities will generate fugitive dust. Hydrocarbon emissions from the mines will either be flared and the vent subsequently sealed, or run through a condensing system and returned to the mine. Thus, no appreciable air quality impact is anticipated. Evaporative hydrocarbon emissions from tanker unloading and loading would be similar to those presented in Table V-2.

The possibility of a catastrophic accident, such as a wellhead shear or an accidental break in an aboveground pipeline, would result in air emissions. If during static operation an entire wellhead were sheared off, a significant quantity of oil would escape. Some hydrocarbons from the spill would evaporate to the air. The air quality impact of this occurrence would be short term and minor.

As discussed in Chapter 1, various time frames for the proposed expanded SPR program are under consideration. These changes would not appreciably affect the "worst case" impact of the expanded SPR discussed above. However, the air quality impact under typical meteorological conditions will change with a variation in time frame. For instance, the average annual emissions would be increased slightly if the entire 1,000 MMB SPR is to be completed by 1983 instead of 1985.

TABLE V-4
ESTIMATED EMISSIONS AND AIR QUALITY
IMPACTS AT TERMINAL AREAS

Major Hydrocarbon Emission Source at Terminal Areas	HC Emissions[1] gm/sec			Maximum Downwind Distance (Km) In Which 3-Hour HC Concentration Standard Would Be Exceeded		
	Seaway	St. James	Sun	Seaway	St. James	Sun
Filling Tanker to Pipeline[2]	133 (1054)	234 (1856)	133 (1054)	15	22	15
Withdrawal Pipeline to Tanker[3]	174 (1380)	307 (2434)	174 (1380)	19	27	19

[1]Numbers in ( ) are emission levels given in lbs/hr.

[2]Emissions from tanker ballasting operations.

[3]Emissions from tanker loading operations.

d. Noise

For evaluation of the impact of environmental noise, FES 76-2 used criteria documented by the Environmental Protection Agency in "Information on Levels of Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety." The effects of noise were evaluated in terms of the definition accepted by the World Health Organization: "a total physical, physiological, and psychological well-being of the individual."

To quantitatively measure the impact of noise, EPA recommends the use of a measure, L_{dn}, the long-term equivalent A-weighted sound level (a single value measure that approximates sound as processed by the human ear) with an adjustment to account for difference in response during daytime and nighttime periods. Mathematically, L_{dn} is expressed as

$$L_{dn} = 10 \log \frac{1}{24} \left[15 \left(10^{(L_d/10)} \right) + 9 \left(10^{(L_n + 10/10)} \right) \right] \text{dB}$$

where
L_d = L_{eq} for daytime (0700 to 2200 hours) dBA
L_n = L_{eq} for nighttime (2200 to 0700 hours) dBA
and
L_{eq} = Equivalent A-weighted sound level over a given time interval

This equation essentially states that a 10 dB penalty is applied for nighttime operations. For the purposes of this program, it can be assumed that L_{eq} is the measured or predicted sound level approximated by a normal distribution having a standard deviation equal to zero, and that these sound levels are those that are exceeded 50% of the time. As such, measured or predicted levels can be considered equal to L_{eq}.

Table V-5 summarizes noise level limits in terms of L_{dn} and L_{eq} considered essential to protect public welfare and safety. Note that L_{dn} = 55 dB and L_{eq} = 55 dB are values that are representative of outdoor areas that will likely be impacted by development of storage facilities. This table serves as the basis for general assessment of environmental noise as required by this program. Further refinement of these guidelines can be achieved by considering the factors discussed below.

The ability to communicate effectively depends upon the presence and level of ambient or "masking" noise. The values of Table V-6 illustrate the person-to-person separation that will permit 95% speech intelligibility in the presence of different A-weight sound levels (dBA) and vocal efforts. The data are representative of male voices with individuals face-to-face outdoors.

The change in ambient sound level is an important factor in assessing the impact from added noise sources. It is possible to just detect a 2-3 dBA change while a 5 dBA is readily apparent.

The effects of noise upon wildlife and domestic animals are not well understood. Studies of animals subjected to varying noise exposures in laboratories have demonstrated physiological and behavioral changes, and it may be assumed that these reactions are applicable to wildlife. However,

TABLE V-5
SOUND LEVELS REQUIRED TO PROTECT PUBLIC HEALTH AND WELFARE

EFFECT	LEVEL	AREA
Hearing loss	$L_{eq(24)} < 70dB$	All Areas
Outdoor activity interference and annoyance	$L_{dn} < 55dB$	Outdoor and residential areas, farms and other areas where people spend widely varying amounts of time, and other places in which quiet is a basis for use
	$L_{eq(24)} < 55dB$	Outdoor areas where people spend limited amounts of time such as school playgrounds, etc.
Indoor activity interference and annoyance	$L_{dn} \leq 45$ dB	Indoor residential areas.
	$L_{eq(24)} \leq 45dB$	Other indoor areas with human activities such as schools, etc.

Source: EN-108

Note: $L_{eq(24)}$ = Equivalent A-weighted sound level over 24 hours

TABLE V-6

MAXIMUM A-WEIGHTED SOUND LEVELS THAT WILL PERMIT ACCEPTABLE SPOKEN COMMUNICATION FOR VOICE LEVELS AND LISTENER DISTANCES SHOWN

	AMBIENT SOUND LEVEL IN dBA			
DISTANCE	Vocal Effort			
(feet)	LOW	NORMAL	RAISED	VERY LOUD
1	60	66	72	78
2	54	60	66	72
3	50	56	62	68
4	48	54	60	66
5	46	52	58	64
6	44	50	56	62
12	38	44	50	56

(Superseded Table V-5 in FES 76-2)

no scientific evidence currently correlates the two. It is known that large animals adapt quite readily to high sound levels. Conversely, it has been demonstrated that loud noise disrupts breeding in poultry and consequently can affect egg production.

Equipment required to create storage caverns in salt domes consists primarily of drilling rigs, vehicles, pumps, and ancillary support machinery. Operation of these equipment generates noise of sufficient levels to be a source of concern some distance from the rig site.

A gross estimation of noise emitted from a single drilling activity was obtained using standard acoustical field equations. Uniform noise radiation, absence of physcal barriers, and a standard day were assumed in the prediction. Additionally, the following sound spectrum level at fifty feet from the drilling operation was used (Table V-7).

TABLE V-7

SOUND PRESSURE LEVEL (dB) at 50 FEET FROM DRILLING

Frequency - Hz								
63	125	250	500	1000	2000	4000	8000	Hz
77	77	83	80	77	73	77	72	dB

(Supersedes Table V-7 in FES 76-2)

Computations revealed the following:

Distance from Rig (Feet)	Predicted Ldn (dB)
500	63
1000	58
1500	54
2000	51
2500	48

Additional evaluation may be made by considering the effect of noise upon communication by telephone. The quality of telephone usage in the presence of a steady-state masking noise may be obtained from Table V-8.

TABLE V-8

QUALITY OF TELEPHONE USAGE IN THE PRESENCE OF STEADY-STATE MASKING NOISE

NOISE LEVEL (dBA)	TELEPHONE USAGE
30-50	Satisfactory
50-65	Slightly Difficult
65-75	Difficult
Above 75	Unsatisfactory

(Supersedes Table V-6 in FES 76-2)

It may be concluded that at distances of 1,000 feet, or less, sporadic complaints about noise may be expected and 25% of the population exposed to the noise level will complain about it. The computations provide only gross approximate answers but do indicate that noise could be a source of environmental concern during the drilling operations. These estimates did not take into account impulsive noises associated with rig operation. Such noises aggravate the problem when considering human response.

e. Biology

The Strategic Petroleum Reserve will have various effects on the biota of the Gulf Coast region. Some actions which may be expected to have the most adverse effect will include waste disposal - liquid, gaseous and solid - construction, with special emphasis on dredging operations, excavation and devegetation. In the programmatic sense the biological impacts must be discussed at a hypothetical level because of the wide variations in the actual environments of the salt domes. However, regardless of actual site selection, there will be some biological impact from both construction and operation.

The construction period will represent the greatest time of disruption in a biological sense. The operational stage for both types of salt dome storage will be relatively free of biological disturbances, with the exception of increased ship and barge traffic, and the risks of accidental spills of crude oil or brine discharges from the solution cavities.

Increasing the volume of the Strategic Petroleum Reserve from 500 MMB to 1,000 MMB would increase the number of sites, and this would impact proportionally on the biota affected. The impacts from the construction phase would generally be localized in the vicinity of the site and pipeline construction. During the operational phase adverse effects would be limited to storage areas, handling points where the mode of transport changes (e.g., barge to pipeline), and to those isolated instances where an accident to the pipeline may result in an oil or brine spill.

f. Historical and Archaeological Resources

In terms of the historical and archaeological resources of the region where the Strategic Petroleum Reserve would be located, the construction and operation of the SPR would have a minimal impact. However, any new construction required by the increase in the SPR from 500 to 1,000 MMB will increase the geographic bounds that will be affected. Such effects may include construction or excavation for surface buildings or equipment, roads, pipelines or pipeline tie-ins would generally result in physical alteration or damage to any historical or archaeological resources within the construction area. The presence of roads, surface buildings and equipment may also result in degrading the aesthetics of an area by introducing elements which are out of character with the perceived historic or archaeological background.

g. Land Use

In the event that the full 1,000 MMB oil reserve were stored in the Gulf Coast Region, the land used for the storage sites would amount to a total of about 2260 acres, or 3.5 square miles distributed throughout the coastal states. Additional land would also be used for pipeline rights-of-way and brine disposal fields for solution cavities in inland areas, but the choice of sites would determine the amount of their additional acreage.

(1) Effects of Sites on Surrounding Land Use

In the Gulf Coast region, the entire oil reserve could be stored in selected salt dome formations. Oil and gas deposits are frequently found around the periphery of these domes and, at the majority of candidate storage sites, the surrounding lands are dotted with oil and gas wells. Use of the domes would not interfere with continued production from these wells.

The candidate sites are in rural areas. Depending on the particular location, the surrounding land may be pasture, crop land, forest, marsh or swamp. The major effects on land use would result from the noise, traffic, and visual impacts. Noise and traffic would be primarily due to construction activities which would last for 1 to 2 years at sites where existing solution cavities and mine space are to be used, and 3 to 4 years where new solution cavities are being developed. Steel tanks that must be built at some sites to provide oil surge capability would constitute the primary visual impact, particularly in pasture, crop, and marsh lands. Typical tanks would be about 60 feet high. The noise, traffic, and placement of tanks, however, would not constitute a conflict with the use of surrounding lands.

The sites would require a network of pipelines and power transmission lines. Oil pipelines are only required at mine storage sites. Solution cavity storage sites require additional pipelines to supply water to the cavities and to dispose of the brine. Where existing rights-of-way can be used, the new pipelines will be laid along those routes. However, it will be necessary to cross farms, forest lands, wetlands, rivers, and highways. The impact would be confined to the construction period except where trees must be cut to prevent their roots from breaking the pipe and where pipeline trenches through wetlands will take time to become silted over and revegetated. The pipeline and transmission line routes will be planned to minimize effects on residential and commercial areas.

The storage sites will not employ a sufficiently large number of permanent workers to induce the establishment of commercial industries near these sites, nor will the use of the land for oil storage be an inducement for industries to locate in the vicinity. Therefore, there are no changes in property values anticipated from the use of the sites.

(2) Site Uses

While oil and gas are often produced around the perimeter of the dome, the ground overlying the dome surface generally does not contain oil and gas deposits. The sites have, in some instances, been used for the production of sulfur, rock salt, and brine which is used in chemical manufacturing. Some existing solution cavities are used for the storage of petroleum products.

Use of the sites for oil storage will preclude the production of sulfur from the caprock during the period of oil storage. Sulfur required for industrial purposes is be produced from stack scrubbing equipment where coal with sulfur content is burned. Efforts to extract sulfur from the caprock of salt domes have been unprofitable.

Salt mining operations, brine production, and storage of refined petroleum products may in some instances be relocated to an adjacent portion of the dome. The net effect in these instances would be an increased utilization of the dome surface area.

Where salt mines or rock mines are used for storage, an office, warehouse, electrical transformer, and pumphouses would be needed at the site, and the use of surface land could be limited to 30 to 50 acres. Where solution cavities are used, a large brine pond must also be built, requiring additional land. The use of the sites for oil storage would be classified as an "industrial use" by the U.S. Geological Survey and by state planning agencies. Where the site has been previously used for production of sulfur, salt or brine, the land use classification would remain unchanged. Some candidate sites, however, may alter land use designations of the area.

(3) Land Use Planning

Since the candidate oil storage sites are located in rural areas, most of which have already been used for extraction of oil and gas, there is no conflict between the use of the sites and existing land use plans. In some cases, the expansion of urban areas may enclose the storage facilities within the next 20 to 25 years if currently projected population growth rates are realized. At sites where this is likely to occur, sufficient acreage around the main storage facilities can be obtained and reserved as a buffer zone between the operations of the facility and the future surrounding land use.

The pipeline rights-of-way and perhaps the power transmission corridors would cross areas that eventually will become residential. The situation does not present a land use conflict, but would influence the future development of roadways and neighborhoods. These portions of the rights-of-way would have to be maintained in accordance with municipal regulations when they are brought inside city boundaries.

(4) Recreation

Hunting and fishing are major forms of recreation in the Gulf Region, where there are large areas of wilderness in the forests, swamps and marshes. It will be necessary to route pipelines and transmission lines across portions of these lands, and the effects of this construction will constitute the major impact of the program on local recreational resources.

In previous years, the canals dredged through wetlands for pipeline construction were allowed to remain as navigable waterways. These canals have often been used by local hunters and trappers to gain access to isolated areas of the swamps and marshes. They are also used by local fishermen. However, since these canals have contributed to long-term erosion of the wetlands, unintentional drainage, and salt-water intrusion, the Corps of Engineers and State agencies have recently promulgated regulations to control the proliferation of these canals. Pipelines constructed for the oil storage program will be buried, and where canals must be dredged to lay the pipe, small dams or other structures will be constructed to prevent alteration of the natural drainage patterns. The consequent formation of pools along the pipeline route may provide additional fishing ponds until such areas are silted in.

Where pipelines and transmission lines are built through forested areas, trees along the right-of-way will be cut. The construction activity will drive away game from the corridor for the duration of construction. The regrowth of low bushes and shrub will, however, provide food and habitat for game to return when construction is finished.

The use of solution cavities presents special concerns not associated with the use of mines or storage tanks. Water intake structures are to be used that will minimize the impingement or entrainment of fish. Brine that is disposed of in the Gulf of Mexico would require the use of diffusers designed to minimize adverse effects on marine life. Where brine is to be injected into subsurface aquifers the brine field, typically 15 to 35 acres, will be fenced and hunting in that area will be prohibited.

h. Economic and Social Impacts

The production and transport of oil and petroleum products is the major industry throughout a large portion of the Gulf Coast Region. Although no single oil storage facility would have a significant impact on the regional economy due to its consumption of materials, equipment, and manpower, if 1000 MMB of oil is stored by the end of 1983, and all of it in the Gulf Coast Region, the project would draw regionally significant supplies of pipeline, heavy machinery and skilled labor. The impact would probably be felt in the form of a longer lead time for the delivery of supplies and construction delays, rather than in the loss of industrial development. Impacts would be compounded in the event that the construction of the proposed offshore oil port is underway at the same time that the oil storage facilities are being built.

The construction of oil storage facilities would require approximately 3500 man-years of direct labor. This would be diffused over a period of 6 to 7 years and involve 8 to 10 storage sites. Due to overlapping construction schedules, the manpower level required would occasionally exceed 1000 workers. Because of these circumstances, some of the workers, particularly in pipeline laying and drilling crews, may be expected to migrate to the area from other oil production centers in Oklahoma and West Texas.

(1) Storage in Solution Caverns

A large number of salt domes occur in the Gulf Coast Region. Some of them have solution cavities in them which can be adapted for oil storage, but there is not sufficient existing cavity space to accommodate the proposed oil reserve. The adaptation of existing solution cavities and construction of ancillary facilities can be accomplished within a 12 month period. Where solution cavities must be developed in the salt formation, significantly more workers are needed and the process will take approximately 3 to 4 years at each site.

Furthermore, the sites differ from each other in their proximity to centers of population and to oil distribution terminals. In some cases, long pipelines will have to be built to carry the oil to and from the dome, and the major source of disruption to the local economic and social structure may be due to the need to accommodate the pipeline workers for the 4 to 6 month duration of their stay in the community.

Storage caverns in salt domes are developed through methods that utilize machinery and specialized equipment more than labor. Some of the equipment required, such as drill rigs to open wells into the salt, is in chronically in short supply. Therefore, even though the SPR program would not divert a significant number of these drill rigs (2 or 3 per site would be sufficient) the use of the rigs and their crews could be viewed as adding to the shortage of this equipment.

Since the fabricators and suppliers of the type of materials needed to develop the salt domes are located in the Gulf Coast Region, the area will retain most of the economic benefits of the program. Prominent among the items that would be consumed in the development of domes are: line pipe, well casings, steel plate for tanks, pumps, and valves.

The average unemployment rate for the four Gulf Coast Region States in 1976 was about 6.4 percent. Although the manpower requirements for the construction of oil storage facilities in any single salt dome would not necessarily require the migration of workers from outside the region to the site, the overall increase in the construction activity in the region caused by simultaneous development of several sites would induce workers from other states to relocate, at least temporarily, in the region. The result on the community level would be a decrease in the available housing market which in many cases, would be alleviated by the increase in mobile home developments. Construction activities at individual salt dome sites would not last long enough to support a significant boost in permanent housing construction.

Many of the workers employed at the domes are expected to commute to their jobs from as much as 50 to 60 miles away. This is in part due to the location of the domes in relatively isolated areas, and the need to draw skilled workers from the major cities. Traffic congestion can be anticipated during the construction period, but not as a long term effect since the storage facilities will employ only about 15 to 20 workers on a permanent basis.

The salt domes which are under review as potential storage sites are scattered over several states. The development of each dome would require only 150 to 200 workers during the construction phase, and reach a peak level of 400 to 500 workers where extensive pipelines are to be constructed. Due to the scattered development and relatively short construction period, increased or additional public services in individual communities would probably not occur as a result of the project.

The increased economic activity in the region during the construction period would provide additional tax revenues to State and local governments. The revenues would be derived indirectly from the federal expenditures, through the increased employment, personal income levels, and secondary business. Higher revenues would be derived from the sales, excise, and personal income taxes without concomitant increases in tax rates.

The property to be developed for oil storage at the salt domes and the required rights-of-way will be acquired by the federal government unless lease or storage agreements are arrived at. This would constitute a loss of property tax income from the site itself and the capital improvements on it. In most cases, this represents a net loss to the individual county in which the dome is located.

The net effect of the program on taxes would be to enable the states and communities which house the workers to realize increased revenues during the period of construction. During the standby phase when oil is in storage, a reduced level of revenue from property would be realized by the host community.

2. Inland Subregion

Development of inland domes for use in the storage of crude petroleum would involve similar types of impacts to those described in the previous section for storage in the Coastal subregion. To the extent that the impacts would be the same, independent of geographic region, they will not be repeated in this section. Several basic differences in impacts do exist between the subregions, and these will be discussed in this section.

Approximately 45 of the inland domes are known to have salt at depths of 3,000 feet or less (FE-155). These domes exist primarily in northern Louisiana and southern Mississippi, and will be considered here as the potential sites for Gulf Coast inland storage. At the present time, two domes in northern Louisiana have existing storage of approximately 3,000 MMB capacity and one dome in Mississippi has approximately 10,000 MMB of existing capacity.

For almost any inland dome, it will be necessary to link the storage sites with the existing Capline pipeline network to create the flexibility to meet the emergency withdrawal requirements. If the SPR is to meet actual strategic requirements for U.S. national interests, there must be a capability to extract the oil from storage rapidly, and to quickly introduce it into the national distribution system. This would require the construction of additional pipelines for each storage site, one for filling the dome (which connects the dome to the terminal), and one linking the dome with a major pipeline. Increased construction and maintenance costs inherent in this action, would increase the cost per barrel for storage at these inland sites.

Most impacts for development of inland domes would be similar to those of coastal sites. The potential for ship casualties resulting in spill will be increased by the large number of barges or the increased number of small tankers required where ship transport further inland is required. The primary differences in water quality impact between coastal and inland storage are discussed below.

The effects of the development of prototype facilities of 60/200 MMB have been considered. General conclusions are contained in the sections on brine disposal and air quality which follow. Unique problems associated with specific sites can only be addressed in site-specific EIS's.

a. Hydrology

For both northern Louisiana and southern Mississippi there is adequate surface water available for potential salt dome facilities, (Table V-9). However, brine disposal by subsurface injection in northern Louisiana would be a serious problem because of relative non-availability of aquifer sands and because saline water already occurs very near the surface in many areas.

(1) Surface Water

Surface water would be the primary source of supply for SPR facilities. On any small stream in the region the continuous withdrawal of fresh water even if physically available at the required rates, would result in environmental impacts. Reduction of low flows on the smaller streams would result in an increase in the severity of pollution resulting from agricultural runoff (high BOD or low DO levels as well as high bacterial pollution). Furthermore, a long-term reduction in low flows could alter erosional and depositional patterns of the stream, which may necessitate increased dredging and the resulting damage to benthic communities.

(2) Ground Water

Adequate supplies of ground water exist for the northern Louisiana area to that it could be used for some portion of the water supply for a storage location. The

TABLE V-9

General Water Availability Northern Louisiana Salt Domes - For Programmatic EIS Expansion

Major Water Bodies:	Average Flows over Period of Record
Red River	Flow of 31,870 CFS @ Alexandria
Ouachita River	Flow of 18,220 CFS @ Monroe
Lesser Water Bodies:	
Bayou Dorcheat	Flow of 1,134 CFS near Minden
Saline Bayou	Flow of 1,182 CFS near Clarence
Dugdemona River	Flow of 484 CFS near Winnfield

General Water Availability Southern Mississippi Salt Domes - For Programmatic EIS Expansion

Water Bodies	Average Flows over Period of Record
Mississippi River	Flow of 573,600 CFS @ Vicksburg
Yazoo River	Flow of 10,247 CFS @ Greenwood
Pascagoula River	Flow of 9,667 CFS near Merrill
Pearl River	Flow of 7,384 CFS near Columbia
Tombigbee River	Flow of 6,451 CFS @ Columbus
Chickasawhay River	Flow of 3,769 CFS @ Leaksville

ground water in the area of Winn Parish and surrounding parishes is primarily soft water. In the Madison, Franklin and Tensas Parish area near the Mississippi River the ground water is hard water.

The effects of pumping large amounts of ground water, such as pressure decreases and land subsidence were discussed earlier and apply for the northern Louisiana salt-dome basin. Withdrawal of large amounts of subsurface water from the deeper brackish formations could conceivably alter rates of oil and gas production.

(3) Brine Disposal

Disposal into the Gulf of Mexico would not be a reasonable alternative because of the distances involved; therefore, the use of subsurface aquifers for disposal would be required for the inland subregion storage.

Construction of a typical 50 MMB facility would require approximately 2.1 billion gallons (350 MMB) of water. The disposal of this brine in deep aquifiers would require approximately 10 disposal wells spaced on 1200 - 1500 ft. centers. Larger facilities would require proportionally larger areas. Storage facilities of 100 MMB or larger would require substantial areas and the disposal of brine might limit the size of development.

In general there are two problems with deep well injection: the extent of aquifer sands is less in northern Louisiana than in the coastal storage area; and deeper injection levels would have to be utilized. Problems have been noted in this area involving injection into unsuitable formations near some of the domes with a resulting flow of brine to the surface. It would be necessary to consider the use of slower injection rates, more injection wells and a larger injection field to overcome possible problems with aquifer capacities.

In the Mississippi Region the northernmost domes lie in an area where brine disposal by deep well injection would require wells far deeper than would be required on the coastal region. Adequate capacity to support waste disposal from specific sites would be a problem. However, this problem is less significant in the southern portion of the Mississippi Region.

(4) Other Water Quality Impacts

Impacts to area water quality would be due to several major activities including dredging and site construction. Dredging impacts are discussed for coastal storage areas in an earlier section as are other construction impacts. The only differences involve the type of habitat where the activities would occur. Impacts due to erosion caused by site construction would be similar in nature but of potentially greater magnitude due to greater surface elevations and slopes in the northern inland area. Dredging impacts would be somewhat lessened as less wetlands habitat would be disturbed than in coastal regions. However, for some potential sites, development would require longer pipeline routes and new oil terminal facilities.

(5) General Conclusions

Adequate surface water is available in both northern Louisiana and southern Mississippi for potential salt dome facilities. A potential exists for serious problems with brine disposal by subsurface injection in Northern Louisiana because not as many aquifer sands are available for disposal as in coastal Louisiana and saline water already occurs very near the surface in many areas. In the Southern Mississippi Region, the northernmost domes lie in an area where injection would have to be deeper than in coastal Louisiana, with some aquifer capacity problems possible. This problem is not as great for domes in the southern portion of the Mississippi Region.

b. Air Quality Impact

Potential inland domes for the expanded SPR exist primarily in northern Louisiana and in southern Mississippi. There are two EPA designated air quality control regions (AQCR 019 Monroe-El Dorado and ACQR 022 Shreveport-Texoma-Tyler) in northern Louisiana and one (AQCR 134 Mississippi Delta) southern Mississippi. The air quality in these AQCR's will be affected by inland dome storage of the SPR.

Inland dome storage will have minimal hydrocarbon vapor losses from the storage caverns. The major hydrocarbon emissions will result from oil transfer and transport operations. In order to transport oil to inland domes, smaller tankers or barges will be used. The port of Baton Rouge is more likely to be used for oil transfer than the port of St. James. Tanker loading and unloading operations will have a temporary impact on the air quality in the vicinity of the port. The extent of this air quality impact will be influenced by the throughputs and emission control measures used. In addition, longer pipeline length will be required for inland dome storage of the SPR, thus resulting in more emissions from pump seals and pipeline valves. The dust impact associated with construction of new pipelines and other facilities will be temporary and localized.

c. Biology

Several diverse natural regions are encountered north of the salt and freshwater coastal marshes of Louisiana and Mississippi. Immediately north of these areas are terrace lands, composed of prairies and flatwoods with bluffs bordering the Mississippi Flood Plain. This Flood Plain is underwater for a great part of the year over most of the area. It is a region of swamps composed of bottom-land and hardwoods and cypress forests. Most of the northern part of these states away from the watercourses is in the Hill Region, which is forested with longleaf pine on the flats and shortleaf pine on the uplands.

The diversity of the inland coastal region makes it difficult to assess the impacts of salt dome storage in anything but general terms. The most sensitive habitats within this area are the freshwater wetlands. Figure V-1 shows the locations of significant wetlands and salt dome formations in Louisiana and Mississippi. Domes in southern Mississippi, for example, will receive special consideration as storage sites because of the relative absence of wetlands in these areas (Figure V-1). An extensive study is planned to assess the feasibility and desirability of use of the inland domes in Louisiana and Mississippi.

Environmental impacts to the inland region would be different from those encountered at more coastal sites.

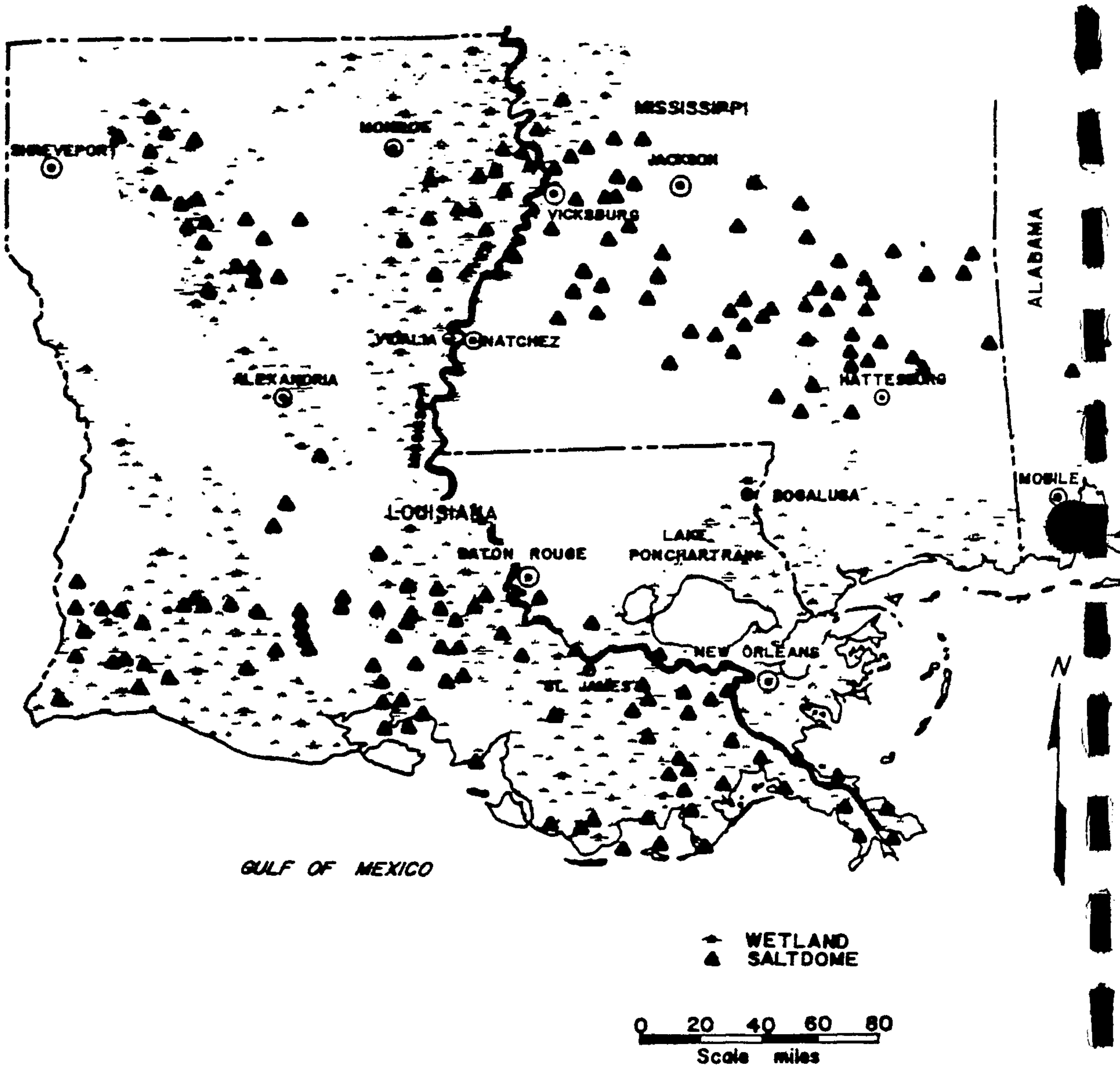

Figure V-1 Locations of Salt Domes Relative to Existing Salt and Freshwater Wetlands

If inland sites were utilized, the transport of oil to the docking terminal would still present the potential danger of accidental spills to freshwater marshes and swamps. Several other types of habitats could also be affected by spills during construction and operation.

Brine disposal would be a significant problem in northern Louisiana and would require more injection wells and a larger injection field. This increased brine disposal activity will increase the probability of an accidental brine spill on the surface. Brine concentrations which would leave the wells during an accidental spill, would be toxic to any plant and animal life which comes into direct contact with the substance.

In general, there would also be an increased probability of oil spills if inland domes were utilized as opposed to coastal domes. Not only would the average pipeline be longer from the receiving terminal to the dome, but also in many cases an additional connecting oil pipeline would be required from the dome to a larger oil distribution line for withdrawal purposes. Increased tanker or barge traffic, both in terms of number of trips and distance traveled, would increase the probability of a spill in inland freshwater rivers. If this spill were to occur in the Mississippi River, much of the oil would remain in the river channel or along the banks because of the continuous levee system. Other rivers, however, such as the Quachita River near

Monroe or the Pearl River near Bogalusa, do not have these continuous levees, and a spill would not only seriously degrade the water quality and habitat value of these watercourses, but it could also damage large areas of streamside wetlands.

Oil spills in a river or dry land have different characteristics and effects from those that would occur in a coastal marsh or open bay. Different organisms are affected, each species having its individual tolerance levels to crude oil concentrations. In general, spills in a marsh are more localized and intense due to the reduced water flow. Dry land spills also tend to remain in the area of the spill. Releases of oil in open bays, however, become dispersed during period of tidal flow, depositing oil in lower concentrations over a larger area. Dispersion and some coating of the banks would occur on inland rivers if a spill occurred during oil transport by tanker or barge. Depending on the size of the spill and flow rate, oil spills in a river can (1) cause most fish to leave the area, (2) kill oil-intolerant plankton because of reduced oxygen or oily sludge covering the riverbed, and (3) produce toxic effects on macrofauna of the sediments and streamside vegetation.

B. East Coast Storage Region

1. Background

The impact of storage of oil on the East Coast was addressed in FES 76-2. With the exception of the following update of predicted air quality impacts, the analysis contained therein remains accurate.

2. Air Quality Impacts

This supplement analyzes the air quality impacts of tank storage for both distillate and residual oil. As distillate oil is more volatile than residual oil, the storage of distillate oil could be considered as the "worst case." The heavier residual oil (grade 6) would have much less vapor loss than distillates at normal temperatures; however, it must be heated for ease of handling. Additionally, this supplement analyzes the storage of light residual oil (grade no.4), which is sometimes classified as a distillate.

In the air quality analysis of the FES 76-2, fixed roof tanks were used. However, it is now considered more likely that double-sealed floating roof tanks will be required to store the SPR in order to reduce hydrocarbons vapor losses from the storage tanks. Double-sealed floating roof tanks were assumed for the air quality impact analysis presented below.

The impact of aboveground tank storage of petroleum on air quality is divided into the construction, filling, operational, and emptying phases. The air quality impacts associated with construction of floating roof tanks will be similar to those of fixed roof tanks. Fugitive dust emission associated with construction activity would be site-specific depending on the degree of ground cover, existing development at the site, local meteorological conditions, etc. The resultant impact on air quality is expected to be short-term and minor. Additionally, precautions such as wetting down gravel roads would be used to reduce emissions substantially.

The impact of dust emissions from sandblasting tanks and evaporative hydrocarbon emissions from tank painting would be a short-term impact. Prior to painting, each tank must be sandblasted. Minor amounts of particulates would be released during sandblasting. It was conservatively estimated that approximately 1 percent of the applied abrasive material would be emitted as fugitive dust. During tank painting operations, there would be an estimated 1,120 pounds of hydrocarbons emissions per ton of primer or paint applied. For a 400,000 barrel storage tank approximately 1.35 tons of hydrocarbons would be emitted.

The primary air impact during the filling, operating, and emptying phases results from evaporative hydrocarbon emissions. What may be termed fugitive hydrocarbon emissions occur from pump and tank seals and connecting points in the supply oil pipeline during filling. These emissions are generally minor if equipment is well maintained.

On an annual basis, maximum total emissions would occur from the following "worst case": tanker unloading, transfer to tank facility, filling tanks, unloading tanks, transfer back to marine tanker for shipment to end users. The expected emissions from this scenario are presented in Table V-10. Also, this table lists published 1973 hydrocarbon emission totals from all sources in the AQCR's defined for the East Coast region. The estimated emission from storage of distillate oil in a 10 MMB prototype facility would amount to less than 0.01 percent of the total emissions from all sources in these AQCR's. The total emissions from storage of residual oil alone would be negligible. Storage of grades 4 and 6 residual oil would account for 0.0005 and 0.00004 percent respectively of the regional total emissions.

Assumed emission rates for both tank standing storage loss and withdrawal loss are presented in Table V-10. The resulting air quality from such emissions was estimated using a Gaussian atmospheric dispersion model (PTMTP) which employs dispersion coefficients from Turner's workbook. The model was applied using meteorological conditions representative of "worst case" atmospheric dispersion during the 6:00 a.m. - 9:00 a.m. period in the East Coast region.

The predicted maximum 3-hr hydrocarbon concentrations downwind from the prototype 10 MMB tank farm are presented in Table V-11. The air quality analysis did not account for chemical reactions occurring during transport of the hydrocarbons. Since the evaporative hydrocarbon emissions being modeled are assumed to be 100 percent reactive in the air, the shown concentrations may be considerably over-estimated.

For site-specific analyses, the tank farm-related hydrocarbon concentrations would be superimposed on the background

TABLE V-10

COMPARISON OF FUGITIVE HYDROCARBON EMISSIONS FROM EXAMPLE TANK STORAGE FACILITY TO TOTAL ANNUAL EMISSIONS IN AQCR'S ON EAST COAST*

10 MMB TANK FACILITY (Double-Sealed Floating Roof Tanks) OPTIONS	ON-SITE EMISSIONS STANDING STORAGE LOSS	WITHDRAWAL LOSS	MARINE TANKER EMISSIONS UNLOADING	LOADING	WORST-CASE** TOTAL
Distillate (grade 2)	23	0.1	3.5	4.6	31.2
Light Residual (grade 4)****	11.5	<0.1	1.8	2.3	15.6
Heavy Residual (grade 6)	1	<0.1	0.13	0.17	1.3

AQCR NO.	TOTAL HYDROCARBON EMISSION***	AQCR NO.	TOTAL HYDROCARBON EMISSIONS***
041	24,000 tons/year	116	11,500 tons/year
042	197,000	118	51,000
043	1,040,103	119	272,000
044	8,200	120	163,000
045	522,400	121	118,900
046	22,700	150	39,100
047	204,500	168	42,200
110	50,500	223	117,300
114	25,100	224	39,700
115	249,900	225	84,300
		EAST COAST TOTAL	3,600,000 tons/year

* All emissions given in tons on an annual basis.

** Based on a hypothetical annual cycle that consists of tanker unloading and filling of storage facilities over a six-month period and loading all stored oil to tankers over a five-month period.

*** Total is based on an incomplete inventory of hydrocarbon sources.

**** Vapor loss of grade 4 residual oil was conservatively assumed to be 50 percent of grade 2 distillate.

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TABLE V-11

PEAK HOURLY HYDROCARBON EMISSIONS FROM EXAMPLE TANK STORAGE FACILITY AND ESTIMATED MAXIMUM CONCENTRATIONS

10 MMB Tank Farm	Standing Storage Loss		Withdrawal Loss	
(12 400,000 bbl tanks and 20 200,000 bbl tanks)	Peak HC emission rate	Maximum downwind HC concentration (6:00 a.m.-9:00 a.m.)	Peak HC emission rate	Maximum downwind HC concentration (6:00 a.m.-9:00 a.m.)
Distillate, double-sealed floating roof tank	3.16 lbs/hr	28 $\mu g/m^3$	12.0 lbs/hr	109 $\mu g/m^3$
Residual oil, double-sealed floating roof tank	0.64 lbs/hr	5.6 $\mu g/m^3$	0.44 lbs/hr	4 $\mu g/m^3$

(Supersedes Table V-20, FES 76-2)

concentration of hydrocarbons and the contributions of any other neighboring sources in order to determine compliance with the standard. Based on the assumptions used, the maximum hydrocarbon concentrations resulting from the prototype 10 MMB tank farm would be less than the non-methane hydrocarbon standard of 100 $\mu g/m^3$.

Air emissions would occur from tankage modules during emptying operations in conjunction with generating steam for tankage heating. For winter withdrawals, an estimated 2,600 gallons of fuel oil per hour would be required to generate steam. Combustion emissions for a typical on-site boiler are presented in Table V-12. During a total withdrawal of stored fuel oil, these emission rates would continue for approximately fifty days. The impact of these emissions on the ambient air quality would be minor.

The expanded SPR would increase the probability of pipeline breakage or other accidents. Oil spills resulting from oil pipeline breakage would contribute some amount of evaporative hydrocarbon emissions to the air. The impact of these emissions would be short-term. Any catastrophic fire occurring from the upset of one or more tanks would contribute major combustion product emissions to the air. The impact of these would be severe but would be short-term.

TABLE V-12

COMBUSTION EMISSIONS FROM STEAM BOILER FOR HEATING STORED PRODUCT

EMISSION	EMISSION FACTORS (lb/103 gal)	EMISSION RATES (lbs/hr)
Particulates	23	60
Sulfur dioxide	110	286
Sulfur trioxide	2	5
Carbon monoxide	4	10
Hydrocarbons	3	8
Nitrogen oxides	80	208
Aldehydes	1	3

Heating oil rate is 2,600 gallons per hour for a tankage withdrawal rate of 40,000 barrels per hour.

Source: EN-071
(Supersedes Table V-21, FES 76-2)

C. Oil Spills

Probably the most publicized and widely reported actions pertaining to petroleum and the environment occur from oil spills, both at sea and on inland waterways. The effects are dramatic, represent substantial impacts on a variety of environmental disciplines, and are frequently costly. In some cases, such as the oil loss from a well in the North Sea in mid-1977, the coverage of the efforts to halt the flow of oil and contain the spill have become international front-page news.

For this reason, as well as the actual substantive issues of environmental damage resulting from oil spills, special emphasis has been placed on this area. A detailed analysis is contained in Appendix A, Oil Spills, dealing with the risks involved in accidental discharges, spills at marine terminals, collisions, and other casualties that might damage the carrier, spills during vessel-to-vessel transfer, and pipeline accidents. An oil spill cause and event tree, and preventive and mitigative measures for reducing oil spillage also are described.

Operational discharges of oil, such as those resulting from the disposal of oily bilge waters, tank washings, and ballast waters, were not considered in the analysis of oil spill risks. It has been established that these constitute the bulk of oil discharges associated with tank vessel operations. However, recent national regulations and pending international conventions will limit these discharges. Existing and proposed U.S. Coast Guard pollution prevention regulations in Title 33, Part 157, Code of Federal Regulations (33 CFR 157), are intended to control the discharge of oily mixtures from tanker operations. These regulations are based on requirements contained in the IMCO* International Convention for the Prevention of Pollution from Ships, 1973, but also include constraints not included in the Convention on the location of segregated ballast spaces.

Specific requirements of 33 CFR 157 concerning operational discharges from U.S. flag vessels are as follows:

- A tank vessel may discharge oily mixtures from machinery space bilges if the vessel is more than 12 miles from the nearest land, proceeding enroute, has in operation an oil discharge monitoring and control system, and is discharging an effluent with an oil content of less than 100 parts per million.
- Tank vessels operating on inland waters and seagoing tank vessels under 150 gross tons must either retain on board oily mixtures or transfer them to a reception facility.
- Seagoing tank vessels of 150 gross tons or more may discharge oily mixtures from cargo tanks and cargo pumproom bilges into the sea, if the vessel is more than 50 nautical miles from the nearest land, and proceeding enroute, the instantaneous rate of discharge of oil does not exceed 60 litres per mile, and the total quantity of oil discharged does not exceed, for an existing vessel, 1/15,000 of the cargo carried, and for a new vessel, 1/30,000 of the total quantity of the cargo from which the discharge came. The vessel must have in operation an oil discharge monitoring and control system.

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*The acronym "IMCO" stands for "Inter-Governmental Maritime Consultative Organization."

Similar regulations have been proposed for foreign flag tankers in U.S. waters. If these regulations are followed, operational discharges will tend to be widely dispersed over the open ocean.

In contrast, accidental spills may occur anywhere, especially in coastal and inland waters, including harbors and harbor entrances. Moreover, accidental spills may result in a large outflow at a single location rather than being widely dispersed as for operational discharges. More significant adverse environmental effects are expected from accidental discharges of oil, and this is the reason for the focus of the analysis.

The results of the analysis of accidental oil spill risks is summarized in Table V-13, which lists the estimated number of oil spills of selected sizes in five major geographical areas. The number of spills are worst case for the transport of 1,000 MMB of oil, and were determined by examining all combinations of three selected marine shipping scenarios and five alternatives for storage configuration. As explained in Appendix A, the estimates were based on historical data on tank vessel casualties, onloading-offloading accidents at Marine Terminals and on pipeline accidents. The five geographical areas are those through which nearly all of the oil would be transported during a fill or refill phase. These areas are:

- Open ocean, primarily the North Atlantic Ocean, the South Atlantic and Western Indian Oceans;
- The waters of the Gulf of Mexico and the Caribbean Sea, more than 50 miles from shore, in which lightering, and offloadings and loadings at a deep water port would take place;

TABLE V-13
RISK OF OIL SPILLS FOR MAJOR GEOGRAPHICAL AREAS*

Area of Impact	Number of Oil Spills During Transport of 1,000 MM bbls., 1,000 MM bbls., Size of Spill Exceeding:				
	100 bbls.	238 bbls.	1000 bbls.	2380 bbls.	10,000 bbls.
Gulf Coast** Pipeline Routes	0.83	0.70	0.45	0.25	0.07
Gulf Coast Harbors and Inland Waters	2.2	1.0	0.31	0.15	0.042
Gulf Coast	0.2	0.11	0.038	0.018	0.008
Waters of Gulf of Mexico and Caribbean Sea	2.1	1.2	0.60	0.38	0.15
Open Sea	4.6	3.3	2.8	1.8	0.98

*The number of oil spills is based on the worst case scenarios and alternatives for each geographic area, as determined in Appendix A (see Figures A-6 through A-10). In addition, all numbers are based upon one fill of 1,000 MMB.

**Based upon 253 miles of pipe, and a usage time of eight years (oil pipelines were assumed to be full for the entire span of the appropriate alternative).

- The U.S. Gulf Coast and waters from the Florida Straits to Texas, within 50 miles of shore;
- Harbors and inland waters of the U.S. Gulf Coast including the Channels connecting the harbors with the sea and the storage site;
- Gulf Coast wetlands and other lands near the pipelines connecting a storage site with a marine terminal.

The results presented in Table V-13 show the frequency with which a major spill (more than 238 barrels or 10,000 gallons) could occur in harbors and inland waterways per 1,000 MMB of oil transported. For pipeline accidents in inland areas of the Gulf Coast, the estimated incidence of a major spill is 0.70. Both vessel casualties and loading-offloading accidents could be significant contributors to major spills in harbors and inland waterways. Offshore, the risk of a major spill (more than 2,380 barrels or 100,000 gallons) is about 0.018 spills per 1,000 MMB of oil transpor[ted] in coastal areas, 0.38 spills in the Gulf, and 1.8 spills in the open sea.

Among the oil storage alternatives are the use of salt domes in Northern Louisiana and Mississippi, rock caverns in the northern Midwest and East, and aboveground and rock cavern storage in the U.S. East Coast area. Oil stored on the East Coast could be imported directly into that area, and based on the storage of 20 MM bbls, the oil spill risk to the East Coast area is estimated to be negligible. For the other two storage alternatives either tank barges or pipelines could be used to transport the oil from Gulf Coast ports. Of the two, the use of pipelines involves the lower risk of oil spills. For the transport of 100 MM bbls the predicted total amount of oil spilled during barge transport is about five times that for pipeline transport. Moreover, spills from barges could result in contamination of the Ohio and Mississippi Rivers, while spills from pipelines would contaminate mostly dry ground.

In comparison with the plan to store only 500 MM bbls, the oil spill risks for any of the proposed alternative plans to store 1,000 MM bbls are approximately double. The reason for this is that the number of shipments and loading-offloading operations are approximately double for the expanded storage alternatives. The only exception to this is the risk of spills from pipelines which increases approximately 31 percent, corresponding to the increases in total length.

Although the oil spill risks estimated in Appendix A are not severe, DOE will take measures to insure that the risks are minimal. For this purpose, the DOE would require each offeror who submits a bid for the procurement and/or transport of oil to the SPR storage sites, to submit an environmental plan indicating steps the offeror intends to follow to minimize oil pollution. These plans, as described in Section II.G, will detail the use of various procedures and equipment for preventing and mitigating against oil spills.

1. <u>Ecological Impacts</u>

Large oil spills may cause extensive damage to aquatic biota. This is a result of the physical properties as a coating or fouling agent, the toxicity of some of its components which dissolve readily in water, or its tendency to form aggregates with suspended sediment and sink to the bottom where it may be carried away from the original site of the spill. Direct damage occurs primarily through smothering attached and floating organisms, including the eggs and larvae of fish and shellfish, and by fouling the feathers of water birds.

Other effects are enhanced by the toxicity of the oil, such as when birds become coated with oil and ingest a portion in attempting to clean themselves. Oil also temporarily reduces photosynthesis in plants by reducing light penetration, occasionally by as much as 90 percent.

In fresh or brackish waters, oil interferes with the respiration of aquatic insects and larvae, including those of mosquitoes and various flies which typically occur at the surface.

The primary effect of spilled oil on benthic organisms, other than intertidal species which may be directly coated, arises from the desposition of clay coated with organic matter and absorbed petroleum. There it can continue to release soluble toxins over a long period of time. Brackish docking areas and turbid, sluggish estuaries are particularly liable to develop this type of bottom sludge. The increased biological and chemical oxygen demand associated with this sludge can deplete bottom waters of dissolved oxygen. However, these effects are generally localized, and are most significant in areas of chronic pollution, rather than waters affected by a single major oil spill.

When spilled oil enters a saltmarsh, it is very difficult to remove. The oil adheres to plants, usually killing the parts exposed to the oil. A film of oil lying over the soil can also slow or prevent gas exchange, and probably decrease the productivity of minute mud algae. These algae are important to the ecosystem. Sluggish or non-mobile animals living in the marsh may also become fouled; shore crabs which live in shallow burrows are particularly sensitive, not only to direct contamination, but to poisoning through ingesting harmful quantities of oil from oil-fouled food.

An oil spill in a saltmarsh can be particularly damaging if it occurs at a time when the shallow "nursery areas" contain large numbers of juvenile fish and shellfish which are likely to be fouled directly or succumb to dissolved toxins.

Hyland and Schneider (1976) provided a review of petroleum impacts on marine organisms, populations, communities and ecosystems. Table V-14 is an extract summary of expected initial impacts on various ecosystems based upon their review. It is noted that the potential impact to the open ocean ecosystem was assessed as light due to anticipated rapid dispersion and degradation of the spill, and the generally low vulnerability of open ocean organisms. The most heavily impacted ecosystems noted were wetlands and open estuaries, bays, channels and harbors. Wetlands are typically shallow water, soft bottomed, highly productive systems where

TABLE V-14

SUMMARY OF EFFECTS OF OIL ON SOME MAJOR ECOSYSTEMS

Type Environment	Expected Initial Impact		Expected Recovery	
Open Ocean	Light:	Impact on pelagic phyto- and zooplanktonic organisms dependent on chance event of contacting floating slick. Many organisms (particularly fish) may avoid spill. Neuston communities (surface dwellers) may be affected. Not likely that oil would accumulate in open ocean sediments to lethal or sublethal levels.	Fast:	Rapid dispersion and degradation of oil. Effective reproductive and dispersal mechanisms for most pelagic organisms (fast immigration of larvae and adults).
Outer Continental Shelf	Light to Moderate, e.g., George's Bank and Gulf of Alaska	Impact on phytoplankton and zooplankton populations light. Spawning population of fish larvae severe. Moderate impact on benthic systems if oil reaches the bottom.	Fast to Moderate:	Fast recovery for phytoplankton and zooplankton because of rapid regeneration times. Moderate recovery to benthic systems if oil reaches bottom.
Open Estuarine Areas, Bays, Channels, Harbors	Moderate to Heavy:	Chronic oil may depress populations of fish and some benthos; or induce changes in species abundance and distribution. Spilled oil effects dependent on time of year (spawning, migration, etc.) and oil's persistence.	Fast to Slow:	Dependent on flushing characteristics, route to benthos, shoreline characteristics, and community stability. Individual year classes of larval fauna may be severely impacted.
Wetlands: Marshes and Mangroves	Heavy:	Potential serious threat as result of vulnerability to spills and significance of estuarine functions (nursery and breeding grounds; high productivity; basis of detritus food chain). Several effects noted: faunal mortalities leading to decreases in population density, changes in species abundance and distribution; damage to marsh grasses after repeated exposure, and decrease in productivity; damage to mangroves and neighboring grasses.	Moderate to Slow:	Persistence of oil in sediments prolongs toxicity. Yet, once oil removed, biological succession may be moderate in some areas, since generally organisms reproduce and disperse fairly rapidly. Mangroves particularly complex and may take long to recover. Marsh area at West Falmouth still slightly affected 5 years after spill.
Special Ecosystems: Coral Reefs	Unknown:	Some reports of lethal damage to corals exposed to air and sublethal effects on growth and behavior of individuals. One report of altered community structure from refinery wastes in Puerto Rico.[65]	Unknown:	Recovery could be slow due to structural complexit of coral communities.

initial impacts to detrital food webs and breeding organisms could be heavy, with a high potential for long term effects from oil fractions which persist in the sediments. The magnitude of impact to estuaries, bays, channels and harbors would depend upon numerous physical factors such as size, flushing action, wave exposure and shoreline characteristics.

a. Relative Vulnerability of Organisms

Hyland and Schneider (1976), in reviewing the effects of petroleum on the marine environment, summarized the initial impacts of petroleum on various marine populations and communities. Table V-15 contains the author's summary, and points out that birds and the subtidal offshore benthos were estimated to be the most heavily impacted components of the marine fauna. Birds can become oil coated resulting in a loss of buoyancy (drowning) or increased heat loss (pneumonia). Ingestion of oil can result in direct toxic mortality, or, as Dieter (DI-099) pointed out, an osmotic imbalance leading to dehydration. Dieter also noted that experimental oiling of bird eggs has led to decreased hatching and possibly direct toxicity from the aromatic compounds. The subtidal offshore benthos can be heavily impacted initially due to a generally higher vulnerability than other benthic communities, and the persistence of oil in the substrate.

b. Relative Toxicity of Oils and Petroleum Products

Weathered crude (crude which has lost the lighter fractions) has been reported to be less toxic than fresh crude. In this regard, the experimental oil spills conducted by Bender et al. (BE-001) are worth noting. Using semi-enclosed sections of a mesohaline salt marsh off the York River (Virginia), which were dosed with fresh and artificially

TABLE V-15

SUMMARY OF EFFECTS OF OIL ON POPULATIONS AND COMMUNITIES

Community or Population Type	Expected Degree of Initial Impact		Expected Recovery	
Plankton	Light to Moderate:	Impact dependent on chance event of contacting floating slick. Decrease in population densities may have effect on local productivity. Greatest danger to small local breeding populations composed of larval fish.	Fast to Moderate:	Effective reproductive and dispersal mechanisms for most phyto- and zooplankton in open waters (populations dense, widely dispersed; individuals ubiquitous, prolific, grow quickly to maturity). Local breeding populations of larval fish and shellfish may take much longer to recover.
Neuston	Unknown:	Chance of contact high since communities exist on or near surface. Contamination reported, but effects unknown.	Unknown:	Ecology poorly understood.
Benthic Communities		Mortalities lead to decrease in population densities and age distributions; changes in species abundance and distribution; imbalances between interacting populations.		
Rocky Intertidal	Light: (with exceptions, e.g., <u>Tampico Maru</u> spill)	Hardiness of organisms. Most damage from coating leading to suffocation or loss of purchase on substrates.	Fast:	Oil rapidly removed by waves. Populations rapidly restored since individuals grow and reproduce rapidly.
Sandy or Muddy Intertidal	Moderate:	Impact increased by persistence of oil in unconsolidated substrates. Chance for greater mortalities since infaunal organisms may be more sensitive than rocky intertidal organisms that have developed defense mechanisms for living in rigorous and variable environments.	Moderate:	Persistence of oil in sediments prolongs toxic effects.

TABLE V-15

SUMMARY OF EFFECTS OF OIL ON POPULATIONS AND COMMUNITIES (CONT'D)

Community or Population Type	Expected Degree of Initial Impact		Expected Recovery	
Subtidal, Offshore	Heavy:	Impact increased by persistence of oil in unconsolidated substrates. Chance for greater mortalities since many subtidal organisms may be more sensitive than rocky intertidal organisms that have developed defense mechanisms for living in rigorous and variable environments.	Slow:	Persistence of oil. Possibly, slow rate of biological succession for complex, highly structured communities found in some subtidal areas where abiotic factors have been historically constant.
Fish	Light to Moderate:	Possibility of avoiding spills; some resistance offered by mucous coating. Greatest danger to local breeding populations in confined waterways (increased chance of contact; sensitive larval forms present; adults display complex breeding behavior) or benthic fish in heavily polluted substrates.	Fast to Moderate:	Effective reproductive and dispersal mechanisms for most pelagic populations (fast immigration of larvae and adults). Local breeding populations may take much longer to recover.
Birds	Heavy:	Mortality from ingestion of oil droplets and coating (loss of body heat and buoyancy). Mortalities lead to decrease in population densities.	Slow:	Individuals long-lived; low fecundity; gregarious behavior increases chances of losing entire population.
Mammals	Light:	In comparison to other groups, marine mammals not extremely abundant along most coasts. Impact dependent on chance event of small population contacting floating slick. Due to mobility, most mammals can probably avoid heavily-polluted areas. Conclusive evidence of mortalities, due to oil pollution, is rare. Possible effects include ingestion of toxic oil droplets during grooming; loss of thermal insulation and/or waterproofing, due to coating; and irritation of eyes and exposed mucous membranes. Eye irritation reported after Arrow spill and spill in Alaska.	Slow, if Population Seriously Affected:	Individuals long-lived; low fecundity--hence, time for recovery increased. Also, some mammals near extinction. However, no supportive evidence for loss of entire populations as result of oil pollution.

weathered South Louisiana crude, the authors recorded impacts to the salt marsh from weathered crude which were, on the whole, as great as fresh crude. In both the fresh and weathered plots (relative to controls), marsh grass production and benthic fauna declined, while periphyton biomass increased. Phytoplankton production suffered a substantial decline immediately after oiling, only to recover fully in seven days.

Recent research on the photo-oxidation of Number 2 fuel oil revealed that two groups of toxic compounds (peroxides and carboxylic acids) resulted from irradiation of the fuel oil with artificial light. This is a further indication that weathering may not detoxify at least some types of petroleum and petroleum products.

c. <u>Biological Recovery</u>

Hyland and Schneider (HY-001) in reviewing the impacts of petroleum on the marine environment, assessed the expected recovery of major populations, communities and ecosystems following oil contamination. The authors' assessments are contained in Tables V-14 and V-15. The open ocean ecosystem was regarded as having the fastest expected recovery due to a rapid dispersion and degradation of the oil combined with a rapid recovery of any affected biota through reproduction and immigration of adults and larvae. Wetlands and estuaries, bays, channels and harbors were estimated as having the slowest recovery rates. Recovery of a wetland could be appreciably hindered by the persistence of oil in the sediments. Estuaries, bays, channels and harbors could be slow to recover if local breeding populations of fish or shellfish were heavily damaged. The populations and communities expected to have the slowest recovery were the subtidal offshore benthos, birds, and, if heavily impacted, aquatic mammals. Persistence of oil in the substrate and a possibly slow rate of biological succession in some communities were noted as factors in the slow recovery of subtidal offshore benthic communities. Birds and mammals could be slow to recover due largely to long life spans and low fecundities.

G.L. Chan (CH-157) reported no long term effects of a 1971 spill of 840,000 gal. of Bunker C in San Francisco Bay. Assessing recruitment for five years following the spill, Chan noted significant increases in population densities of some species of intertidal mollusks which had been heavily impacted by the spill. Nadeau and Bergguist (NA-009) made follow-up observations of a spill-impacted area in Puerto Rico where 24,000 bbl of Venezuelan crude had washed ashore from the tanker Zoe Colocotronis in 1973. Three years after the spill, red mangrove (Rhizophora mangle) and black mangrove (Avicinnia nitita) had died-off in part of the impact area where sediments still contained high levels of petroleum hydrocarbons. Epibenthic communities in turtle grass (Thalassia) beds, initially impoverished as a result of the spill, had begun to recover three years later, as had the Thalassia infaunal community. Certain fauna in the mangrove prop root community, also heavily impacted, had begun repopulation during the three year span. Krebs and Burns (KR-001) surveying the recovery of salt marshes contaminated by a 1969 spill of number 2 fuel oil, found that recovery of fiddler crab (Uca pugnax) populations was still incomplete seven years later. The authors attributed the long term reduction in the crab population to the persistence of toxic oil components in the sediments of the salt marsh which led to direct mortality of juvenile crabs and impairment of locomotor activity and general behavior in adults. Hershner and Moore (HE-164) performed a post-cleanup assessment of the 1976 Chesapeake Bay spill of 250,000 gallons of number 6 oil. Selecting Vancluse Shores as a monitoring site for eight months following the spill, no significant short term effects could be detected in populations of the intertidal mussel Modiolus demissus or the American oyster (Crassostrea virginica). Snails (Littorina irrorata), initially heavily reduced in numbers, appeared to be recovering at the end of the study period, while the marsh grass (Spartina alterniflora) exhibited an increase in standing crop and density. The authors hypothesized that the impact of the spill was minimized by the relatively low toxicity of the spilled oil, the time of year (dormant), and the wave and tidal action of the shoreline.

In summary, the impact and subsequent biological recovery of an area following a petroleum spill will depend upon a complex variety of factors such as the type of material spilled, time of year, energy characteristics of the impacted area (tidal exchange, wave action, etc.), vulnerability of the biological community, and dynamics of the affected populations such as turnover rates and fecundity. Imposed upon these factors is the cleanup operation itself (response time, techniques, etc.). Biological recovery may require only a few months for some communities, to several years.

d. Effects of Chronic Oil Pollution

The original subsection contained in FES 76-2 presents an overview of studies conducted in marine areas subject to chronic low-level oil pollution and the potential effects of chronic exposure on marine populations. As such, this material is not affected by expansion and acceleration of the SPR program.

e. Summary of Effects on Marine Organisms

Recent research indicates that weathered crude may not necessarily be less toxic to marine biota than fresh crude. Bender et al. (Be-001) determined that the overall impacts of weathered crude on experimental plots in a mesohaline marsh were as great as fresh crude. It has also been found that photo-oxidation (a weathering process) of Number 2 fuel oil can yield highly toxic compounds such as peroxides and carboxylic acids.

Expansion of the SPR to 1000 MMB over a slightly longer period of time (1985 versus 1983 for the base case) would result in a higher probability of oil spills in a given portion of the marine transport phase of the project (open ocean, Gulf of Mexico/Caribbean, Gulf Coast, East Coast, and inland waters). The frequencies of oil spills greater than 1000 barrels over the total marine transport life of the project are given in Appendix A. The frequencies noted are about twice that expected for the base program (500 MMB). As such, expansion of the SPR program increases the risk of ecological damage from the project as a whole. The greatest risk arises from transport operations in the Gulf Coast, East Coast and inland waters since these areas are near or contiguous with the biologically productive wetlands, estuaries, and other fin and shellfish habitats of the coastal zone of the United States. The Caribbean transfer phase (Scenario C, Appendix A) could also have a high risk of ecological damage from a large spill, assuming that the transfer point would be relatively close to shore. The open ocean and Gulf of Mexico transport phases are not considered "worst cases" since it is assumed a spill in these areas would not reach the coastal ecosystems. It should be noted that the frequency of a spill greater than 1000 barrels in the "worst case" transport phases are very low for each alternative to the original case of 500 MMB. A large spill in these zones could have severe impacts on the affected ecosystem, requiring up to several years for biological recovery. The magnitude of impact would vary with numerous factors, mentioned in earlier subsections, ranging from the type of product involved, time of year, rapidity and effectiveness of containment and cleanup, and the biological characteristics of the impacted environment.

As an adjunct to marine transport of oil, there is the possibility that river barge transport could be utilized if an inland salt dome (e.g., northern Louisiana or southern Mississippi) were to be used for storage. The frequency of a spill (larger than 1000 bbl) for this transport mode over the life of the project is quite low. A large spill during barge transport could affect an extensive area along the shoreline of the river due to rapid transport of the spill by currents. Such a spill could have a significant short-term impact to the ecology of the affected area, especially commercial and sport fisheries which are extensive along the Mississippi River. Recovery of the impacted area should be relatively rapid due to the high flushing rate of the river and the broad biological base available for repopulation.

2. Ecological Effects of Onshore Spills

An oil spill on shore must always be considered possible, although the probability is relatively low. Mechanical failure such as wellhead shearing off, the rupture of a pipeline from an external impact, the failure of a valve, are all possible. Human failure could also create a spill, and must be weighed for consequences.

Tankage area spills are contained inside safety dikes. Only spills outside of the area, such as a pipeline rupture, would be expected to create an adverse ecological effect. Such a spill could occur as a result of a ruptured pipe or a sheared wellhead, however, a combination of safety devices and the fact that the pressure on the oil in the well would rapidly reach equilibrium would probably limit the volume of such a spill to less than a hundred barrels.

Small pipeline leaks can be totally contained in the soil before they move a great distance horizontally or downward if the quantity is small enough. Chronic leaks, if undetected, may travel long distances both horizontally and downward. If porous backfill is used in a trench made in impermeable material, the oil would follow the course of least resistance and migrate along the pipeline within the trench. This usually can be eliminated easily with no environmental consequences.

In either the Gulf Coast or East Coast regions small spills on land should present few cleanup problems. However, the vegetation and soil organisms would probably be destroyed locally by either the oil or the cleanup operation, which usually consists of removal of the contaminated soil. The possible exception would be large trees that could survive if the cleanup were rapid.

The destruction of the vegetation would temporarily displace whatever animals lived in the area prior to the spill. Most animals would be able to avoid the spill area, and would not be harmed. Revegetation can be assisted by reseeding and replanting after the cleanup is completed.

If an oil spill is not cleaned up promptly, but permitted to continue for several days the effects would be much more extensive, and the following cleanup more difficult. If the spill were carried by surface water the effects would be felt by the aquatic organisms in the streams and throughout the drainage system affected by the spill.

3. Ecological Effects of Spills of Refined Products

Spills of refined petroleum products are generally more harmful than those of crude petroleum. To insure "worst case" evaluation, the catastrophic loss of a complete tanker of about 35,000 DWT was considered. Two refined products were selected for this evaluation: Number 2 Fuel Oil and Bunker "C." The worst case area for such a disaster was a U.S. port, where tankers of that tonnage are frequently found. In the port area the Loss would have the greatest environmental effect. Carried by tidal currents, the product would be widely distributed throughout the harbor unless cleanup and containment were promptly initiated to protect sensitive areas. The spilled products would be washed ashore, and enter the small bays and wetlands adjoining the harbor.

Tides and estuarine circulation would distribute the products in both surface and subsurface waters. Since most refined products are lighter than water they will generally move with the net flow of surface water in a seaward direction, but turbulent mixing can also distribute the oil throughout the water column as an emulsion and through dispersion of tiny oil droplets. The net landward flow would carry these materials back into the harbor, spreading the products widely throughout the system. The oil may enter marine food webs through planktonic or benthic organisms.

The lighter petroleum products contain higher concentrations of the more toxic constituents of petroleum. When washed ashore quickly after a spill, and before loss by evaporation or burial in sediments, these refined products can cause widespread losses of marine organisms in wetlands. If the product should become buried within sediments where anaerobic conditions exist, degradation could take years. In this event, the product would represent a long-term ecological hazard which could significantly impede the speed of biological recovery within the impacted area.

Bunker C is a heavy residual fuel oil with a propensity for water-in-oil emulsions. This, combined with its high viscosity causes it to tend to remain at the surface, where mechanical recovery or removal is facilitated. Since it would remain at the surface a spill of Bunker C would endanger the marine birds in the harbor and adjacent wetlands if control and cleanup were not promptly initiated. Other marine fauna, especially benthnic communities, could be heavily impacted by a spill of Bunker C, although biological recovery should be relatively rapid.

4. Regional Overviews

This portion of the chapter briefly summarizes appropriate portions of the final Environmental Impact Statement for the Maritime Administration Tanker Construction Program, which in turn drew from CEQ studies on supertanker port sites. Those elements extracted have some regional significance and are appropriate to the considerations of the SPR.

a. Texas Gulf Coast

The biological productivity of the marine environment of the Gulf of Mexico is lowest in open waters, increases toward the coast and is greatest in the estuaries. An oil spill inside a Texas bay would have a greater potential for significant ecological impacts than a similar spill further offshore. The shallow bay waters provide less volume for dilution of toxic oil components, and the slow flushing characteristics of the estuarine systems would result in a longer contact time for marine organisms with the spilled oil. Depending upon the time of year, fin and shellfish, especially larvae and juveniles using the estuary as nursery habitat, could be subjected to long-term impacts through loss of a substantial portion of the year-class. Recovery following an estuarine spill could require years.

Winds and currents have been estimated to drive spilled oil toward the Texas coast approximately 60 percent of the time. Barrier islands along approximately 300 miles of the Texas coast protect bays and estuaries from most effects of offshore oil spills. The small tidal openings through the islands would probably inhibit the movement of large volumes of oil into the estuaries. As a result, the major short-term impacts would occur at the barrier beaches where a large portion of an oil spill would most likely be stranded. Intertidal and subtidal benthic communities would probably be the most heavily impacted components of the ecosystem. The impact to waterfowl would probably be minimal since they should be protected by the barrier islands from the major force of a spill. Pelagic organism residing in the offshore area would be affected primarily through loss of the more susceptible larval and juvenile stages which come into contact with the contaminated water strata.

Low-level continuous spills in the Gulf of Mexico are not likely to reach the shore. Soluble fractions from thin oil films should be diluted enough to prevent damage to swimming organisms. Chronic oil contamination of some Gulf Coastal areas has been associated with past offshore drilling operations on the Gulf Coast, but its effects have not been reported.

b. Southeastern Coastal Area of Louisiana

The areas most vulnerable to oil spills along the Louisiana coast are the estuaries. Oil drift projections (based on regional winds and local currents) indicate that the (supertanker) site most distant from the shore will have the least effect because a potential spill there would probably not reach the estuarine areas.

Estuarine areas of Louisiana are flanked by levees and, on the Gulf side, usually by barrier islands. This configuration, coupled with a gentle slope, has produced a nutrient-rich environment that now supports over four million acres of estuarine marshlands -- one of the world's most extensive coastal wetland areas. The climatic regime provides high solar radiation, abundant rainfall and a wind system that interacts with the physical setting in such a way that primary production supports the largest fishery in the United States. The principal commercial species are menhaden and shrimp. These species depend on the estuaries for habitat and/or nursery area and for detrital food -- the product of marsh grass disintegration.

Oil drift projections were based on a hydrodynamic numerical model. By using four wind conditions, local tides and bathymetry, the hypothetical oil spills nearest shore moved either northwest toward Timbalier Bay, Louisiana, or northeast toward Barataria Bay, Louisiana. Oil spills further into the Gulf did not impinge on the shorelines or estuaries. Oil spills at both sites usually assumed an east-west orientation and moved somewhat faster than drift projections based solely on winds.

Effects resulting from an oil spill would be potentially most severe in the estuaries. If repeated oilings occurred, valuable oyster grounds located in this area could be destroyed. Oil could temporarily damage extensive areas of marsh grass, thereby eliminating or reducing important spawning and nursery grounds. Most of the marsh fauna is located near the boundary between the grass zone and deeper estuarine waters. If oil enters the estuaries, it is believed that it will concentrate in this boundary area and thereby possibly cause high mortalities to these forms and damage the fishery species since they use this area for protection, spawning and nursery grounds, and as a food source. The larval and juvenile stages of the fishery species use the tidal passes into and out of the estuaries as migratory routes. If oil reached these areas during such a movement, juvenile mortalities could have severe effects on later fish harvests. Damage to the Gulf shoreline from spilled oil will probably be minimal unless the oil concentrates in the littoral currents which are used as a migratory aid. The most severe effect offshore would probably be damage to the spawning waters or feeding grounds used by the fishery species.

c. Atlantic Coast Region

The circulation of coastal water along the Maine coast is generally southward during the cooler months of the year. This circulation is driven primarily by density effects associated with local river discharges and modified by regional winds and is most vigorous in early spring. In autumn, when winds are relatively weak and river discharge is low, the circulation is sluggish. Tidal currents dominate the circulation of near-coastal waters but the details of the circulation are not well known. The complicated geometry of the coastline makes it difficult to develop simple mathematical simulation models that adequately describe the nearshore circulation that would play a dominant role in moving oil slicks resulting from accidents to ships or at the terminal.

Oil would have severe effects on the intertidal organisms living on the rocky shoreline. Oil would also likely enter the small wetland areas and cover the small beaches at the head of small coves in the area. Data on marine communities of intertidal rocky shorelines are adequate to permit qualitative assessments of damage from the stranded oil. Less data is available for wetland areas and information needed for assessment of damages to aquatic organisms in the coastal waters or on the continental shelf is inadequate for reliable assessments. The study concluded that such oil spills could possibly cause localized permanent changes in communities of marine organisms.

Oil spills at sea on the lower portions of the Atlantic Coast would probably present increased hazards from pollution of beaches and wetlands due to easier access from open water. Generalizations are necessary because of the

wide variety of possible sites along the coast, and the wi[de]
range of variables affecting each as a separate site for consideration.

D. Summary of Cumulative Impacts

Consideration of cumulative impacts becomes more important with examination of the increase in the Strategic Petroleum Reserve from 500 to 1,000 MMB, and the acceleration in attaining the original storage goals.

Cumulative impacts can be considered in two ways: those that are additive because of the location of two or more facilities in the same area, or those where the impact results from two or more operations at the same facility.

Since the sites have not been selected, the methodology for additive impacts because of proximity is not valid in a programmatic evaluation -- although it must be a major consideration in site-specific examination of the cumulative effects when two candidate sites are co-located or in close proximity.

Estimations on a per-site basis were made in FES 76-2, and have been updated in this supplement. However, the amount of oil stored by facility type has been modified, and this data was contained in Table I-1 in Chapter I of this supplement. Using this revised capacity for prototypes, the following Tables V-16 through V-24 of cumulative effects have been derived.

TABLE V-16
CUMULATIVE IMPACTS - MAXIMUM LOCAL STORAGE OF PRODUCT (WORST CASE)

	Gulf Coast: 210 MMB of Crude in Existing Solution Caverns	Gulf Coast: 605 MMB of Crude in New Solution Caverns
AIR	Negligible emissions from storage caverns HC emissions at terminal (one cycle) Filling phase: 1,952 tons Withdrawal phase: 2,425 tons	Negligible emissions from storage caverns HC emissions at terminal (one cycle) Filling phase: 5,336 tons Withdrawal phase: 6,988 tons
WATER	Brine disposal: Produced during solution mining - none Produced during displacement - 2.12×10^8 bbls with oil (initial fill) Area affected if brine disposed of in the Gulf during initial fill and subsequent cycling Maximum area of ≥ ppt increase in salinity (assumes no vertical mixing) - 1,080 acres Water requirements: Required for solution mining - none Required for displacement - 2.21×10^8 bbls fresh water, or (one emptying)	Brine disposal: Produced during solution mining - 4.6×10^9 bbls Produced during displacement - 5.95×10^8 bbls with oil (one refill) Area affected if brine disposed of in the Gulf during solution mining and subsequent cycling Maximum area of ≥ ppt increase in salinity (assumes no vertical mixing) - 3,100 acres Water requirements: Required for solution mining - 3.76×10^8 bbls fresh water, or - 4.5×10^9 bbls sea water Required for displacement - 6.43×10^8 bbls fresh water (one emptying) - 5.95×10^8 bbls sea water
LAND USE	275 acres	790 acres
SOCIO-ECONOMIC	Effects of construction: Direct expenditure* \$210 - \$315 Total employment ** 1,662 - 3,325 man-years Effects of operation: Direct expenditure* \$3.3 per year Total employment** 165 persons	Effects of construction: Direct expenditure* \$761 - \$945 Total employment** 12,939 - 21,858 man-years Effects of operation: Direct expenditure* \$3.7 per year Total employment** 183 persons

* In millions of dollars.
** Includes direct, indirect, and induced employment.

TABLE V-17
CUMULATIVE IMPACTS - MAXIMUM LOCAL STORAGE OF PRODUCT (WORST CASE)

	Gulf Coast: 95 MMB of Product in New Tanks	Gulf Coast: 90 MMB of Crude in Existing Salt Mines
AIR	Tank Painting = 285 tons of HC Floating roof Tanks: Standing HC loss = 3 lbs/day Withdrawal HC loss = 26 tons (one cycle) HC emissions at terminal (one cycle) Filling phase: 838 tons Withdrawal phase: 1,097 tons	HC vapor loss from salt mines = 70 lbs/hour HC emissions at terminal (one cycle) Filling phase: 794 tons Withdrawal phase = 1,039 tons
LAND USE	1900 acres	40 acres
WATER	Minor impacts	Minor impacts
SOCIO-ECONOMIC	Effects of construction: Direct expenditure* $570 - $1140 Total employment** $4.5 \times 10^5 - 6 \times 10^5$ man-years Effects of operation: Direct expenditure $12.0 per year Total employment** 3250 persons	Effects of construction: Direct expenditure* $81 - $135 Total employment** 2250 man-years Total increase in personal income - Effects of operation: Direct expenditure* $.24 per year Total employment** 1 person

* In millions of dollars
** Includes direct, indirect, and induced employment.

TABLE V-18
CUMULATIVE IMPACTS - MAXIMUM LOCAL STORAGE OF PRODUCT (EXPECTED)

	Gulf Coast: 15 MMB of Product in New Tanks	Gulf Coast: 80 MMB of Product in New Rock Mines
AIR	Tank Painting = 45 tons of HC Floating roof Tanks: Standing HC loss = less than 1 lb/day Withdrawal HC loss = 4 tons (one cycle) HC emissions at terminal: Filling phase: 132 tons Withdrawal phase: 173 tons	HC vapor loss from rock mine = 70 lbs/hour HC emissions at terminal (one cycle) Filling phase: 705 tons Withdrawal phase = 924 tons
LAND USE	300 acres	1200 acres
WATER	Minor impacts	Minor impacts
SOCIO-ECONOMIC	Effects of construction: Direct expenditure* \$90 - \$180 Total employment** 7.1×10^4 - 9.4×10^4 man-years Effects of operation: Direct expenditure \$1.9 per year Total employment** 515 persons	Effects of construction: Direct expenditure* \$320 - \$480 Total employment 8.67×10^3 man-years Effects of operation: Direct expenditure \$1.3 per year Total employment** 6 persons

* In millions of dollars
** Includes direct, indirect, and induced employment.

TABLE V-19
CUMULATIVE IMPACTS - MAXIMUM LOCAL STORAGE OF PRODUCT (EXPECTED)

	Gulf Coast: 530 MMB of Crude in New Solution Caverns	Gulf Coast: 235 MMB of Crude in Existing Solution Caverns
AIR	Negligible emissions from storage caverns HC emissions at terminal (one cycle) Filling phase: 4,675 tons Withdrawal phase: 6,121 tons	Negligible emissions from storage caverns HC emissions at terminal (one cycle) Filling phase: 2,073 tons Withdrawal phase: 2,714 tons
WATER	Brine disposal: Produced during solution min'ng - 4.02 x 10^9 bbls Produced during displacement - 5.24 x 10^8 bbls with oil (one refill) Area affected if brine disposed of in the Gulf during solution mining and subsequent cycling: Maximum area of $\geq$ ppt increase in salinity (assumes no vertical mixing) - 2,730 acres Water requirements: Required for solution mining - 3.31 x 10^9 bbls fresh water - 3.62 x 10^9 bbls sea water Required for displacement (one emptying) - 5.71 x 10^8 bbls fresh water - 5.24 x 10^9 bbls sea	Brine disposal: Produced during solution mining - None Produced during displacement - 2.36 x 10^9 bbls with oil (initial fill) Area affected if brine disposed of in the Gulf during initial fill and subsequent cycling: Maximum area of $\geq$ ppt increase in salinity (assumes no vertical mixing) - 1,210 acres Water requirements: Required for solution mining - None Required for displacement (one emptying) - 2.38 x 10^8 bbls fresh water - 2.36 x 10^8 bbls sea water
LAND USE	670 acres	350 acres
SOCIO-ECONOMIC	Effects of construction: Direct expenditure* $678 - $827 Total employment ** 11,872 - 18,921 man-years Effects of operation: Direct expenditure* $2.49 per year Total employment** 125 persons	Effects of construction: Direct expenditure* $235 - $353 Total employment** 1,865 - 3,730 man-years Effects of operation: Direct expenditure* $4.1 per year Total employment** 207 persons

TABLE V-20
CUMULATIVE IMPACTS - MAXIMUM SUBSTITUTION OF CRUDE OIL (EXPECTED)

	Gulf Coast: 120 MMB of Crude in Existing Salt Mines	East Coast: 20 MMB of Crude in Existing Rock Mines
AIR	HC vapor loss from salt mines = 70 lbs/hour HC emissions at terminal (one cycle) Filling phase: 1,058 tons Withdrawal phase: 1,386 tons	HC vapor loss from rock mine = 70 lbs/hour HC emissions at terminal (one cycle) Filling phase: 176 tons Withdrawal phase: 231 tons
LAND USE	100 acres	100 acres
WATER	Minor impacts	Minor impacts
SOCIO-ECONOMIC	Effects of construction: Direct expenditure* $108 - $180 Total employment** 3000 man-years Effects of operation: Direct expenditure* $.38 per year Total employment** 1 person	Effects of construction: Direct expenditure* $9.8 - $23. Total employment** 1400 man-years Effects of operation: Direct expenditure* $.17 per year Total employment** 2 persons

* In millions of dollars
** Includes direct, indirect, and induced employment.

TABLE V-21
CUMULATIVE IMPACTS - MAXIMUM
SUBSTITUTION OF CRUDE OIL (WORST CASE)

	Gulf Coast: 90 MMB of Crude in Existing Salt Mines	No East Coast Storage
AIR	HC vapor loss from salt mine = 70 bls/hour HC emissions at terminal (one cycle) Filling phase: 794 tons Withdrawal phase: 1,039 tons	
LAND USE	40 acres	
WATER	Minor impacts	
SOCIO-ECONOMIC	Effects of construction: Direct expenditure* $81 - $135 Total employment** 2,250 man-years Effects of operation: Direct expenditure* $.29 per year Total employment** 1 person	

* In millions of dollars
** Includes direct, indirect, and induced employment.

TABLE V-22
CUMULATIVE IMPACTS - MAXIMUM SUBSTITUTION OF CRUDE OIL (WORST-CASE)

	Gulf Coast: 700 MMB of Crude in New Solution Caverns	Gulf Coast: 210 MMB of Crude in Existing Solution Caverns
AIR	Negligible emissions from storage caverns HC emissions at terminal (one cycle) Filling phase: 6,174 tons Withdrawal phase: 8,085 tons	Negligible emissions from storage caverns HC emissions at terminal (one cycle) Filling phase: 1,852 tons Withdrawal phase: 2,435 tons
WATER	Brine disposal: Produced during solution - 5.31×10^9 bbls Produced during displacement - 6.90×10^8 bbls with oil (one refill) Area affected if brine disposed of in the Gulf during solution mining and subsequent cycling: Maximum area of $\geq$ ppt increase in salinity (assumes no vertical mixing) - 3,600 acres Water requirements: Required for solution mining - 4.36×10^9 bbls fresh water - 4.79×10^9 bbls sea water Required for displacement (one emptying) - 7.38×10^8 bbls fresh water - 6.9×10^8 bbls sea water	Brine disposal: Produced during solution mining - None Produced during displacement - 2.12×10^8 bbls with oil (initial fill) Area affected if brine disposed of in the Gulf during initial fill and subsequent cycling: Maximum area of $\geq$ ppt increase in salinity (assumes no vertical mixing) - 1,080 acres Water requirements: Required for solution mining - None Required for displacement (one emptying) - 2.21×10^8 bbls fresh water - 2.10×10^8 bbls sea water
LAND USE	910 acres	275 acres
SOCIO-ECONOMIC	Effects of construction: Direct expenditure* \$896 - \$1092 Total employment** 15,680 - 24,990 man-years Effects of operation: Direct expenditure* \$3.29 per year Total employment** 165 persons	Effects of construction: Direct expenditure* \$210 - \$315 Total employment** 1,667 - 3,334 man-years Effects of operation: Direct expenditure* \$3.7 per year Total employment** 185 persons

* All dollar amounts in millions of dollars.
** Includes direct, indirect, and induced employment.

TABLE V-23
CUMULATIVE IMPACTS - MAXIMUM
SUBSTITUTION OF CRUDE OIL (EXPECTED)

	Gulf Coast: 120 MMB of Crude in Existing Salt Mines	East Coast: 20 MMB of Crude in Existing Rock Mines
AIR	HC vapor loss from salt mine = 70 lbs/hour HC emissions at terminal (one cycle) Filling phase: 1,058 tons Withdrawal phase: 1,385 tons	HC vapor loss from rock mine = 70 lbs/hour HC emissions at terminal (one cycle) Filling phase: 176 tons Withdrawal phase: 231 tons
LAND USE	100 acres	100 acres
WATER	Minor impacts	Minor impacts
SOCIO-ECONOMIC	Effects of construction: Direct expenditure* $108 - $180 Total employment** 3,000 man-years Effects of operation: Direct expenditure $.38 per year Total employment** 1 person	Effects of construction: Direct expenditure* $9.8 - $23 Total employment** 1,400 man-years Effects of operation: Direct expenditure $.17 per year Total employment** 2 persons

* All dollar amounts in millions of dollars.

** Includes direct, indirect, and induced employment.

TABLE V-24
CUMULATIVE IMPACTS - MAXIMUM
SUBSTITUTION OF CRUDE OIL (EXPECTED)

	Gulf Coast: 625 MMB of Crude in New Solution Caverns	Gulf Coast: 235 MMB of Crude in Existing Solution Caverns
AIR	Negligible emissions from storage caverns HC emissions at terminal (one cycle) Filling phase: 5,512 tons Withdrawal phase: 7,219 tons	Negligible emissions from storage caverns HC emissions at terminal (one cycle) Filling phase: 2,073 tons Withdrawal phase: 2,714 tons
WATER	Brine disposal: Produced during solution - 4.74 x 10^9 bbls Produced during displacement - 6.19 x 10^8 bbls with oil (one refill) Area affected if brine disposed of in the Gulf during solution mining and subsequent cycling: Maximum area of ≥ ppt increase in salinity (assumes no vertical mixing) - 3,220 acres Water requirements: Required for solution mining - 3.88 x 10^9 bbls fresh water - 4.26 x 10^9 bbls sea water Required for displacement (one emptying) - 6.67 x 10^8 bbls fresh water - 6.19 x 10^8 bbls sea water	Brine disposal: Produced during solution mining - None Produced during displacement - 2.36 x 10^9 bbls with oil (one refill) Area affected if brine disposed of in the Gulf during solution mining and subsequent cycling Maximum area of ≥ ppt increase in salinity (assumes no vertical mixing) - 1,210 acres Water requirements: Required for solution mining - None Required for displacement (one emptying) - 2.38 x 10^8 bbls fresh water - 2.36 x 10^8 bbls sea water
LAND USE	812.5 acres	350 acres
SOCIO-ECONOMIC	Effects of construction: Direct expenditure* \$800 - \$975 Total employment** 14,000 - 22,312 man-years Effects of operation: Direct expenditure \$2.94 per year Total employment** 147 persons	Effects of construction: Direct expenditure* \$235 - \$352 Total employment** 1,865 - 3,730 man-years Effects of operation: Direct expenditure \$4.1 per year Total employment** 207 persons

* All dollar amounts in millions of dollars.
** Includes direct, indirect, and induced employment.

VI. MITIGATING MEASURES AND UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

In general terms the mitigating measures that were applicable to the Strategic Petroleum Reserve when the volume was established with a goal of 500 MMB remain valid for an expanded 1,000 MMB SPR. Measures having site specific application remain useful and appropriate, since the shift is not to enlarge individual sites, but to increase the number of sites to be used in the program.

The acceleration of petroleum deliveries to meet the new goals will increase the volumes of petroleum to be moved, in some cases by as much as four times, through selected marine terminals during a specific time frame. This will increase the statistical probability of accidental spillage and will increase the quantity of emissions. Both factors support greater emphasis on mitigating measures to reduce the adverse environmental impacts to a minimum.

A. Mitigating Measures

1. General Measures

a. Use of Existing Storage Space

The magnitude of the environmental impacts, or potential impacts, is generally more significant with new construction than with the use of existing facilities. The original goal for the SPR was 500 MMB, and the 370 MMB potentially available storage volume in existing facilities provided a substantial mitigating factor in the impact of the program by limiting the degree of new construction. With the planned increase to 1,000 MMB the requirements for new construction may be expected to increase by a factor of approximately four. This represents a measure of the scope and magnitude of the possible impacts on the environment created by the expansion and acceleration of the SPR.

b. Location

Since various options as to the actual sites are open, the combinations represent alternatives which, in themselves offer a very effective way of mitigating the adverse effects on the environment of the total SPR system. This flexibility exists at both the regional and local levels. In the regional approach, for example, surface facilities may be located only in those areas that do not have any appreciable seismic risk (such a difference exists in the Atlantic Coast region between the northern and southern extremes, as an example). Within local areas ecological impacts can be mitigated by locating storage site facility components and pipeline routes away from highly productive wetlands, breeding areas, nesting areas, tidal inlets and offshore banks and reefs.

In addition to flexibility in actual location, consideration of time of construction can also reduce adverse impacts. If a pipeline is to be run through wetlands, the construction can be timed to minimize disruption of breeding, nesting or migration in that area.

Once the relative impacts on specific sites and routes are determined, programs to weight the environmental advantages can be derived and translated into engineering specifications and timetables for construction.

c. Accident Risk Reduction

The risk of oil spills and attendant fire hazards are an ever-present factor in petroleum handling operations. There are practices which can be employed during the development and operation of the Strategic Petroleum Reserve sites which would reduce the risk of spills and fires. Generally, such risk reduction equipment and techniques are employed as standard practice throughout the petroleum industry. During construction at the storage caverns the risk of blowouts can be greatly reduced in some operations through the use of blowout preventers on drilling rigs. During well-workover operations, depressuring the system with strict control of potential ignition sources could substantially reduce the risk of accidents. Radiographic inspection of all pipeline welds, cathodic protection of buried pipelines and proper identification of pipeline location can greatly reduce the chances of pipeline spills.

Redundant high and low pressure detection mechanisms as well as pump vibration and high temperature detection devices integrated into the oil delivery system can greatly reduce the probability of spills resulting from equipment failure. Downhole safety valves can also be employed for certain well designs in order to reduce the volume of oil spilled in the event of major damage to the wellhead during the static storage phase of the program.

The use of specific equipment, instrumentation and operational procedures is a function of the detailed system design. As this detailed design is developed, appropriate oil spill risk reduction measures will be incorprated into the system consistent with the goals and operational philosophy of the SPR. Human error is by far the most common cause of oil spills. Proper training and close supervision of both terminal and site operations personnel is the most effective means of reducing the risk of spills caused by human error.

d. <u>Pipelines</u>

The safety and accident standards required on pipelines will be particularly beneficial in lessening the statistical probability of an event which would be destructive to the environment. Pipelines required for the storage facility have, or will have a number of features intended to avoid rupture or corrosion damage. The design is for the conditions that might be imposed by the worst storm recorded in the last century, with appropriate safety factors. The pipes will be coated externally with an asphalt-sand mixture or coal tar enamel for corrosion protection. The pipelines will also contain sacrificial zinc anodes to lessen internal corrosion.

Welding will join the pipe sections, with X-ray verification of each weld. In offshore installations the pipeline will be lowered onto the sea floor and hydraulically jetted beneath the sea bed. Safe clearances will be provided at pipeline crossings. Offshore, pipes will be lowered to provide at least three feet of clearance. Onshore, in accordance with industry practice, pipelines will be placed beneath existing lines, except where it is more practical and permissable to lower existing lines.

Backfilling of pipeline trenches will be given careful attention, particularly at beach and surf zones to avoid erosion or littoral currents which might affect the pipeline. Pipeline routes would avoid barrier islands and tidal passes which are of special importance to birds and migratory aquatic life.

Pipelaying ditches will be backfilled and spoil banks lowered to approximately the original contour to preserve the natural ground water patterns; this will minimize post-construction effects.

e. Pipeline Construction Methods

The techniques of pipeline construction selected for use with regard to the new pipelines required for the Strategic Petroleum Reserve will minimize the probable effect on the environment. The methods will vary according to the nature of the soil, the local conditions, terrain configuration, pipeline size and construction schedules.

Three basic modes will be available to meet the needs for pipeline construction, and will provide reliable methods of construction. These methods include conventional land lay for dry land construction; conventional push ditch and flotation canal. A fourth mode of construction called the "modified push ditch" has application in some wetland terrain where the water levels are either constant or predictable.

(1) Conventional Land Lay Construction

This method is applicable to dry land pipeline construction. It applies to areas where the ground is capable of supporting heavy equipment. Pipe is installed in ditches excavated by standard ditching machines and backhoes. The pipeline is assembled above the ground level and lowered into the prepared ditch. Follow-on backfill and cleanup is then accomplished by conventional construction equipment. This is a practical method in areas of higher elevations where water is not generally an impediment.

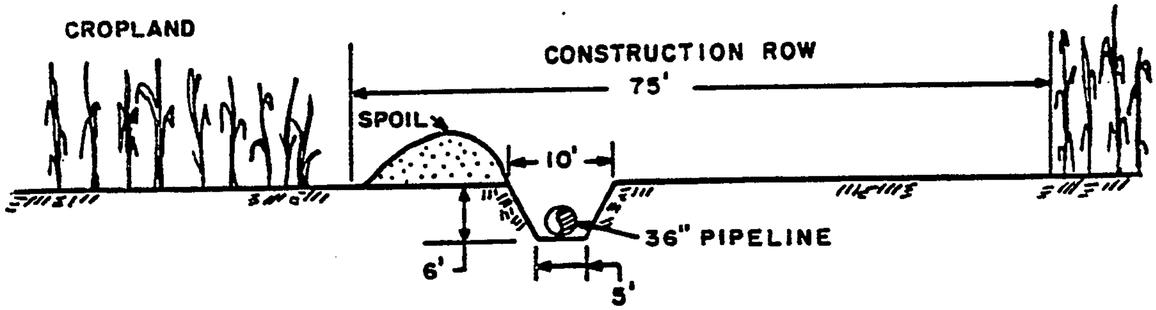
Typical conditions immediately following land lay construction, and several months after backfilling, are shown in Figure VI-1. Excavation required totals about 8200 cubic yards per mile, but backfilling will return the terrain to the original contours, and normal vegetation will return.

(2) <u>Conventional Push-Ditch Construction</u>

Where water depths are reasonably stable and predictable, including swampy areas, conventional push-ditch construction is used. Initially the right-of-way is cleared. Heavy equipment, usually working from mats, excavates a ditch of required depth. After this initial push-ditch has been prepared, an initial "push site" is excavated. The pipeline is assembled at the the "push site," including welding, inspection and pipe coating. The fabricated pipe is then moved from the "push site" and floated into place, in sections up to several miles in length, using floats to provide bouyancy. When the pipe is properly positioned on the surface of the ditch the floats are removed and the pipe sinks into position. Backfill and cleanup is then accomplished with conventional heavy construction equipment working from mats.

Typical conditions following push-ditch construction, and several years after backfilling, are shown in Figure VI-2. The average volume of material excavated is about 15-20,000 cubic yards per mile, although differing soil conditions may create variations from 8-40,000. Backfilling depends on the

A. CONVENTIONAL DRY LAND DITCH AFTER EXCAVATION



B. CONVENTIONAL DRY LAND DITCH AFTER BACKFILLING

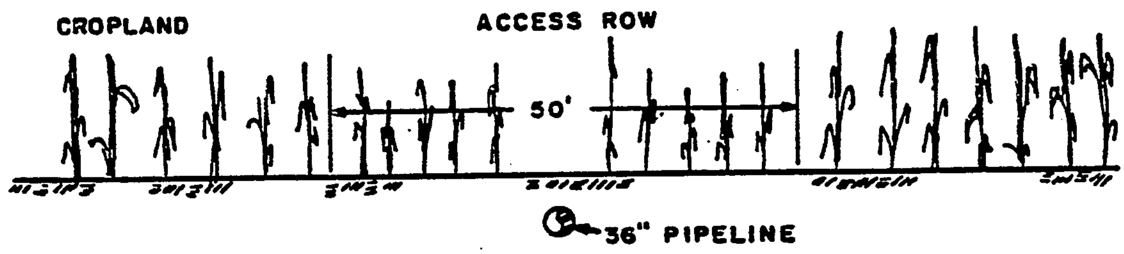


Figure VI-1. Typical Cross-Section of Conventional Dry Land Pipeline Construction After Excavation and Several Months After Backfilling.

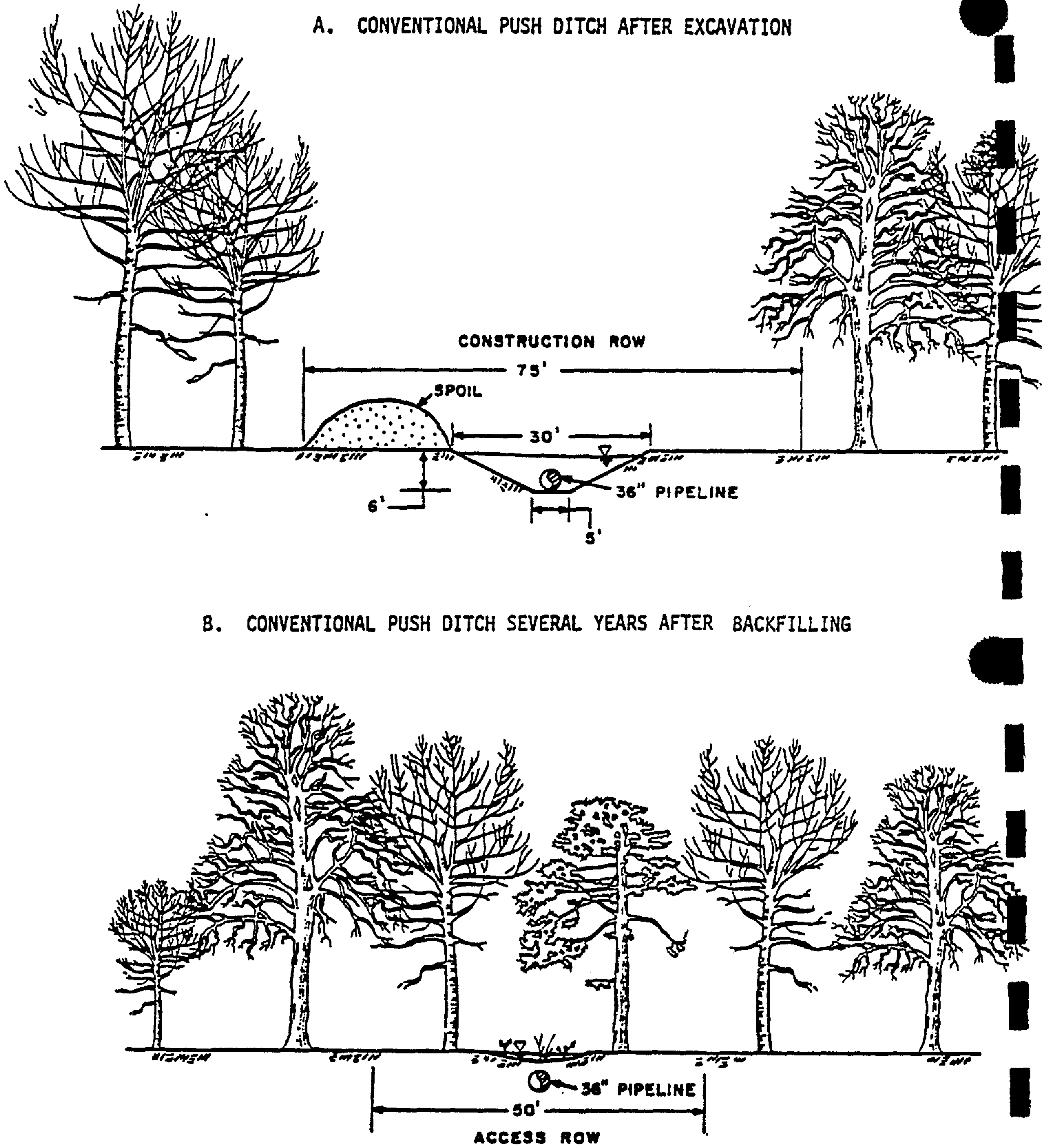


Figure VI-2. Typical Cross-Section of Conventional Push Dit
Pipeline Construction After Excavation and
Several Years After Backfilling.

nature of the material excavated. Restoration to original contours may range from a best case of near-original conditions after pipeline installation, to spoil having a liquid consistency and hence providing no backfill material at all. The reestablishment of vegetation in the construction site depends primarily on the success of backfilling.

(3) Flotation Canal Construction

Excavation of a canal of a size and depth to accommodate the barges and floating equipment required for pipeline construction and installation is required for the flotation canal construction method. The dimensions necessary to accommodate the equipment requires a water depth of six to eight feet minimum, while excavation barges are usually about 40-50 feet in width. These barges are from 150-200 feet in length, with six to eight clam bucket excavators for continuous 24-hour operation. Tugboats are used for supplying the barges; and to accommodate the maneuvering and movement, the canal must be approximately 80-100 feet in width. The spoil from the dredging is deposited on the areas alongside the canal.

The actual installation of pipeline into the canal that has been excavated is accomplished by the lay-barge method. This operation is accomplished on the deck of a lay barge (40 feet in width and up to 400 feet in length), lowering sections into the canal after preparation. The flotation canal is not backfilled after the pipe is installed. Normal water flow and access to the flotation canal is controlled by the selective installation of plugs (across the canal) to prevent waterflow, and barriers ("fence" which is parallel to the canal) which remains intact until maintenance may be required.

Typical conditions following flotation canal pipe installation and several months after bank stabilization are shown in Figure VI-3. The average volume of excavation is about 130-165,000 cubic yards per mile. A 120 to 140 foot construction right-of-way and 15-50 foot permanent access right-of-way are typical. Terrestrial vegetation is excluded from the pipeline canal, while the spoil banks will support grasses, shrubs, cottonwoods and willows.

Where there is an existing pipeline canal with space available along one bank it is often possible to widen the older canal, rather than excavating a separate parallel canal. This would moderate the amount of excavation per mile to about 40,000 cubic yards. Typical conditions after expansion, and then after several years are shown in Figure VI-4.

(4) Pipeline Construction at Crossings

Where pipelines cross either highways or railroad right-of-way, the crossings will be bored under the roadbed to preclude the interruption of normal traffic. Where local roads are crossed the pipeline will be projected by either boring or open trench. If trenching is selected, only one half of the road would be opened at one time to permit the normal movement of traffic during the construction operation. In settled areas there would be additional provision to preclude interference with both pedestrian and vehicular traffic. Where the excavated material cannot be piled along the ditch it will be hauled away, and where essential, the ditch would be bridged temporarily with steep plates to maintain traffic flow while the pipeline is being installed.

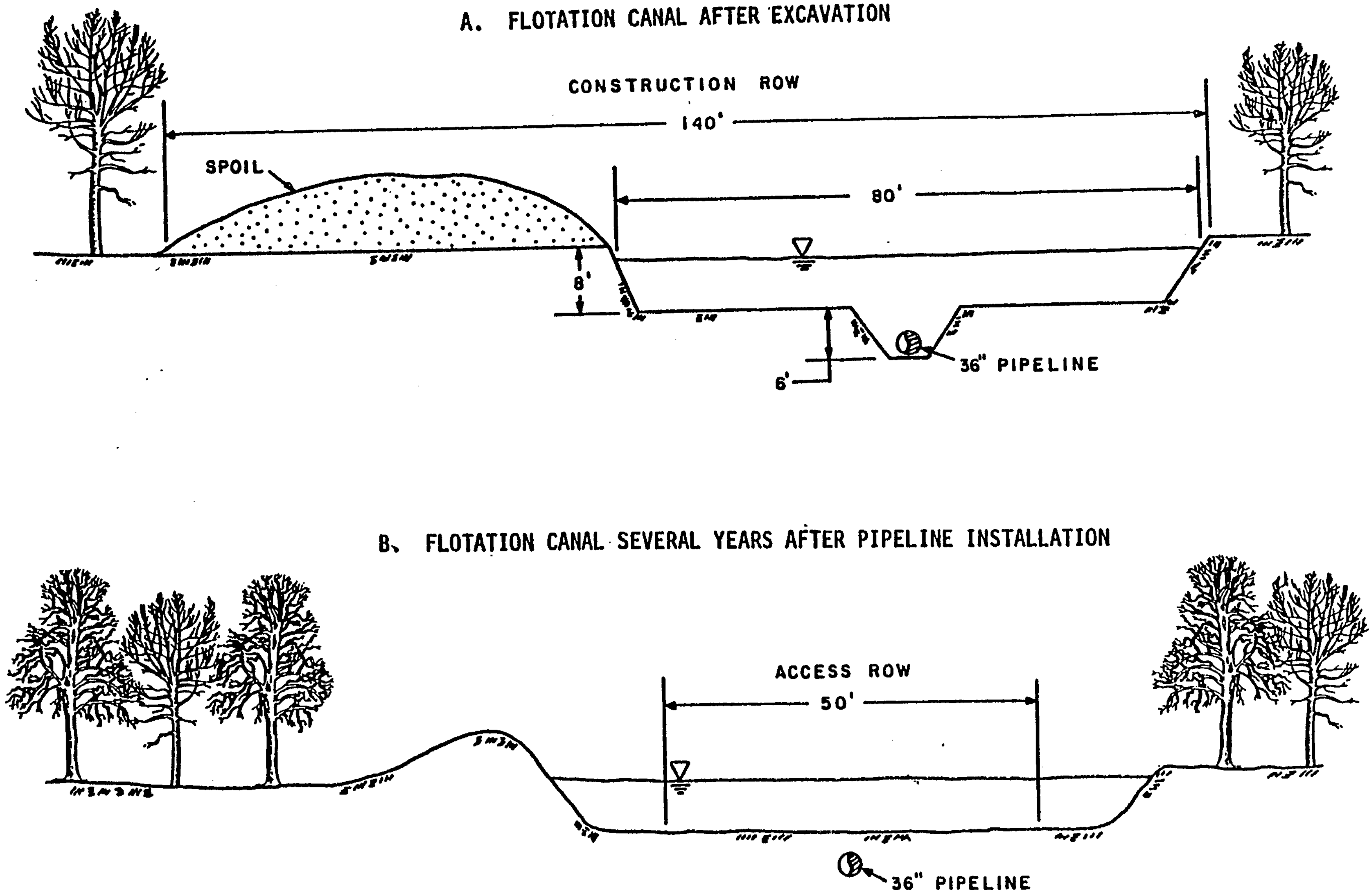


Figure VI-3. Typical Cross-Section of Conventional Flotation Canal Construction After Excavation and Several Years After Pipeline Installation.

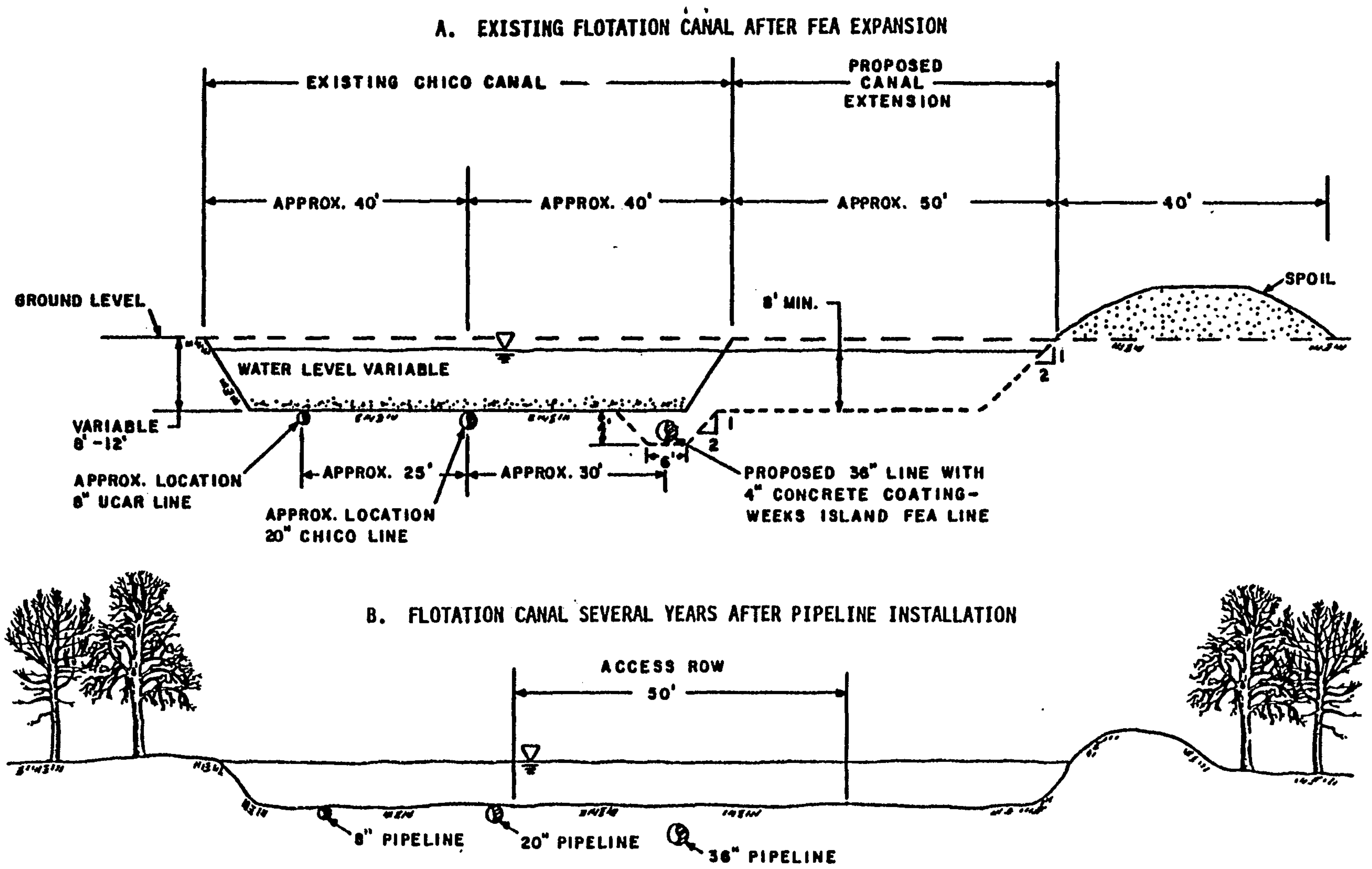


Figure VI-4. Typical Cross-Section of Conventional Flotation Canal Expansion of Existing Canal After Excavation and Several Years After Pipeline Installation.

Special measures will be used at points where the pipeline would cross streams and rivers to control potential environmental impacts during the construction phase. Usually it will be necessary to excavate or dredge a trench into which the assembled pipeline would be placed where the line crosses a river. For smaller streams the actual construction techniques would vary, according to the volume of flow and the conditions of the streambed. To minimize interruption of the stream flow and turbidity, the stream may be temporarily diverted or passed along the pipeline trench by means of a flume or conduit. Backfills into these streams would be the original material.

Where major streams, those greater than 100 feet in width, are crossed, the installation would normally be open trenching using dragline dredges operated from the banks, or excavating equipment operated from barges. Excess excavated material would be deposited in a spoil area, usually on the stream bank, but selected and approved with consideration of possible environmental impact.

Where there are major crossings of streams or canals, it is estimated that an area of about 170 acres would be required for equipment access, pipe storage and temporary spoil storage.

Where a stream has a silt or clay bottom, there would be no excavation until immediately before the actual pipe-laying operation. After the ditch is open the concrete-coated pipe is pulled into the trench by cable from the opposite bank until it spans the stream. The ends are plugged during this portion of the operation to prevent water from entering the pipe. Where the stream channels are relatively unstable, or where future channel widening is planned, the horizontal run of the pipe is extended well into the banks of both sides. Pipe under the stream would have a minimum of five feet of cover below the maximum depth of the river bottom or scour.

Equipment crossings of soft bottomed streams are usually done using causeways constructed of the most suitable locally available materials, and with an elevation equal to or slightly higher than the normal water level. Where the possibility of causeway erosion exists, normal erosion control methods are applied.

f. Accident Prevention

The design of all equipment, all buildings and all facilities is in strict accordance with Federal, state and local standards. Monitoring systems and inspections will insure operation within safe limits, including pressures in the pipelines. Pumping equipment will be protected from the effects of temperature, pressure and vibration damage by sensors which have an automatic shut-down capability. All pipelines will be coated, both externally and internally to minimize corrosion. Peaking electric generators will provide power in the event of a utility system power failure.

g. Rock Disposal

Rock excavated during the construction phase represents a potential degrading influence. To the extent practicable, this rock will be sold commercially for use as aggregate in construction, thus lessening the impact that rock debris might be expected to create. The sites selected for disposal of rock debris must reflect efforts to minimize the effects on both surface and subsurface water supplies.

2. Geology

Control of the total volume of salt domes excavated insures that the proportion of cavity to remaining structure mitigates against accidental acts or events which might impact on the environment. During operation, oil that would be removed from the cavities would be replaced with water, thus mitigating against collapse or other accident to the cavity.

3. Hydrology

a. Brine Disposal

Detailed geologic and hydrogeologic reconnaissance, subsequent proper siting and spacing of disposal wells, and specialized injection well design matched to expected aquifer performance will minimize the number of injection wells and the environmental consequences of deep-well disposal of brine. With dynamic pressure monitoring and positive control over injection rates and wellhead pressures, dangerously high pressure gradients may be completely avoided. Properly conducted disposal into saline aquifers is essentially a safe environmental practice.

For brine disposal in the Gulf, the primary measure for mitigating impacts is the placement of the outfall diffuser and the resultant orientation of the plume under all reasonable ambient conditions. By avoiding reefs and banks that are known to support abundant, diverse marine biota and by not obstructing tidal inlets with the salinity plume, adverse ecological impact will be restricted to the immediate vicinity of the diffuser. A large distance between the shore and the outfall will serve as an additional buffer against environmental damage. The brine diffuser will be sited and designed to provide minimal physical obstruction to those normal activities that take place in coastal waters.

b. <u>Sediment Production</u>

The amount of sediment produced and the consequences with respect to stream siltation may be minimized with sound, available erosion and sediment control practices. The methods suitable for accomplishing this must be evaluated on a site-by-site basis but generally will include avoidance of potentially difficult areas, diversion of runoff, vegetative buffers, and stabilization and sediment trapping by vegetative filters and detention (or retention) basins.

c. <u>Dredging</u>

The adverse impacts of dredging may be mitigated and localized to the removal and disposal sites by good engineering practices, especially by proper disposal site selection to minimize ecological impacts and by prior characterization of the dredged material as to its toxicity to aquatic organisms.

d. <u>Water Use</u>

The large volumes of water to be used in constructing and operating solution mined-cavities cannot be reduced. However, the impact of this water use can be largely mitigated by using water of poor quality, i.e., high salinity. The Gulf of Mexico represents an essentially unrestricted source of saline water. Large amounts of saline ground water are available in storage and it is not likely that this water would have competing uses during the course of the program. Storage of saline surface water in brine ponds may also be used to provide the required water supply.

e. Aqueous Discharge

Aqueous wastes associated with aboveground tankage consist of tankage condensates and rainwater runoff. The impact of aqueous wastes on the environment is minimized by waste water containment and proper disposal. Tankage condensates are stored in a closed vessel and delivered to a waste disposal company. Rain runoff water is retained within the diked areas until absorbed or evaporated.

4. Meteorology and Climatology

Tankage and other above-ground appurtenances will be constructed out of or above the hurricane tidal surge zone. Permanent buildings will be constructed to withstand maximum wind loads occurring with a one hundred year frequency.

a. Air Quality

No significant impact on the air quality in the Gulf Coast region will occur from construction, filling, or operation of subsurface storage facilities for the expanded SPR. The associated tanker loading and unloading, under worst-case meteorological conditions, is predicted to cause local and temporary violations of Federal hydrocarbon standards.

b. Pressurized Underground Storage Space

To reduce the explosiveness of the vapor space in mined storage facilities containing volatile products or crude, the vapor would be allowed to build to a pressure greater than atmospheric at which point the vapors would be vented to the atmosphere. The elimination of hydrocarbon emissions may then be accomplished in one of two ways. As one alternate method, a temporary flare system may be used. A second alternative would provide for the vented vapors to be directed through a condensation unit on the surface, and the condensed liquid returned to the storage caverns.

c. Air Residuals of Aboveground Tankage

Mitigating measures available in the design of above-ground tankage can be divided into four categories, those applicable to the construction, filling, static storage, and the withdrawal phases.

(1) Construction

Air residuals generated by the construction of above-ground tankage were identified as dust from earth-moving operations, fine particulates from sandblasting, and hydrocarbon from spray-painting. Dust generated by earth-moving operations can be greatly reduced by dampening the ground regularly. Tank sandblasting operations are not readily controllable; however, alternative grinding techniques may be available which generate fewer fine particulates. Hydrocarbon emissions from spray painting operations can be reduced by using high density primers and paints which reduce the required number of coats, and therefore the hydrocarbon emissions, by potentially 50 percent.

(2) Filling

Floating roof tanks are to be used for the expanded SPR. As there is virtually no vapor space between the liquid surface and the roof, little hydrocarbon vapor will be displaced during filling operations.

(3) Static Storage

During the static storage period there will be small amounts of standing storage loss around roof seals. These standing storage emissions can be reduced by designing the storage tanks with a large height to diameter ratio; by painting the tanks with a heat-reflecting white paint; by using double tight-fitting seals around the roof; and by periodic regular maintenance on the roof seals to insure adequate functioning.

(4) Withdrawal

As floating roof tanks are to be used for the expanded SPR, hydrocarbon emissions will occur in the withdrawal phase due to wetting losses as the roof level drops, leaving the tank walls coated with a thin film of oil. This withdrawal loss is generally very small for the type of steel tanks intended for use in the SPR. No control measures have been proved to be effective.

Other emissions occurring during emptying operations are associated with the combustion products generated by the steam boiler. Steam is required to liquify residual oil. Major combustion emissions are particulates, sulfur oxides, and nitrogen oxides. Under most conditions these emissions will have negligible impact. Nitrogen oxide emissions can be reduced through combustion modifications, and sulfur oxide emissions can be reduced by burning a lower sulfur fuel.

d. Marine Tanker Operations

The hydrocarbon vapor emissions occurring from unloading and loading marine tankers have been shown to have the largest air impact. Several measures for prevention of these impacts are described below. Because of cost limitations, some of these measures may only be feasible for new tankers.

(1) Unloading Operations

Emissions are caused by ballasting subsequent to unloading. One method of reducing in-port emissions from ballasting would be to take on less water in port. Also, tankers which have segregated ballast tanks could be used. These tankers use separate tanks for ballast and oil cargo storage. The number of this type of ship available for use in the proposed program is thought to be small.

Another emission prevention method would be hydrocarbon vapor control equipment. Hydrocarbon vapors are collected on-board the tanker and piped to on-shore recovery or disposal equipment. Refrigeration, absorption, and incineration are the most likely control devices used on-shore. Incineration, although having an effective control efficiency of over 99 percent, is a potential hazard due to explosion.

(2) Loading

During loading, hydrocarbon emissions from tanker cargo tanks occur by the displacement of vapor-rich air by in-coming crude. Emissions can be prevented by two methods. The first is to purge empty tanks at sea so as to remove hydrocarbon vapors. Two forms of this clean-up operation are heel washing and butterworthing. Heel washing removes puddles of oil left from the previous cargo shipment after unloading. Butterworthing is the washing down of tank walls. It is estimated that these housekeeping activities could reduce in-port filling emissions by over 50 percent. The second means of emission prevention is to employ vapor control equipment as described for unloading operations.

5. Biology

Use of the most recent technology during the construction of the facilities can be an important step toward mitigating adverse effects on the biological ecosystem. This is particularly true where dredging in marshes or waterways is required. Proper use of a hydraulic dredge reduces turbidity effects which are detrimental to aquatic biota.

Where waterways are used by migratory species such as shrimp, activities such as dredging in the waterways could be scheduled to avoid the migration season as much as possible.

Efforts should be made to revegetate areas where the soil has been excavated for the construction of roads, dikes, pipelines and other facilities. Where herbicides might be used to control growth of undesirable plants along pipeline or transmission line rights-of-way, care will be taken to use the minimum amount necessary.

6. Noise

Construction noise levels will be kept as low as practical through proper maintenance of exhaust systems and through adherence to OSHA standards. Personnel will be protected in their work environment according to established OSHA noise level standards. For sites near inhabited areas, it may be necessary to institute a noise reduction program with installation of noise abatement designs.

7. Historical and Archaeological Resources

Mitigation measures could include professional salvage of a site to preserve a meaningful record of its existence or selection of an alternate location for the undertaking. Should there be no feasible or prudent alternative, the procedures for the protection of historic and cultural properties contained in Federal laws will be followed.

It is the expressed policy of the ESR and SPR Programs to utilize only those sites and rights-of-way that do not affect historical and archaeological resources listed in or eligible for inclusion in the National Register. FEA will conduct a survey of such resources of each site, and will request review and concurrence from appropriate Federal and State agencies if utilization is essential.

8. Land Use and Related Planning

Adverse impacts on the use of lands adjacent to the oil storage sites can be largely avoided by careful selection of the sites. Underground storage will be built primarily in rural areas and once constructed, will not significantly affect the surrounding land use. The primary efforts in mitigating adverse effects will be where tanks, transmission lines, and pipelines are to be constructed.

Wherever possible, existing rights-of-way can be used for both the proposed pipelines and the necessary power transmission lines. As much as possible, routes will be chosen that will not require the removal of homes or businesses.

State and regional planning commissions will be consulted to determine whether the anticipated growth of residential and commercial areas will engulf portions of the right-of-way during the next 20 to 25 years. Where practicable, the rights-of-way will be planned to remain outside of such areas, but where it cannot be avoided, the rights-of-way in urbanized areas will be landscaped and maintained in such a way that they will not degrade the value of adjacent properties.

a. State Land Use Programs

Each state planning office will be able to review the proposed plans for oil storage facilities in that state prior to the finalization of designs and right-of-way selection. Often there are a number of state agencies that have jurisdictional interests related to land use although land use planning is not specifically a part of their function. Those agencies empowered to protect the fish and wildlife resources of an area will be consulted to that such valuable and fragile environments as shellfish beds, fish and waterfowl breeding and nursery areas, and the habitat of rare or endangered species can remain unaffected by the project.

Construction practices recommended by state agencies to protect the land from unnecessary erosion will be followed. This includes such actions as seeding and placing sod on slopes where natural vegetation has been removed, and placing barriers across channels cut through wetlands for laying pipelines.

b. Storage Site

Disruptions to the use of lands around the storage sites will be due primarily to noise created by the pumps and drilling rigs, the visual impact of massive storage tanks, and the deposition of excavated rock from new mines. These impacts can be mitigated by the purchase of sufficient land around the facilities to act as a buffer between the site activities and surrounding lands. Trees and undergrowth in this buffer area can reduce the noise emanating from the site and mitigate the visual impact of the storage tanks.

Where excavated rock must be stockpiled near the storage facilities in new mines, the rock can be covered with soil, landscaped, and seeded. This will help stabilize the landfill area, control sediment runoff from the rock that would be deposited as silt in streams near the site, and mitigate the impact of having to stockpile the rock on the existing landscape.

9. Control and Cleanup of Spilled Oil

A principal criterion governing storage system operational procedures is the need to prevent chronic or major releases of oil to the environment. Efforts will be made to educate personnel and to supervise, monitor, and improve operations to prevent any accidental releases of oil.

An oil spill contingency plan will be developed which outlines response activities and areas of responsibility in the event an oil spill accident or leak should occur. The plan objective is to deploy the proper equipment as quickly as possible for containment of the oil, to recover the oil as efficiently and completely as possible, and to clean up impacted areas to restore the original condition, insofar as practicable.

a. Spill Prevention Control and Countermeasure Plan

Spill Prevention Control and Countermeasure (SPCC) Plans are being developed in accordance with Federal law for all facilities in the SPR Program. The objective of an SPCC is to prevent discharged oil from reaching both the surface and navigable waters of the United States. The Plan will contain a description of the facility and its operation, control and alarm systems for leak detection, security measures against unauthorized entry into the facility, the spill prevention systems (dikes, retention basins, drip pans) at on-shore and non-production systems, record keeping and inspection procedures, and training of operating and maintenance personnel. The training is particularly important since on-site personnel will be able to significantly limit the quantity and extent of a spill in most cases. In the case of the SPR program, supervisory personnel will be trained prior to facility start-up. Emphasis will be placed on the SPCC Plan, and in the case of operating supervisors, operational procedures, safety and spill prevention is stressed. Maintenance supervisors will also concentrate on preventive maintenance. Supervisory personnel will receive monthly refresher courses, and in turn, will instruct remaining facility personnel.

b. Oil Spill Contingency Plans

An oil spill contingency plan, developed in accordance with Federal law, is an integral part of an SPCC Plan at facilities where an oil spill can reach navigable waters.

Oil Spill Contingency Plans are defined as a predetermined sequence for communications and actions in the event of an oil spill. The objective of such a plan is to prevent an on-land spill from reaching water, or in the case of a water-based spill, to contain, remove and minimize contamination of the water body. The plan covers items such as internal alert procedures wherein the personnel discovering a spill notify the "person in charge" at the facility. Procedures are also delineated for notification of regulatory agencies by the "person in charge."

The role of the On Scene Coordinator (OSC) is defined. The OSC is responsible for spill countermeasures at the site, and may be from the facility management, industry, or a governmental agency. The OSC directs the deployment of available equipment and personnel for containment, cleanup and restoration, and serves as a focal point for all phases of these operations. The contingency plan contains a list of predesignated On Scene Coordinators, one of whom is always available.

Control and cleanup procedures are also addressed. In this regard, the plan stresses identification of the product and quantity spilled, the status of containment, potential hazards to health and the environment, and a description of the spill site. These actions are necessary if the proper response equipment and personnel are to be mobilized. Restoration of the spill site is also delineated. The OSC and the regulatory agency determine the extent of this action which can take the form of replacing sand on contaminated beaches, to the removal of contaminated debris.

The contingency plan also contains information on predetermined disposal sites for contaminants and debris collected during cleanup. A comprehensive inventory of on-site spill resources (equipment and manpower) in addition to the resources of local and regional entities that can be called in. Public relations and information procedures are also stressed in a contingency plan as a vital part of the cleanup process.

c. Operations Manuals

Operations Manuals, as required by Federal law, will be prepared for "large oil transfer facilities" (onshore and offshore) where oil is transferred in bulk from a vessel of 250 barrel capacity or larger. As such, the SPR terminals will file Operations Manuals with the U.S. Coast Guard. This document contains a detailed description of the facility, its methods of operation, equipment and personnel, emergency shutdown systems, the quantity, location, instructions for use of spill containment equipment, in addition to specific procedures for each phase of a loading/unloading operation. A spill contingency plan is also an integral part of the manual.

d. Salt Marsh Cleanup

Coastal salt marshes are generally highly productive ecosystems supporting breeding populations of fin and shellfish, often serving as nursery areas for the larval and juvenile stages of these forms. The proximity of salt marshes to various phases and elements of the SPR program makes these systems vulnerable to oil spillage.

Westree (1977) identified three general types of salt marshes along the coastal United States: (1) Spartina marshes; (2) saltbush marshes; and (3) mangrove marshes. The Spartina marsh is characterized by tall grasses in waterlogged soil frequently innundated by tides, containing brackish to saline water. The saltbush marsh contains low-growing or prostrate vegetation growing on an occasionally waterlogged soil occasionally innundated by tides, with highly saline water. The mangrove marsh generally consists of trees or shrubs in a soil that is frequently water logged, or is subject to tidal innundation. It normally will have brackish to saline water. With the exception of mangrove marsh, all three types occur along the Gulf and East Coasts (mangrove marsh in Florida).

Westree recommended five approaches to oil spill cleanup in these marshes. Low pressure water flushing was recommended for all types of oil spills in all three marsh situations since the technique provides physical transport and dilution of the oil. Depending upon the amount of effort required for recovery and the availability of disposal sites, sorbents were also recommended. A third method is cutting of vegetation, primarily in Spartina marsh, while saltbush marsh was considered as somewhat tolerant of cutting, and mangrove marsh was assessed as intolerant of this practice. A fourth alternative discussed was burning off the marsh vegetation, although this was considered applicable to only the Spartina marsh and then only in the dormant season. A final alternative was the "do-nothing" approach which would be feasible when the spilled oil was non-viscous and adhering well to vegetation with no threat of recontamination by tidal flushing, and when waterfowl use was minimal and other wildlife was not endangered.

Cutting marsh grass has been successfully applied to oil contaminated salt marshes following the 1976 Chesapeake Bay oil spill (1977), and along the Hackensack River following a spill in 1976 (HE-164; RO-001). Hershner and Moore (1977) found good recovery of Spartina following cutting, which they felt was aided by the fact that the spill occurred during the dormant winter season. Mattson, (1977) recommended cutting if it could be accomplished quickly during the early phases of cleanup, having found less regeneration of grasses cut late in the New Jersey cleanup operation.

e. Bacterial Degradation and Other Biological Processes

Kator and Herwig (1977), following microbial responses to fresh and artifically weathered south Louisiana crude spills in experimental plots of a mesohaline salt marsh off the York River (Virginia), found that within a few days after the spill the levels of petroleum degrading bacteria rose by several orders of magnitude compared to a control plot. The bacteria remained at high levels, relative to controls, for one year following the spills, while the bacterial levels in the weathered crude plots were statistically higher than in the fresh crude plots, (KA-144).

Lee (1976) noted that biological degradation of oil in sediments could be attributed to microfauna, meiofauna, and macrofauna (LE-001). Microbial degradation is apparently more rapid at the soil-water interface than in the subsurface, and the rapidity of degradation depends, to some degree, on the concentration of high molecular weight aromatics in the soil. The Meiofauna, interstitial copepods, nematodes, turbellarians and polychaetes, presumably function in hydrocarbon degradation although the contribution of this group has not been fully explored. Macrofauna (benthic crustaceans, molluses, large polychaetes and spinculid worms) may function in petroleum degradation by reworking the lower sediments exposing the hydrocarbons to water and bacterial action. Lee noted that sediment oil uptake has been demonstrated by brown shrimp (Craugon craugon) and by the spinculid worm Phascolosoma agassizi, and also by certain polychaetes.

f. Costs of Oil Spill Cleanup

Roland (1977) reported the cost of cleanup operation following the 1976 Chesapeake Bay oil spill at about $400,000 with a recovery of 167,000 gallons of oil (RO-001). Extensive beach and marsh cleanup was required following the spill which contributed to the cost. On a recovery basis, the cost associated with this spill amounted to approximately $400 per barrel.

g. Summary of Spill Removal Techniques

Current guidance in Federal Regulations for removing spilled oil emphasizes the timely and effective use of mechanical/ manual methods and judicious use of sorbents (agents used to absorb oil on a floating mass for subsequent collection and removal) that minimize secondary impacts. A variety of other treating agents have been used effectively in the past to control oil spills. These include:

- Burning agents are chemicals or other materials which assist ignition or enhance combustion of spilled oil.

- Dispersants are chemicals forming oil-in-water suspensions.

- Biodegradants are substances that promote oxidation of oil by bacterial action.

- Gelling agents are chemicals that form semi-solid oil agglomerates and facilitate removal.

- Herding agents are chemicals that concentrate the spilled oil in a small area.

However, the use of these chemical treating agents is now carefully regulated as their secondary effects can also be adverse, and they may be employed only on a site-by-site basis after evaluation and authorization by the Federal response team.

h. Containment and Cleanup at Terminal

In the past, routine operations in terminal areas caused chronic, low-level oil pollution from small spills. While industry has substantially ameliorated such conditions in recent years, the potential for small oil spills at terminal areas is still relatively high, and containment and removal equipment will be required to be on-site, ready for immediate deployment should oil be spilled.

In addition to booms and pneumatic barriers, there are other methods of controlling and collecting spilled oil. Skimming devices scrape oil off the water surface or force it along rotating elements (plates, disks, belts, etc.) from which it can be recovered. Vortex generating devices to separate oil and water have been developed. Magnetic liquids can be added to the oil, and recovery by magnetic pick-up devices is then possible. One of the most promising of all these collection devices for use in offshore terminal harbors appears to be a skimmer boat using an inclined plane. As the collection boat moves through the water oil and water-in-oil emulsions are forced along the moving plane. When the oil-water mixture reaches the collection well it is pumped to an auxiliary collection tank.

Using known containment and cleanup techniques, it appear that control of small oil spills from ships in a terminal can be effective. Control should be a relatively minor problem if terminal site selection and design incorporates environmental considerations for proper functioning of existing oil spill containment and removal devices.

i. Containment at Sea

Although it is recognized that containment and recovery of spilled oil at sea is highly desirable, no system is now available that is applicable to the possible range of oil spill sizes. Wave heights of six to eight feet and currents greater than one knot are conditions which commonly occur at sea and which have caused considerable difficulty in containment and removal of spilled oil.

Current experience and reports indicate that presently available containment barriers (booms) are ineffective in currents greater that one knot, and in six-to-eight foot high waves; large removal devices have yet to be systematically developed and evaluated for efficient designs; and dispersants (although economic and effective in heavy seas) are toxic, and their use must be restricted.

Laboratory tests of the toxicity of various dispersants show the newer compounds to be less toxic than those developed some years ago. National environmental authorities maintain, however, that there is a significant difference between data generated in a laboratory and occurrences that result in field situations. The effects of a dispersant on marine life are partly due to its concentration in the water column. Efforts are being directed towards developing application equipment and techniques that will assure that concentrations of the dispersant do not exceed acceptable limits. Much research remains to be done to determine toxologically safe dispersant agents, proper application techniques, and conditions under which the use of such dispersants is environmentally acceptable. Use of oil dispersants will probably be an option available for cleaning up oil spills, but the primary emphasis is currently on methods of containment and recovery of the oil. Past experience indicates that a spill of 30,000 tons or larger could not be contained in the open sea. Depending on local conditions and proximity to shore, such a spill could conceivably reach shore before it could be contained.

j. <u>Containment at Coastal Inlets</u>

Bays, lagoons, and many estuarine areas along much of the Atlantic and Gulf Coast are naturally protected by barrier beaches. Various inlets penetrate the barrier beaches and provide passages for spilled oil to enter estuaries or lagoons.

In the event that oil from a major spill approaches the coast, it would be desirable to seal off the inlet(s) involved with containment booms. Thus, oil would be kept out of the most ecologically important areas with a minimum effort. However, should oil reach a barrier beach area far from an inlet, natural longshore sand transport processes would tend to eventually move the contaminated sand along the shore until an inlet is reached. From there, it could spread to the estuary or adjacent wetland area.

k. Beach Cleanup

When oil comes ashore, pronounced economic and ecological damages usually result. In many cases of offshore spills, complete removal or dispersal of the oil will be impossible; therefore, methods and procedures for beach restoration must be available. When a spill occurs and oil washes ashore, it accumulates along the shoreline and may contaminate vessels and shore installations. On beaches, the main impact is aesthetic and the immediate remedy is physical removal of the oil-contaminated sands.

Oil contamination of beaches usually causes one or both of the following situations.

1. Beach material becomes uniformly contaminated with a thin layer of oil up to the high tide mark and/or deposits of oil dispersed randomly over the beach surface. Oil penetration is usually limited to approximately one inch, unless dispersants have been used.

2. Agglomerated pellets of oil-sand mixture or oil-soaked material such as straw and beach debris are distributed randomly over the surface and/or mixed into the sand.

The choice of restoration methods depends upon the economic and recreational value of the area and the urgency of returning the area to "normal" conditions. A highly developed resort complex, where a large proportion of the area's economic activity depends upon retaining the attractiveness of the beach, will require implementation of cleaning methods chosen more for their quickness than for their cost. In other instances, where the shoreline is mainly valued for its view, the presence of contaminants on the beach will not be so critical and restorative techniques of a slower, less costly nature will be found adequate.

In conclusion, it appears that the most effective beach-cleaning methods available under the current state-of-the-art:

- For rocky areas: sandblasting and/or steam cleaning.
- For sandy beaches: removal of the top oily layer of sand entirely or screen-separation where the contaminant occurs in lumps or nodules.
- Disposal of debris in approved areas.

Other methods of cleaning contaminated sand that have been tried include froth flotation cleaning at an estimated cost in pilot operations of 50-70 cents per ton of sand cleaned and hot water fluidization, a method that has not been successful.

1. Biological Decomposition

Another strategy for dealing with an oil spill, often the only feasible one where a relatively small spill has reached shore in a remote area, is to leave the spilled oil to be decomposed by biological processes. Bacteria have an important role in removing oil from the sea, shore and wetland areas. Bacterial oxidation can proceed as much as ten times as fast as auto-oxidation and there is no doubt that bacteria can utilize a variety of hydrocarbons. In general, however, bacteria cannot degrade the heavier aromatics and branched hydrocarbons such as those found in residual oil. Also, bacterial decomposition is slow, permitting an oil slick to spread over a large area.

Micro-organisms capable of decomposing petroleum occur in the ocean, especially in near-shore areas subject to frequent oil spills. Under laboratory conditions, normal marine bacteria have been observed to decompose nearly 60 percent of added fuel-oil in 8 weeks. Light oils are oxidized more rapidly than heavier ones and paraffinic (aliphatic) hydrocarbons more rapidly than aromatics. Decomposition proceeds most rapidly at higher temperatures and in the presence of abundant oxygen. On-going work at the Virginia Institute of Marine Science indicates that petroleum-degrading bacteria also become abundant in salt marsh sediments after oiling.

Anaerobic degradation occurs at a much slower rate. This process also depends on the availability of nitrates, phosphates or sulfates which are sources of oxygen for anaerobic bacteria.

The final products of aerobic oxidation are carbon dioxide and water. Many of the intermediate products are water-soluble and almost all are readily susceptible to further attack by micro-organisms commonly present in coastal waters. Some of the intermediate decomposition products may themselves by deleterious to marine organisms.

Intermediate products of degradation, as well as the bacteria themselves, provide support for many higher micro-organisms, protozoa, fungi, and lower algae. Many ciliates occur among oil droplets, some with oil in food vacuoles, and an increase has been noted in the numbers of protozoans following that of oil-degrading bactria in polluted waters. The small polychaete _Ophrytotrocha_ burrows into weathered oil, presumably to feed on the bacteria.

Larger animals contribute directly to oil removal, although they probably do not actually digest oil. Limpets (Patella), which exist in great numbers along the coasts of the United States, can scrape weathered oil from rocks during their normal browsing. Oil then appears in the feces, mixed with rock fragments and plant debris, while the limpets are apparently unharmed. Some three to four months after a fairly severe oil spill, parts of the Cornish shore were cleared of oil except for a band deposited above the highest level beyond which limpets could not feed. On the worst-affected shores in Cornwall, England, after the _Torrey Canyon_ wreck, all limpets were killed by emulsifier spraying. Chitons, which occupy a similar ecological niche to limpets but are nearly twice as large, removed much of the fuel-oil spilled from the stranded _General Colocotronis_ from limestone beaches in the Bahamas.

m. Costs of Oil Spill Cleanup

Historically, oil spills have contaminated the environment to varying degrees depending on the quantity of the oil spilled, location, weather conditions, and a variety of other variables. Oil can dissipate quite rapidly through evaporation, wave dispersion, or sinking. However, once the oil comes in contact with the shoreline it tends to stick or be absorbed by grasses, sand, or rock. Data of actual oil spill incidents were reviewed to obtain an approximate estimate of cleanup costs. The cost data are highly specific to the particular incident; therefore, a range of possible cleanup costs was developed rather than a specific value. This range of costs results from selected incidents which represent a wide variation in oil spill variables.

Cleanup costs include all attempts or actions to salvage, contain, remove, or cleanse oil on the surface of the water, shore, or private property. Costs also include, where appropriate, removal of oil from a damaged vessel which posed a threat to the environment.

There is a wide variation in the cleanup cost per barrel of cargo. In the World Glory mishap, where no shore contamination occurred, the cleanup cost was comparatively low, at about $1.00 per barrel. However, for the Santa Barbara offshore leak, cleanup costs were nearly $50 per barrel due to the heavy oil contamination of beach and harbor areas in Santa Barbara and Ventura, California. Thus, the estimated oil spill cleanup costs range from a minimum of $1.00 to perhaps $50 per barrel, or $7.00 to $350 per tanker DWT. For the complete loss of cargo from a 400,000 DWT tanker the cleanup cost may range from a minimum of $2.8 million to as high as $140 million if all the oil damage was concentrated on valuable beach property areas. Generally, the cleanup cost per barrel is smaller as the amount of oil spilled becomes larger, so the $140 million cost figure would apply only in a particularly unfortunate set of circumstances.

The above comparison pertains to actual data from relatively large unintentional oil spills. There is some indication that smaller spills (less than 5,000 gallons) in waterways and harbors are more expensive to clean up on a per-barrel basis. A recent study indicates an average cleanup cost of about $4 per gallon or $168 per barrel on spills between 500 and 5,000 gallons (US-124). Other sources indicate small spills can cost as high as $1,000 per barrel for cleanup. These smaller spills are generally related to tanker operational discharges and cargo transfer accidents.

10. Mitigating Effects of DOE Planning

As described in Section II.G., DOE environmental planning spans site development and operation as well as oil procurement and transport. Environmental specifications for site design, construction and operation are documented in the Programmatic and Site Environmental Action Reports. Environmental operational procedures for the prevention, containment and clean-up for oil spills are documented in the Spill Prevention Control and Countermeasures Plan, and the contingency plan developed for each site. The previous sub-section describes these plans. Environmental criteria for the transport of crude oil will be contained in carrier-contracted stipulations.

These environmental specifications, procedures and criteria have been promulgated in response to identified environmental impacts or concerns. When implemented, these requirements will mitigate or avoid environmental impacts consistent with the environmental policy of DOE Strategic Petroleum Reserve Office. The details of promulgation, including analysis of engineering practicality, economic cost and environmental effectiveness, are contained in the above cited planning documents.

To effectively mitigate impacts, these developmental and operational requirements must be implemented. Implementation is by contractural stipulation, environmental review and surveillance. The design criteria, construction practice and operational procedures, as documented in the Environmental Action Reports, are part of the contracts between DOE and the design and construction engineering contractors. In turn, their site dsigns and construction specifications are reviewed for compliance by DOE. Complaince during actual site construction and operation is monitored by environmental inspectors stationed at each storage site.

The cumulative effect of the DOE environmental planning process is to force adherence to standards, procedures and techniques which will insure that adverse effects of the SPR will be mitigated to the extent feasible.

11. Floodplains/Wetlands Mitigation

Executive Order 11988, Floodplain Management, and Executive Order 11990, Protection of Wetlands, require Federal agencies to reduce the risk of flood loss and take action to minimize impacts of floods, and to minimize the destruction, loss, or degradation of wetlands. DOE has proposed regulations to implement these Executive Orders. Because the wetlands order (and hence its regulations) provide that it is inapplicable to wetlands projects under construction prior to October 1, 1977, or to those projects for which a draft or final EIS was filed prior to that date, a large percentage of candidate sites are exempted. Regarding DOE activities within floodplains, the regulations are applicable to all proposed actions where practicable modifications or alternatives are still available. With respect to projects for which the appropriate environmental review has been completed or a final EIS filed prior to the effective date of the regulations, DOE will, in lieu of plenary floodplain procedures, review the alternatives identified in the environmental review or the final EIS for potential floodplain impacts. If project implementation has progressed to the point where review of alternatives is no longer practicable, or if DOE determines after a review of alternatives to take action in a floodplain, the selected alternative will be designed or modified to minimize potential harm to or within the floodplain and to restore and preserve floodplain values.

B. Unavoidable Adverse Impacts

1. Geology

a. Gulf Coast Region

There are no certain unavoidable impacts related to the geological characteristics of the region. Probably a very small change in the geothermal gradient within the salt domes in which new cavities are constructed will occur; also, the geomechanical stability of the portion of the salt dome covering the mined cavities will be decreased. The magnitude of the environmental impact of any kind, if any, engendered by these changes is not known with certainty, but is believed to be insignificant. The historical precedence of petroleum storage, albeit, at a smaller local scale, indicates negligible impact under conditions of sound engineering design and construction practices.

b. East Coast Region

Any storage facility or other structure, existing or new, in the New England area is subject to higher risks of damage due to earthquakes than in most other areas of the country. This is based on historic records of earthquake intensities, and is true only if one occurs. There is no implication of frequency of occurrence.

Ground motion resulting from an earthquake could, depending on magnitude, result in damage to oil storage tanks and pipelines. This in turn could result in oil spills.

Although an earthquake would be unavoidable, any oil spill on site that might result would be contained by the dike system, and the impact of any oil spill due to off-site pipeline damage would be minimized by system shutdown and mobilization of cleanup crews.

2. Hydrology

a. Gulf Coast Region

(1) Surface Water Impacts

Runoff from construction sites will introduce higher concentrations of suspended solids into proximal water bodies during the construction phase and for a short time thereafter

The likely impact of this will be short-term increases in the naturally higher turbidity during storm/runoff events.

The program will require a continuation or an increase in the dredging activity for channel deepening or maintenance at several Gulf Coast ports or docking locations. Short-term, direct water quality degradation by increased suspended and dissolved solids will accompany this dredging, and the dredged bottom material generally represents a long-term potential source of various pollutants that requires attentive maintenance for confinement to the disposal site. The direct effects on water quality will be limited to the project area and may include: increased turbidity and its effects; reduction in photo-synthetic activity, flocculation of planktonic algae, and a decrease in available food supply; sediment buildup that may smother benthos; oxygen depletion; and removal of substrate materials and associated benthos. The more long-term effects are less well-known but may include the slow release to toxic dissolved heavy metals, hazardous organic compounds, and anaerobic gases (methane and hydrogen sulfide).

Increased traffic of vessels carrying petroleum and petroleum products in the coastal region will result in higher potential for oil spills during the initial filling phase of the program and probably also during cycling. Water supply intakes and brine diffuser pipelines, if any, constitute an additional navigation hazard that would not otherwise exist. The increased probability of catastrophic degradation in water quality due to spillage of oil or other hazardous substances and ensuing water quality problems from disposal of oil spill cleanup debris cannot be avoided, although consequent impacts are site-specific and also may be mitigated.

If brine is discharged into the Gulf of Mexico as a result of either solution mining or fluid displacement, the salinity of Gulf waters near the diffuser will be increased. Owing to dispersion and advection, the plume of excess salinity will reach a steady-state condition. Under reasonable worst-case conditions of highest brine rates (from a 200 MMB facility), very little solute advection, and low dispersion, the approximate area over which the increased salinity may be detected by aquatic organisms is 3000 acres; this water quality change would primarily affect the bottom waters rather than surface layers. Behavioral changes (including avoidance) for mobile species or possibly death for sessile species may be encountered in an area of several hundred acres. In addition, about seven acres of marine bottom would be severely disrupted by construction activities for each mile along each of the diffuser pipelines' rights-of-way. Up to five widely separated areas such as those described above may be affected by implementation of the proposed program. No interactions of water quality-related effects among the various areas are predicted, however.

(2) Ground-Water Impacts

Although usage of ground water and any consequent impacts may be avoided by using surface water, especially Gulf water, at any location, it is a viable alternative water-supply at some locations. Owing to the projected fresh surface water shortages in the western Gulf Coast over the next few decades, ground water is attractive for use at other inland locations; during the long term, where operation of the storage facility during a crude shortfall may require an instantaneously available, reliable water supply.

If ground water were used to displace stored crude from a 200 MMB facility during a five-month period, an equivalent water inflow crude outflow of 39,000 gallons per minute (or 56 million gallons per day) would be required. The production of this ground water from a properly designed well field will lower the potentiometric surface in the aquifer being pumped as much as 150 feet. Such large drops in hydrostatic pressure within the aquifer system may be accompanied by a few feet of surface subsidence, slow salt-water encroachment up-dip within coastal aquifers, and "activation" of near-surface faulting with differential compaction. Within the area of ground-water pressure declines, foundation damage due to differential settlement and increased flooding potential, particularly in more coastal settings, are possible results.

The effects are site-specific in that they depend on the aggregate amount and thickness of the clay beds in the lithologic sequence as well as the actual pressure decline. While most compaction takes place in the clay beds, some compaction of the aquifer material may also occur, which results in long-term loss of storage capacity and thereby may affect the local water-yielding properties of the aquifer. Recovery of water levels will occur fairly rapidly after pumping ceases, but some of these physical changes may be irreversible.

Brine disposal by deep-well injection will nearly always degrade the quality of the existing formation fluid. Effects on the biosphere are not a necessary consequence, however, if prior, adequate evaluation and design are conducted.

b. <u>East Coast Region</u>

A minor degree of water quality degradation within surface water bodies near construction sites is unavoidable. The principal pollutant of concern is suspended sediment from eroded areas. Dredging will also cause short-term deterioration in water quality in marine and estuarine locations.

3. Meteorology, Climatology and Air Quality

Catastrophic meteorological events could conceivably destroy surface facilities at a salt dome storage system, but impact from the facility will be minimal. Some oil spillage will occur from fractured pipelines and flow from the storage cavern. Additionally, some oil spillage and uncontrolled hydrocarbon vapor release could occur as a result of conventionally mined storage areas. These impacts will be negligible when compared to that caused by the storm.

No significant permanent impact on the air quality in the Gulf Coast region will occur from construction, filling, or operation of subsurface storage facilities for an expanded SPR. The associated tanker loading and unloading, under "worst case" meteorological conditions, is predicted to cause local and temporary violations of the Federal hydrocarbon standard.

Storage of residual oil and/or distillate fuel oil in tanks and the required tanker operations will increase local hydrocarbon emissions levels.

4. Noise

Noise from acoustically untreated equipment used during construction of tank farm storage facilities will have an adverse impact on human and wildlife populations within approximately one-half mile of the activity. Radiated noise from filling and operation will be of sufficiently low levels to be of no environmental consequence.

Noise from drilling activities in developing salt dome storage will cause an unavoidable adverse impact up to abou

1500 feet from the drilling site. Operation of the facility will impact the area within 3500 feet of the center of the pumping station.

5. Biology

Unavoidable biological impacts will be the temporary loss of habitat from development activities and long-term loss of habitat from physical existence of storage facilities, roads, pipelines, dredged channels, etc. Aquatic organisms will be damaged or killed by entrainment and impingement on intake structures if used for water withdrawal in the solution mining of salt caverns. Aquatic organisms will be temporarily disturbed in the area of brine disposal into the Gulf. Streams, rivers, and estuaries will have temporarily increased siltation caused by dredging, drilling, and construction of roads and pipelines. In the Gulf Coast region, endangered species of animals could be disturbed. Odor from storage in tanks could disturb organisms.

6. Historical and Archaeological Resources

Impacts to historical and archaeological resources listed in or eligible for inclusion in the National Register will be avoided by the selection of sites and rights-of-way away from such resources. Should there be no prudent or feasible alternative to the use of sites and rights-of-way that affect such resources, the requirements of Federal law will be met.

7. Recreational Resources

The project's impact on recreational resources will be related to its use of wilderness areas that are local hunting and fishing areas. The noise and activity associated with constructing the storage facilities will force wildlife away from the sites. Furthermore, the sites will be fenc Where the lands were privately owned and used for productio of brine, sulfur, salt, limestone and other industries, the restriction to hunters and fishermen will not constitute a change. Where new solution cavities, mines, or tank farms are built in wilderness areas, there will be a net loss of recreational land. The most severe impact of this kind would occur if oil is stored in new mines and the excavated rock must be stockpiled over a few hundred acres.

The solution cavities in salt domes and the new mines require pumping water into the storage space when the oil is removed. There will be some loss to sport fisheries due to entrainment of fish eggs and larvae, but this loss will not be a major one. Where pipelines cross beaches to dispose of the brine from salt solution cavities via its diffusion i ocean waters, there will be an avoidable but short-term interference with other uses of the beach.

The major impact on recreational resources would occur in the event of an accidental spill of oil or brine. A spill occurring in a waterway would spread, and depending on the quantity of oil or brine lost, vegetation, fish and waterfowl would be injured or destroyed.

8. Land Use

The project will either use sites that are already bein used for industrial purposes or build new facilities in sparcely populated areas. The construction of rights-of-way through farms, forests, wetlands and lands that will eventually become residential, is unavoidable. If the reserve is to include storage in new mines, the piling of excavated rock on adjacent land is also unavoidable.

Sites used for petroleum storage will become designated as industrial sites. Where there are sites located near urban areas, they may affect zoning regulations that will tend to reserve surrounding lands for industrial use also.

9. Economic and Social Impacts

Adverse impacts that are unavoidable and would be common to both the Gulf Coast region and the East Coast Region include: (1) traffic congestion, (2) accommodation of a migratory pipeline construction crew, (3) a local shortage of plate steel if the maximum amount of petroleum product is stored in steel tanks.

Traffic congestion will occur during the construction period at practically every site. It will be due to workers travelling to and from the site and large trucks bringing equipment and materials.

Pipeline construction requires workers with specialized skills and experience. While some of the right-of-way preparation and restoration may be done with local labor, it is very likely the pipeline contractor will be from outside the area, and 60 to 100 workers will move temporarily into the communities near where the pipelines are to be laid. The extent to which this may affect the host communities will depend on the size of their current population and the degree to which they can accommodate the pipeline crew.

If as much as 95 MMB of petroleum product is stored in steel tanks, it will consume about 360 thousand tons of steel plate. While this constitutes only about 3 percent of the projected capacity for steel plate production in 1978, it could cause delays in delivery of steel to other users, and some local shortages.

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Implementation of the Strategic Petroleum Reserve plan will require some irreversible and irretrievable commitments of resources. With an increase of the total volume of the SPR from 500 to 1,000 MMB, these commitments of resources would increase, although not in direct proportion to the volumetric increase. Some of the terminals and transmission facilities will only have increased use, and new construction on the same scale as the initial 500 MMB plan will not be required.

A. Land Resources

The land used for surface facilities and pipeline or transmission line corridors is not a permanent commitment. The buildings, equipment, pipelines and other fixtures could be removed and the land used for other purposes. Land that has been used as a site for the disposal of dredge spoil or of excess rock from new mines will be irreversibly altered, but could also be used for other purposes or allowed to revert to a wilderness condition.

Some mineral resources will be irretrievably committed. Where solution cavities in salt domes are used to store oil, salt will be removed to create the cavities and more salt lost each time the oil is withdrawn and replaced. The quantity of salt that would be unrecoverable; however, it would be less than one percent of the rock salt reserves in the Gulf Coast States alone.

Where oil is stored in rock mines, there will be a loss of this material. Rock, such as limestone, is somewhat permeable and would be contaminated with oil along the edge of the storage area. Technically, the stone could be recovered, but it would not be economical to do so. Assuming that there is not an established market for the stone excavated from a new mine and that the stone is crushed and removed, there would be an irretrievable loss of stone that may have been used as dimension blocks. Crushed stone deposited in a land fill could be retrieved. National reserves of stone for construction materials are adequate to provide for the expected demand indefinitely. High-purity limestone and dolomite suitable for use in the manufacture of chemicals and metals is restricted in extent, but selection of mine sites for oil storage could avoid use of these reserves.

In the construction of new mines as storage facilities, some rock material may be rendered useless and discarded, even though most is potentially marketable and therefore not irretrievably committed. The geological and hydrological aspects of the developed mine area will be permanently altered, but the change will not be significant.

Whether land required by any storage facility or its appurtenances could be restored to its original state and/or use after the life of the facility is unknown. It seems likely that some irreversible damage could possibly occur to the present land composition. Rock disposal (or long-term storage) areas and dredged spoil disposal areas are essentially irreversibly committed to that use and realistically generally irretrievable.

B. Water Resources

When subsurface injection is the method chosen for brine disposal, the injection well will be sufficiently deep so that fresh water sources are not contaminated. Proper use and installation of well casings will prevent the contamination of fresh water sands that are pierced by the wells. In the event of an accidental break in the well tubing (i.e. seam failure, improper weld, or corrosion) the well could be plugged to prevent saline water from rising up the well. Normal groundwater movement would then gradually dissipate the brine.

Should large quantities of nearly fresh ground water be used, permanent changes in head relationships and flow patterns in aquifers could occur. Changes in the hydraulic regime of aquifers could slightly affect the quality and quantity of discharge into springs and streams.

Large quantities of water, ranging from 426,000 to 562,000 acre-feet, will be irreversibly committed to this project for developing new solution-mined cavities. The high salinity after its use makes this water irretrieveble from a practical standpoint. Operation of the facility during a period of interrupted supply may require up to 124,000 acre-feet per complete cycling event on demand at any time; this water is also an irreversible and irretrievable commitment to the storage program.

C. Ecological Resources

The loss of any endangered species constitutes an irreversible and irretrievable resource commitment. In particular, the Southern bald eagle could be sufficiently disturbed by activity at several sites under consideration to seek other nesting areas more remote from developed sites. This change may be tantamount to a resource commitment.

D. Archaeological and Historical Resources

Any disturbance of archaeological and historical resources would be an irretrievable loss. While it is as yet unknown how many historic and cultural resources may be affected by this program, it is DOE policy to survey each project area to locate such resources and to avoid them whenever possible. Where avoidance is not possible, DOE will consult the appropriate SHPO and, if appropriate, the ACHP, to develop a plan to mitigate the adverse impact of the project on such resources.

E. Human Resources

The major sociological resources to be committed are people's work hours and personal time spent on the project.

An approximate amount of manpower required to implement the program is difficult to establish with certainty, owing to inadequate information on program components. In the ESR, about 500 man-years of direct labor will be required, and in the SPR, up to 5400 man-years may be expended depending on the type of facilities constructed.

Statistical predictions are that fatal accidents will occur in construction of the storage facilities as in construction of any large facility. Other loss of life will result from increased population in traffic accidents and other increased human interactions.

F. Materials

Some materials used in the storage facilities will be committed and therefore represent an irretrievable resource. Besides materials such as paint, asphalt, lumber, and glass that will deteriorate or be discarded in lieu of reuse, a significant amount of steel may be irretrievably lost for other uses. Most of this steel loss is represented by several hundred thousand feet of down-hole casing and pipe that will eventually corrode; some pipeline materials, especially water and brine piping, may also be irretrievable. Most oil pipeline material is anticipated to be salvageable, owing to measures designed to prevent erosion, corrosion, and subsequent rupture.

G. Energy

The energy consumed in constructing and operating the reserve is a commitment of electric power, and therefore equivalent amounts of solid and liquid fuels that will be irretrievably lost to other uses. The amount of energy to construct the reserve is estimated to be no more than about 4 million megawatt-hours, and to cycle the total system will consume less than 10.5 million megawatt-hours of energy. The system will store up to 1.7 billion megawatt-hours of energy.

In a broader context, the crude petroleum itself acquired for filling the reserve is a resource that is destined for irretrievable, although no irreversible, consumption that could not otherwise take place. In this sense, it is a resource commitment, but it is also the rationale for the storage program. The quantity of petroleum ultimately required will depend upon the ultimate capacity of the reserve and the number of times that it will serve as an emergency supply.

VIII. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Virtually any use of the environment, both long- and short-term, will cause some eventual changes in the productivity of the development areas. The overall program for the Strategic Petroleum Reserve, as expanded and accelerated, will insure that longer term national productivity will not suffer a discontinuity through interruption of imported oil to the United States. The impact of such a disruption in imported oil cannot be overemphasized in terms of the gross impact on the national socio-economic growth, and the directed degradation of human living standards, primarily in the economic area, which would result for millions of Americans throughout the nation. This overall national impact, were there no Strategic Petroleum Reserve to insure economic stability, is the overall balance against which localized short-term and longer term uses of the environment for the SPR must be measured.

A. Geology and Hydrology

For the expanded Gulf Coast Region, the geological relationship between short- and long-term results will depend greatly upon the methods chosen for developing salt caverns and the susceptibility of the geological regime to a particular method. Should ground water be used for leaching of salt dome caverns, a risk of subsidence by proportional compaction of affected strata is present. However, surface water sources are adequate to meet the needs of the project, so the use of groundwater would not be necessary.

Some of the sites will require land fill in order to provide a firm base for well pads, roads, and building foundations. Dikes will be raised around tanks, and berms may have to be built to elevate brine ponds. This will cause local changes in soil composition, but not to the extent that it would significantly change the productivity of the surrounding land.

The greatest concern in terms of impacts on soil is that of prolonged seepage of brine into the ground from an undetected leak in the brine handling equipment. If such an accident did occur, the soil would become less able to support vegetation. The length of time this effect would last would depend upon the extent of seepage and local conditions that would wash away the salt deposit; but generally, brine seepage from an undetected leak would have a long-term effect.

For the East Coast region, development of new tank farms will have negligible impact on the short- and long-term relationships. Construction of new mines will alter the local geology and in some cases hydrology in the mine vicinity.

Use of existing mines, salt caverns and tankage for the Early Storage Reserve will require an insignificant change in existing hydrological and geological conditions. Long-term productivity should remain essentially the same as for pre-storage periods.

B. Water Quality

The solution cavities in salt domes would require approximately 183 billion gallons of water from the area during construction of the cavities, and up to 25 billion gallons during the displacement operation. Comparison of this level of consumption with the available water supplies in major surface water bodies alone indicates that the use of the water would not limit the development of industry in the area or the growth of cities that need to share these water resources.

Where subsurface injection is the preferred method of of brine disposal, measures will be taken to protect fresh water sources, including those which are not presently used for drinking water purposes but which may be used in the future.

For development of new facilities, short-term water quality impacts arise primarily from dredging and ditching required to emplace pipelines. Near the dredging operations, increased siltation causing increased turbidity will occur. Resuspension of waterway bottom deposits may raise the pollutant levels of heavy metals, pesticides, and organics. Modification of existing capacity to convert it to storage systems will cause less severe degradation of water quality except where new roads or pipelines require development. Increased oil transportation will increase oil spillage about one percent during the fill period, and result in some water quality degradation.

In the long-term, water quality as related to activities of the storage system will stabilize to prestorage conditions.

C. <u>Air Quality</u>

There will be a short-term degradation of air quality caused by the development of either new or existing storage capacity. Some fugitive dust emissions will result near storage sites, and will be present only during the construction phases. The increase in the Strategic Petroleum Reserve from 500 to 1,000 MMB, and the acceleration in the filling process will increase the fugitive dust emissions as more construction activities will be required. The expanded SPR will cause temporary and localized increases in hydrocarbons and photochemical oxidant levels during marine tanker unloading and loading of crude oil. This short-term air quality problem will not occur in the East Coast storage region because storage will probably be limited to low volatile oils (residual oil and distillate fuel oil).

Hydrocarbon emissions from subsurface storage cavities in the Gulf Coast region will be minimal. The employment of double-sealed floating roof tanks in the East Coast region will reduce the standing storage hydrocarbon emissions to a great extent. No long-term degradation of air quality is anticipated to result from the expanded SPR.

D. Biology

Short- and long-term biological productivity of certain limited areas will be lowered by implementing the program, primarily from construction of new storage facilities and increased oil spills. Short-term productivity will be affected by the reduction of available habitat by the occupying facility and destruction of organisms during construction activities. Increased noise levels will disturb and displace some wildlife. The effect on long-term productivity will be negative but local to the storage site. Increased population will have a very small effect on biological production in the long term because the percentage of increase in a local area is small.

For modification and development of existing mines, tanks, and salt caverns, a small to moderate biological disturbance of each site will occur. Development of existing facilities will have appreciably fewer short-term effects than will development of new storage facilities. Long-term productivity will be about the same.

E. Archaeological and Historical Resources

During surveys in preparation of new site development, those archaeological and historical resources that are discovered will provide important gains to scientific knowledge regarding the history and prehistory of the site.

F. Recreation

For development of new facilities, three types of recreation will be principally affected on the short-term basis: hunting, fishing, and water-contact sports. Game birds and animals will be displaced from the area occupied by the site. Game fish will avoid stream and estuarine waters in areas of excess siltation, and such water-contact sports as swimming will be limited in these areas. The potential for increased oil spills during the fill period could increase pollution on bathing beaches. In the long-term, wildlife may return to the affected areas both on water and land.

G. Agriculture

If the developed site were previously used for agriculture, some short-term loss of agricultural productivity will occur. Usage of existing storage capacity will have little effect upon agriculture; some right-of-way for pipelines may remove land previously under cultivation. Fencing of facilities may impede grazing of livestock and will lessen available pasturage.

Implementation of the program could result in both short-term and long-term benefits to agricultural productivity. In the event of another severe supply interruption, all industries, including agriculture, will be affected. With the storage reserve in place, the severity of the associated impact will be lessened.

H. Socioeconomic Factors

Development activities associated with the program will provide new jobs on both short- and long-term bases. The short-term effects will be significant at a local level, particularly in rural areas. Long-term job productivity is not appreciable but is present. Local inhabitants will benefit by having increased job opportunities and additional revenue. On a regional basis, the increase in jobs and capital will be insignificant.

The overriding objective of the program is enhancement of socioeconomic conditions during and after a severe interruption of imported supplies. This can best be measured in terms of impact without the program. Some estimates indicate that an impact in terms of job losses could reach an additional two million persons unemployed if a storage buffer is not available. Such loss of jobs carries with it the attendant human suffering, anxiety, and personal hardships for those affected. With the project, the effects will be significantly lessened.

IX. CONSULTATION AND COORDINATION WITH OTHERS

Various agencies, governmental units, and local groups contributed information and assistance for the preparation of this Supplement to the Final Environmental Impact Statement. A list of these agencies is given in Section A. Further advice and coordination will be sought from agencies having regulatory jurisdiction over those segments of the environment which will or could potentially be affected by the proposed project.

The Draft Supplement to the Final Environmental Impact Statement was released for public review and comment in September 1977. A list of those agencies and organizations from which comments were requested is given in Section B. Those comments which were received within the time allotted, are included in Section C. Minor changes to the text of the statement have been made in response to these comments. The comments from various agencies are included in their entirety in Appendix C.

A. Agencies and Groups Consulted

In preparation for the Environmental Impact Report, numerous agencies, governmental units and groups were consulted for information and technical expertise pertaining to the proposed project. These groups are listed alphabetically below.

Federal Agencies

Army Corps of Engineers
Bureau of Land Management
Coast Guard
Environmental Protection Agency
Fish and Wildlife Commission
Geological Survey
Maritime Administration
National Oceanic and Atmospheric Administration
Smithsonian Institute

State Agencies

Georgia University Institute of Natural Resources
Louisiana Department of Conservation
Louisiana State University
Louisiana State Wildlife and Fisheries Commission
Mississippi Bureau of Environmental Health,
  Division of Solid Waste Management and Vector Control
Mississippi Marine Conservation Commission
Mississippi State Central Planning and Development District
Mississippi Governor's Office
Texas A&M University, Marine Station
Texas Parks and Wildlife Department
Texas Water Development Board

Local Government Agencies

Houston-Galveston Area Council

Other Groups

C.R. Cushing and Company, Inc.
Exxon Corporation
Gulf Marine Management Corporation
Gulf Trading and Transportation Company
Tanker Advisory Center

B. Parties From Which Comments Were Requested

As a part of the review process for the Environmental Impact Statement, comments have been requested from the departments, agencies, and organizations listed below:

Federal Agencies

Appalachian Regional Commission
Council on Environmental Quality
Department of Agriculture

(Federal Agencies continued)

Department of the Army, U.S. Corps of Engineers
Department of Commerce
Department of Defense
Department of Health, Education, and Welfare
Department of Housing and Urban Development
Department of Interior
Department of Labor
Department of State
Department of Transportation
Department of Treasury
Energy Research and Development Administration
Environmental Protection Agency
Federal Power Commission
Interstate Commerce Commission
Nuclear Regulatory Commission
Tennessee Valley Authority
Water Resources Council

State Agencies

All State Clearinghouses including Puerto Rico and the Virgin Islands

Regional and Local Agencies

Assumption Parish Police Jury
Brazoria County Commissioner
Gulf States Marine Fisheries Commission
Iberia Parish Police Jury
Iberville Parish Police Jury
Louisiana Offshore Terminal Authority
South Central Planning and Development Commission
St. Mary Parish Police Jury

Other Organizations

Acadiana Planning and Development District
American Fisheries Society
American Littoral Society
American Petroleum Institute
Baton Rouge Audubon Society
Calcasieu Rod & Gun Club

(Other Organizations continued)

- Canoe & Trail Shop, Inc.
- Center for Law and Social Policy
- Council on the Environment
- Domtar Chemicals, Inc.
- Ecology Center of Louisiana, Inc.
- Edison Electric Institute
- Electric Power Research Institute
- Environmental Defense Fund, Inc.
- Environmental Policy Center
- Environmental Resources and Energy Group
- Florida Audubon Society
- Friends of the Earth
- Funds for Animals, Inc.
- Institute of Gas Technology
- Interstate Natural Gas Association
- Izaak Walton League of America
- League of Women Voters
- LOOP, Inc.
- Louisiana Power and Light
- Louisiana Wildlife Federation
- Louisiana Department of Justice
- Morton Salt Company
- National Association of Counties
- National Audubon Society
- National League of Cities
- National Parks and Conservation Association
- National Resource Defense Council, Inc.
- National Science Foundation
- National Wildlife Federation
- New Orleans Audubon Society
- RESTORE, Inc.
- Seadock, Inc.
- Sierra Club-Delta Chapter
- Sierra Club-Gulf Coastal Regional Conservation Committee
- Sierra Club-New Orleans Group
- Sierra-Southern Plans Regional Conservation Committee
- The Courier
- The States-Item
- The Times-Picayune
- U.S. Conference of Mayors
- U.S. Louisiana Department of Justice

C. Parties From Whom Comments Were Received

The comments on the Draft Environmental Impact Statement addressed herein are those received by the Department of Energy within the allotted comment period. Copies of those letters of comment are contained in Appendix C.

Comments received by DOE after the expiration of the time period also have been considered in the preparation of this Supplement to the Final Environmental Impact Statement to the degree practicable within such time limits, but are not addressed individually within Chapter IX.

Comments Received from Federal Agencies

1. Department of Commerce, Maritime Administration

Comment a:

> The discussions on page V-50 and in Appendix A of operational discharges of oil from tankers should be rewritten and expanded.

Response:

> The discussions on page V-50 and in Appendix A have been expanded by the inclusion of detailed information provided by the Maritime Administration.

Comment b:

> The last sentence of the first paragraph on page V-54 should be corrected to indicate that 2,380 barrels of oil is about equivalent to 100,000 gallons.

Response:

> This correction has been made on page V-54.

Comment c:

> "The first paragraph [on page VI-32] states among other things that "dispersants (although economic and effective in heavy seas) are toxic, and their use must be

restricted." It is suggested that more discussion be devoted to the recent development of dispersants with lower levels of toxicity. The use of these dispersants would require prior approval by national authorities, but they could prove useful in mitigating the effects of large oil spills in open ocean areas where containment is impossible".

Response:

The text on this page has been expanded to include a discussion of dispersants. Recent developments in producing dispersants with lower levels of toxicity are recognized along with the need for further research in their use.

2. Department of the Interior

Comment a:

"The supplement points out that a capacity now exists for 370 million barrels (MMB) of oil storage previously proposed. This means that the previous proposal would require 130 MMB of new storage capacity while the new proposal to store 1,000 MMB would require 630 MMB of new storage capacity, which is approximately a fourfold increase in new capacity. This same type of relationship for oil storage capacity requirements could occur for other phases as well. Impacts that previously were projected to be minor, local, and insignificant could possibly now become major, regional, and significant. Consequently, we question the rationale that doubling a program will double the impacts without noticeably altering their direction or significance. There may be a fourfold increase in some impacts, and the timing should also be considered".

Response:

The extent of increase in environmental impacts is not expected to be in a linear relationship with the increase in the number of barrels of oil to be stored. Furthermore, some types of impacts will be disproportionately increased relative to other types of impacts. That construction impacts would not be merely doubled by the expansion of the reserve is acknowledged in the opening paragraphs of Chapter VI. The significance of individual kinds of impacts brought about by expanding the reserve will depend upon the storage methods and oil transport methods to be used, and the environmental characteristics of the sites chosen. While it is true that most or all of the second 500 million barrels will require new leached storage capacity, as compared to about one-half of the first 500 million barrels (thus resulting in a tripling of the amount of brine to be disposed), it does not necessarily follow that the cumulative impacts will become more significant, merely because of the increased volume. The question turns rather on the environmental acceptability of the selected disposal method for each storage site. Since the sites are sufficiently separated geographically so that the effects of disposal from any two cannot interact, no synergistic impacts will occur to cause significant results where none would have been produced otherwise. In general terms, it may be said that doubling the amount of oil to be stored means that more sites will be used and affected by the program, but it does not necessarily mean that individual sites will be more severely impacted.

Comment b

"It is noted that violations of carbon monoxide and photochemical oxidant standards are frequent on the East Coast (p. IV-22). It should also be mentioned that hydrocarbons are a major contributor to the reaction with sunlight which creates photochemical oxidants. We suggest that the environmental statement should identify the increment of pollutants that may be added as a result of the proposed project".

Response:

The increment of hydrocarbon emissions resulting from the proposed project has been identified and assessed in the Sections V.A.1.C, V.A.2.6. and V.B.2. However, the impact of the increased hydrocarbon emissions on ambient levels of photochemical oxidant was not quantified. This is because photochemical oxidant is primarily a regional air pollution problem, while the SPR will generate emissions from one or two specific sites. The state-of-the-art is not sufficiently advanced to quantify the regional photochemical oxidant level resulting from a couple of single polluting sources.

Comment c:

"The discussion of wetlands [on pages V-27 and V-28] should take into account Executive Order 11990, signed by President Carter on May 24, 1977. The Order directs Federal agencies to avoid wherever possible the long-and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. We are especially concerned about possible impacts to wetlands because of their value as a recreational resource and the uniqueness of their habitat. Careful consideration should be given to the implementation of any part of the Strategic Petroleum Reserve program which would involve the modification of wetlands".

Response:

Although Executive Order 11990, by virtue of the exemption contained in Section 8, does not apply to those SPR sites assessed in environmental impact statements prior to October 1, 1977, nevertheless DOE believes that it is developing the SPR in consonance with the spirit of the Order by taking all mitigative measures practicable to minimize adverse impacts to wetlands.

The discussion on pages V-27 and V-28 is focused on the use of land for recreational purposes. Along the Gulf coastal area, most of the land used for recreational hunting and fishing is wetland, although dryland forests are also used for hunting, hiking, camping, and other forms of recreation. The discussion of the project's potential effects on recreational land, and measures that are to be taken to mitigate adverse impacts is in accordance with Section 5(c) of Executive Order 11990 which directs each agency to consider public use of wetlands for recreation as a factor relevant to a proposal's effect on the quality of such wetlands.

Comment d:.

"We are also concerned about possible infringement by man-made canals upon recreational lands funded under the Land and Water Conservation Fund Act of 1965, as amended. Section 6(f) of the Act states, 'No property acquired or developed with assistance under this section shall, without the approval of the Secretary, be converted to other than public outdoor recreation uses. The Secretary shall approve such conversion only if he finds it to be in accord with the then existing comprehensive statewide outdoor recreation plan and only upon such conditions as he deems necessary to assure the substitution of other recreation properties of at least equal fair market value and of reasonably equivalent usefulness and location'".

Response:

The construction of canals is not a feature of the design for SPR development. Dredging associated with the project will be confined to the deepening of existing waterways at oil ports, excavation needed to construct and maintain water intake structures, and the laying of pipelines under water. Where the burying of pipelines under wetlands would normally result in the formation of small canals, these will be blocked at appropriate intervals to prevent the alteration of natural drainage patterns and to enable the channels to become silted in.

Comment e:

"As pointed out [on page V-55,] the doubling of the proposed capacity for the Strategic Petroleum Reserve program will result in a doubling of the risk of a major oil spill sometime during the life of the project. We remain concerned about the possibility of spills in wetlands areas which are utilized for local recreational activities and urge that the latest available technologies be implemented in order to minimize this possibility".

Response:

The potential seriousness of oil spills is recognized and stringent measures are being taken to obviate such risks. In addition to preparing Spill Prevention Control and Countermeasure Plans as required by the U.S. Environmental Protection Agency, and complying with the U.S. Department of Transportation regulations on standards for equipment, testing procedures, and operation activities, efforts are being directed toward further reducing the dangers of oil spills. Prospective oil shippers are being required to submit an environmental plan specifying the equipment they have on board for preventing oil spills and the extent of training of the crew in its use. Studies are being conducted to identify the best available technologies for reducing the danger of oil spill at each site.

3. Environmental Protection Agency

Comment a:

"The Draft Supplement states that the proposed SPR expansion will require large quantities of surface water for construction and operation of the expanded facilities. If intake structures will be required, the Final Supplement should provide adequate information to allow EPA to determine that the best technology to minimize environmental impacts will be implemented in the design of these structures".

Response:

Intake structures will be required. Their designs will take into consideration the water elevation, sediment load, the characteristics of fish or fish larvae that may migrate through the waterway, and various other factors. It has not been assumed that any single type of intake structure would best minimize environmental impacts at all sites. The intake velocity, however, is not to exceed 0.5 feet per second. This generic standard has been set to enable most fish to swim away from the intake. Bars, screens, and other components will be selected on a site-specific basis.

Comment b:

EPA is developing the Underground Injection Control program which will regulate such operations as the pumping of oil into salt domes, solution mining to create cavities in these domes, and deep well injection of brine. Draft regulations for this program, published August 31, 1976, require certain data and analyses to be provided before such actions are permitted. The Department of Energy should now provide data and analyses consistent with the requirements of the proposed regulations and of the State agencies which will enforce the Underground Injection Control Program. Selected technical data should also be made available to the public by request.

Response:

The purpose of the programmatic EIS is to identify the cumulative impacts of the program on the environments of various regions that would be suitable for oil storage. Site specific EISs are a more appropriate place for the detailed data and analyses that are being gathered prior to underground injection at individual sites. The data and analyses of each site vary according to the geology and geohydrology of the area, the depth of the surface of the salt dome, the location of wells, the capacity of the cavities, the characteristics of the water used for displacement of oil and for solution mining, and similar factors. The Department of Energy is providing to State agencies governing injection programs the data and analyses they request, and such data is also available to the public.

Comment c:

"The discussions of operational discharges of oil from tankers [on pages V-50 and A-1], while correct, do not fully describe the status of control measures being developed. These discussions refer to pending U.S. Coast Guard regulations and the 1973 Marine Pollution Convention of IMCO (Intergovernmental Maritime Consultative Organization).

The 1969 amendments to the 1954 International Convention for the Prevention of Pollution of the Sea by Oil have been adopted, but the 1973 Convention has not... The Convention may not be adopted in time to affect the SPR, but if it is, it could affect the statistical analysis in Appendix A of the EIS..."

Response:

The discussions on pages V-50 and A-1 have been expanded to include requirements of the pending 1973 Convention which have been incorporated into the U.S. Coast Guard pollution prevention regulations in Title 33, Part 157, Code of Federal Regulations (33 CFR 157).

The statistical analysis in Appendix A addresses the issue of accidental oil spill and remains unaffected by conventions and regulations pertaining to operational oil discharges.

Comment d:

"EPA strongly recommends that the method of brine disposal involving use of the displaced brine as a chemical feed stock be used wherever practicable. Discussion on this recommendation should be addressed in the Final Supplement".

Response:

Where brine production cavities are being converted to oil storage facilities, as much brine as will be accepted by the chemical plant is being provided to it via the existing brine feed stock pipelines. These plants use raw water that has been tested and treated so that it does not contain impurities that would contaminate facilities or the substances for which the brine is used. The water used by SPR facilities for solution mining and oil displacement will not be treated prior to injection. The resulting brine is generally not acceptable as feed stock. Additionally, because chemical companies use caverns created by brining for their own storage purposes, they are reluctant to accept SPR brine which would limit their own rate of cavern development.

Furthermore, the rate of brine used locally as chemical feed stock is very small compared to the rate generated by the solution mining which will be done to create storage space or to displace the oil. If the problem of trace impurities in the brine were overcome, vast quantities of brine would have to be stored at the site in artificial reservoirs that would cover several hundred acres. The environmental risks of storing such a great volume of brine over several years makes this alternative unacceptable.

Comment e:

"The Draft Supplement indicates that pipelines serving the SPR salt domes sites will be coated externally with an asphalt-sand mixture or coal tar enamel for corrosion protection. The pipelines will also contain sacrificial zinc anodes to lessen internal corrosion. The Final Supplement should discuss whether these corrosion preventive measures could cause any adverse impacts to groundwater quality in the project areas".

Response:

Pipelines are usually coated with a relatively inert asphaultic material which provides oxidation protection and insulation properties. In addition cathodic protection is achieved by having a small DC current on the pipeline or by having a sacrificial metal such as magnesium nesium alloy (e.g., 6% Al, 3% Zn, and 91% Mg) as the anode and the pipeline as the cathode. The technique of utilizing a small DC current to inhibit electrochemical reactions introduces no foreign materials into the environment. The sacrificial anode scheme utilizes the oxidation of the magnesium anode to provide the current flow to inhibit oxidation of the pipeline and consequently forms ionic materials over the lifetime of the anode.

It is generally assumed that for a large pipeline of 30 inches in diameter or more, a 17 to 32 pound anode rod will be utilized with a coating of plaster, which is composed of gypsum, bentenite clay, and sodium sulfate to provide protection for a section of pipe several hundred feet long (e.g., 500 ft) for approximately 12 to

14 years. The plaster will also deteriorate as the anode is oxidized. One would expect to obtain sulfates, silicates, oxides, and carbonates of the aluminum, magnesium, zinc, and calcium materials from the anode and its coating.

The proposed pipelines in the Gulf Coast Region will be buried primarily in prairie-type soils which are composed of pleistocene clays. Smaller segments of the pipeline may potentially be buried in marshy soils. These soils represent the upper layer of an impermeable clay aquitard from 100 to 400 feet thick. Where the water table is within one or two feet of the surface, the soil will be generally water-saturated. Thus, due to the presence of ground water some dissolution of the cathodic system will occur. The carbonates, which are formed from the ground water are relatively insoluble, and contribute to the hardness of water. The sulfates are relatively soluble in water. All of these materials are relatively common constituents of ground water. The insoluble materials will no doubt aggregate onto clay particles present in the soil and present no problem.

Comment f:

"The Draft Supplement needs to be strengthened in its address of the Spill Prevention Control and Countermeasure (SPCC) Plan required under 40 CFR 112 (Oil Pollution Prevention, Non-Transportation Related Onshore and Offshore Facilities). The Final Supplement should acknowledge DOE's intention toward developing a SPCC Plan which meets the requirements of 40 CFR 112 within six months after a storage facility begins operations. DOE should provide that the SPCC plan shall be fully implemented no later than one year after facility operation begins".

Response:

The text on page II-13, which discusses SPCC Plans for the oil storage facilities, has been expanded to acknowledge DOE's intention of complying with the 40 CFR 112 regulations regarding the filing and implementation of SPCC Plans.

Comment g:

"The Draft Supplement does not address any discharges or treatment of domestic wastewater for the proposed SPR expansion. If such discharges will exist, the point of discharge, the type of treatment and possible impacts to the receiving stream should be identified and addressed in the Final Supplement. In addition, DOE should indicate if application for a National Pollutant Discharge Elimination System (NPDES) permit has been made. Discussion on this matter should also be included in the Final Supplement".

Response:

The additional oil stored in expanding the SPR will not all be placed at a single site. The methods used for disposing of domestic wastewater will depend upon the environmental characteristics of the sites chosen. Several methods of sanitary waste disposal are being considered, including (a) connection into existing municipal sewage treatment systems, (b) holding tanks which can be pumped out and wastes carried to local treatment centers, (c) septic tanks designed to comply with state and local health ordinances, and (d) incineration.

NPDES permits will be obtained for the various kinds of wastewater discharges from these sites. These include discharges from settling ponds which collect rainwater runoff from the site, discharges from the oil-water separator, and similar releases.

Comment h:

The expansion of the SPR program from 500 million barrels of oil to 1 billion barrels will increase hydrocarbon emissions from the use of above ground tanks as well as from fill and withdrawal operations. This may cause localized violations of the Federal air quality standard for hydrocarbons in areas that are already experiencing violations of this standard. The compatibility of the program's storage with State Implementation Plans for attaining and maintaining air quality standards will require specific site-detailed analysis.

Response:

The impact of hydrocarbon emissions from SPR tanks and from fill and withdrawal operations on local air quality is being addressed in the site-specific EISs. Consultations are being held with State agencies regarding the design of emission control systems so that SPR facilities will be compatible with State programs for attaining and maintaining air quality standards.

Comment i:

"In addressing ambient air quality standards, the Final Supplement should recognize that the Clean Air Act, amended on August 7, 1977, has changed past Prevention of Significant Deterioration (PSD) Regulations. The changes significant to this project are: a) that PSD regulations no longer apply only to particulate and sulfur dioxide emissions, but to all criteria pollutants, (i.e., Sulfur Dioxide (SO_2), Total Suspended Particulate (TSP), Non-Methane Hyudrocarbon (NMHC), Nitrous Oxides (No_x), Carbon Monoxide (CO), and Photochemical Oxidants (O_3), and b) that PSD designated source categories have been expanded from 19 to 28 sources, one of which is petroleum storage and transfer facilities. The effect of these changes upon the project should be addressed in the Final Supplement".

Response:

Appropriate modifications have been made to the text of the discussion of air quality on page V-4 to include the recently enacted changes in National Ambient Air Quality Standards.

Comment j:

"In addressing Federal Clean Air Regulations, the Draft Supplement states that EPA's emission offset policy excludes new sources with "actual" emissions, totaling less than 100 tons per year. However, this amount will be based upon "potential" emissions and not "actual" emissions. Clarifications of this matter and its possible effect upon SPR projects should be included in the Final Supplement".

Response:

The USEPA has set New Source Performance Standards (NSPS) limiting allowable emissions for certain industrial facilities. These include standards for petroleum refineries and storage vessels for petroleum liquids. The NSPS for storage vessels would normally impact the SPR project as it applies to vessels with a capacity greater than 40,000 gallons (950 barrels). This regulation does not apply to pressure vessels, subsurface caverns, porous rock reservoirs, or underground tanks under some conditions.

In December 1976, USEPA adopted an "emission offset" policy under which construction permits for new industrial sources in non-attainment areas could be issued if any increase in air pollution from the new source was more than offset by additional emission reductions by existing sources beyond those levels required by the applicable state implementation plan. The newly enacted Clean Air Act Amendment of 1977 (42 U.S.C. 7401 et. seq.) accepts this offset process and extends the date by which states must attain the primary standards to July 1, 1979 in these currently non-attainment areas.

During the initial implementation of the SPR, the EPA determined that the offset policy did not apply to SPR facilities due to the temporary and intermittent nature of its associated emissions. DOE is aware that the EPA policy regarding emission offsets, and its applicability to the SPR program, is currently undergoing review, and that a clarification will be issued in the near future. DOE will take any steps necessary as a result of this clarification.

Comment k:

"In discussing possible mitigative measures in eliminating hydrocarbon emission venting from the underground storage caverns, we suggest that condensation units in lieu of a flare system be used. The condensation unit would not only provide less potential for explosion of the volatile gases within storage but would also provide fuel conservation by allowing the condensed emissions to be returned to storage".

Response:

Condensation units are being considered as a means of controling hydrocarbon emissions from underground storage.

Comment l:

"The statement [on page V-12] that hydrocarbon emissions which result from VLCC-tanker operation will not be as significant as those occurring at dock may be correct; however, the emission may add to already intolerable air quality conditions which exist in the Gulf Coast near the three terminal areas of Capline, Seaway, and Texoma. DOE should address this issue in particular light of the accelerated filling schedule proposed".

Response:

The VLCC tankers will be operating 50 to 100 miles offshore, and their hydrocarbon emissions will be dispersed over a wide area. In general, the hydrocarbon vapor concentration diminishes with increased distance from the source. For this reason, the impact on the air quality in the coastal region is not anticipated to be significant.

Comment m:

In Appendix B, page 5, the last line should read as follows: "Hydrocarbon vapor loss is generally increased as the molecular weight of the crude oil decreases (emphasis added)".

Response:

It is not the modecular weight of liquid crude oil that is being referred to, but rather the molecular weight of crude oil vapor. Given the same vapor rate, hydrocarbon vapor loss is generally increased as the molecular weight of the crude oil vapor increases. The text of Appendix B, page 5 has been modified to clarify this issue.

Comment n:

Address more fully in the Final Supplement, proposed and alternative storage sites with respect to their potential for wetlands impact. For future SPR projects DOE is urged to contact EPA for consultation and recommendations in the selection of any future SPR sites. DOE should announce its intentions in this respect within the Final Supplement.

Response:

A section of text addressing the potential for wetlands impact has been inserted into this Supplement starting on page V-39. However, the issue of potential impact to wetlands can be fully addressed only in the study of a particular site. The appropriate site-specific EIS should be consulted for a discussion of this issue as it pertains to that site. EPA is one of several agencies that is routinely requested to review proposals for the use of various sites for oil storage facilities.

Comment o:

"Inland salt domes for storage sites located in the Northern Louisiana Interior Basin and the East-Central Louisiana Mississippi Interior Basin are being considered With this information, EPA questions why these inland sites were not addressed as possible sites for the currently proposed SPR expansion in the alternative section of this Draft Supplement".

Response:

The second section in Chapter III is "B: Structural Alternatives" which includes a discussion of solution-mined cavities in salt, mines, tank farms and tankships. The feasibility of using inland salt domes as possible sites for the SPR expansion is addressed in this section.

Comment p:

"As possible alternate salt dome crude oil storage sites for future storage reserves and expansion, the Final Supplement should consider the possibility and practicability of using off-shore salt domes lying within the Gulf of Mexico. Feasibility and potential impacts should be discussed in the Final Supplement".

Response:

The development of offshore salt domes is discussed in the programmatic Environmental Impact Statement in Chapter III under the section entitled "Development of Salt Dome Storage Facilities." Their use remains as an alternative to onshore sites. Studies of potential candidate offshore domes are currently underway.

Comment q:

"In discussing land use of the proposed SPR expansion, the Draft Supplement states that approximately 2260 acres or 3.5 square miles of land distributed throughout the Gulf coastal states will be used. To assist in effectively evaluating overall environmental impacts, the statement would be strengthened if this total amount of land was identified and categorized into segmented amounts according to existing land use, and state location. This would assist EPA in evaluating the overall impact of the proposed expansion".

Response:

The estimate of total land that would be used was based upon expected average sizes of the various kinds of sites. Since the storage sites have not been chosen, it is not possible to know yet the specific locations of the sites or the amount of land currently in various categories of usage. Where candidate sites have been identified, the site-specific EIS quantifies the existing use of the land at the site and surrounding it, and also discusses projected future uses of adjacent lands.

Comments Received from State Agencies

1. Arizona, Solar Energy Research

Comment:

"Have Arizona's salt deposits been considered as possible sites for petroleum storage"?

Response

Yes, they have been considered. However, the lack of abundant water resources for solution mining to create storage space and the distance from oil ports and major oil refineries makes other salt formations more suitable as candidate storage sites.

2. Kentucky Bureau of Environmental Protection

Comment a:

"The statement does not identify the specific site where these additional 500 MM barrels of crude petroleum will be stored. We will certainly be interested to know if storage capacity at Central Rock Mine (Fayette County) will be increased from 14 MM barrels. Also, we would like to know if the terminal capacity at Tates Creek will be increased".

Response:

The additional 500 MM barrels of oil will not all be stored at one site. The potential exists for storing part of this additional reserve in areas of the Midwest. Specific sites have not yet been selected so it is not yet possible to state whether Central Rock Mine or the terminal at Tates Creek will be used for SPR expansion.

Comment b:

"In spite of good objectives associated with the SPR, the amount of hydrocarbon emissions throughout SE U.S.A. will delay attainment of the photochemical oxidant standards".

Response

The release of hydrocarbon emissions will be almost entirely due to unloading and loading tankers. These emissions will be intermittent and temporary. They are generally considered to be unavoidable, but DOE is undertaking special efforts to reduce such emissions.

During the period of storage, there will be practically no release of hydrocarbons from the reserve. Surface tanks will be equipped with appropriate roofs and seals to prevent vapor losses, and will be coated with a heat-reflecting paint. Underground storage facilities will not be subject to the temperature fluctuations that cause vapor releases from surface tanks. Mines used for storage will be equipped with vapor control systems, and solution cavities in salt will be kept full of brine and oil in a way that prevents the formation of air spaces where vapors may accumulate.

3. North Dakota Geological Survey

Comment:

"The massive salt beds of the Williston Basin should be considered as alternative sites for solution salt cavity storage of the SPR. This would help to insure crude availability to the northern tier refineries".

Response:

In the initial stages of SPR development, all salt formations were considered. The lack of abundant water resources to use in leaching the solution cavities and displacing the oil was a primary drawback to the use of the Williston Basin. Use of the basin would also have required the construction of hundreds of miles of pipeline to carry the oil from ports or existing oil pipelines into the storage facility.

4. Texas Parks and Wildlife Department

Comment a:

"Future preparation of "Environmental Action Reports" specific sites is mentioned on page VI-38. Since it is anticipated that these reports will contain detailed information, and proposed procedures for construction and operation of each site, review and comment upon the reports would be desirable".

Response:

Site-specific environmental impact statements will be made available for review and comment before they are made final. The Environmental Action Reports are internal documents which are largely based on the site-specific EISs and which serve as technical specifications for the design and construction of the facilities.

Comment b:

"In regard to alternative brine disposal techniques for use in the Texas coastal area, it is recommended that injection of the brine into subsurface aquifers be utilized to the maximum possible extent in order to minimize discharges to surface waters or the Gulf of Mexico".

Response:

The selection of any brine disposal method must take into consideration numerous factors, among which are: the volume and rate of brine produced, the receiving capacity of subsurface aquifers available to the site, the engineering feasibility of various alternatives, and environmental impacts. For this reason, the selection of brine disposal methods is being made on a site-specific basis.

5. Texas Department of Agriculture

Comment:

"With regards to the selection of future SPR sites, we support the idea that a careful review should be made to avoid taking of unique or prime agricultural land. In general, however, we believe the benefits from the SPR will outweigh the costs; we therefore, offer no objections to the proposed expansion".

Response:

In the site selection process, considerable attention is focused on existing and possible future use of the land. Whether the site on unique or prime agricultural land is one of the issues that is addressed. Where pipelines must be constructed across agricultural lands, steps will be taken to restore the topsoil.

6. Texas Department of Water Resources

Comment a:

> "One of the major water quality policies of the State has been to disallow any direct discharge of brine into the State's waters. This policy is particularly applicable to any proposed brine discharges within the State's three-league seaward boundary and especially to estuaries having fish and shellfish nursery areas. Therefore, we support the Federal Energy Administration's rigorous efforts to explore all viable methods of brine disposal including usage by local industry, deepwell injection, and disposal to the Gulf of Mexico. And, we concur that final site-specific brine disposal method determinations should be based on the geographical location of the site with respect to the Gulf of Mexico, the proximity of saline aquifers, estuarine productivity, and relative costs of alternative brine disposal methods".

Response:

Various methods of brine disposal are being considered. Where it appears that brine diffusion in the Gulf of Mexico is the most acceptable alternative, great care is being given to selecting the dispersion area and the design of the diffuser to minimize adverse impacts on the marine ecology. Studies performed to date indicate that the zone of adverse impact can be limited to a few acres in the immediate vicinity of the diffuser.

Comment b:

> "The report duly notes that the large quantities of surface water (i.e., approximately 183 billion gallons of water from the area during construction of the cavities and up to 25 billion gallons during displacement operations) required for the construction and operation of storage caverns in salt domes is a significant concern. Further, the report notes that there are ...few undedicated fresh surface water supplies in the Gulf Coast region...' In view of the foregoing findings, we reiterate one of our early comments...that a special analysis of project impacts on vested surface water rights be prepared".

Response:

The impact of the project on vested surface water rights is an issue that is best addressed in site-specific EISs. Before commitments are made to use a specific site, the impact of its water use is analyzed and is one of the determining factors in site selection. The scope of this analysis includes not just water rights but also existing and future needs for water resources for urban areas, industrial growth, and agriculture.

Comments Received from the Public

1. National Wildlife Federation

Comment a:

The statement makes no attempt to assess the hazard potential associated with various spill locations, or to contrast the hazard potential of inland versus coastal sites. In terms of estimating the frequency of oil spills in various "impact areas," the statement is misleading because, for instance, it assumes that all oil spills in wetlands will be associated with pipelines. This obscures the fact that transport in harbors and channels connecting the harbors with the sea and the storage site, also has potential for spilling oil in wetlands.

Response:

The five categories of areas affected by oil spills (listed on page A-19 and A-20), are grouped according to the type of data available on spills. The fifth category is pipeline spills. The historical data, based on reports of pipeline spills, does not distinguish between pipelines in wetlands and pipelines on dry land. Similarly, the category of oil spills in harbors and inland waters was chosen because records of oil spills do indicate their being in harbors and inland waters, but do not indicate whether these harbors or inland waters were surrounded by wetlands or not, or whether the spill floated downstream to a wetland area.

The statistical units in which the data are compiled are (a) spills per vessel per year, and (b) spills per mile of pipeline per year. Thus, there is a direct relationship between the distance and time the oil must be transported and the expected number of spills. The use of inland storage sites would increase the distance and time for delivering oil to storage sites, and greater incidence of spills would be expected.

While the use of inland domes would reduce the number of pipeline oil spills in wetlands, it would not appreciably reduce the number of oil spills from ships affecting wetlands. Except in the early stages of facility construction, oil is not being brought to coastal storage sites via waterways. Oil for both coastal and inland sites will have to be brought by ocean vessels into coastal harbors and ship channels, where there is a risk of oil spill contaminating adjacent wetlands. Oil destined for coastal wetlands is then transferred from the harbor to the site via pipelines. Oil destined for inland must be transferred either into much longer pipelines or into smaller ships or barges that can navigate the shallower inland waterways. Transport of oil to inland sites via the major rivers, would present a serious risk of oil spill to freshwater wetlands along their banks.

Comment b:

"The estimated incidence of a major spill for pipeline accidents in inland areas of the Gulf Coast is incorrectly stated [on page V-54] to be 0.1 gallons per 1,000 MMB transported; the correct figure (from Table V-13) would be either 0.1 MMB per 1,000 MMB transported, or 0.1 gallons per 1,000 gallons transported."

Response:

This discussion has been revised. In Table V-13, on page V-53 it is stated that the estimated frequency of a major spill (greater than 238 bbls.) from pipeline accidents in inland areas of the Gulf Coast is 0.70 spills during the transport of 1,000 MMB of oil.

Commment c:

While this supplement discusses numerous potential problems related to the use of inland salt domes, it fails to emphasize environmental advantages of using inland rather than coastal salt domes.

Response:

The function of the programmatic environmental impact statement is to identify environmental impacts, particularly the adverse impacts which must be taken into consideration, prior to the selection of sites for the proposed facilities. However, DOE believes that either inland or coastal sites can be developed in an acceptable manner, provided that appropriate mitigative measures are employed to protect the environment.

Comment d:

This supplement "should take pains to contrast in some detail, the nature, number, and distribution of wetlands in association with inland versus coastal Gulf Coast salt domes."

This would be aided by a map "which shows the location of each of the following, in addition to the other information found in Figure III-1: The Exxon pipeline, Capline, the port of St. James, Vicksburg, Vidalia, Old River, Red River, Ouachita Black River, Gulf Intracoastal Waterway. Each of these items is mentioned on pp. III-4 to III-5, but is nowhere to be found on the accompanying map."

Response:

This supplement focuses on the expansion of the oil reserve and discusses the various means of implementing this expansion. The value of using inland sites because there are fewer wetlands associated with them is recognized. Figure V-1 has been added to the chapter on environmental impacts to show the locations of the salt domes in the Louisiana and Mississippi salt basins in relation to the wetlands of the area.

In addition, Figure III-1 has been improved to include items noted in the text.

Comment e:

"The discussion of 'Mitigating Measures' (beginning at p. VI-1) would...greatly benefit from a discussion of reduced wetland losses associated with increased reliance on inland salt dome storage site. As the Draft states (p. VI-2), ecological impacts can be mitigated by selecting sites...away from highly productive wetlands...."

Response:

The referenced sentence has been clarified to indicate that, on a localized basis, the application of appropriate mitigative measures and design techniques can significantly reduce the potential for wetland impacts.

Comment f:

"We firmly believe that the potential for seriously damaging the vital coastal wetlands of Louisiana and Texas (as an unintended side-effect of the SPR Program) is sufficiently great as to justify slowing the program's pace to the extent necessary to permit maximum possible use of inland salt domes for as much as possible of the proposed storage reserve. Major resource commitments have already been made to several coastal salt dome sites. We strenuously urge (and we believe NEPA requires) that commitments to additional coastal sites be withheld until the evaluation of inland salt dome alternatives has been completed."

Response:

SPR oil is being stored at West Hackberry, Bryan Mound, and Bayou Choctaw. Work is under way to convert Sulphur Mines and the Weeks Island salt mine to storage facilities. All of these sites have been used for industrial operations for many years. They are on dry ground and only the Bayou Choctaw site requires a modified building design because of the risk of seasonal floods. Portions of their oil and brine pipelines will cross wetlands, but efforts are being taken to avoid damaging these wetlands during pipeline construction.

Studies are being undertaken to identify candidate inland salt domes which may be used for the oil storage program and to find solutions to some of the critical problems that are associated with the use of the inland domes. Although the stringent congressionally mandated schedules for implementation of the SPR dictate that the program must move forward, inland domes are being studied to determine what part they might play in the expanded program, given their locations and the technical problems discussed in the text.

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WE-103 Westree, B., 1977. Biological Criteria for the Selection of Cleanup Techniques in Salt Marshes. In: Proceedings: 1977 Oil Spill Conference, March 8-10, 1977, New Orleans, American Petroleum Institute, Washington, D.C. (p. 231-235).

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WO-044 Wood, Leonard A., R. K. Gabrysch and Richard Marvin, Reconnaissance Investigation of the Ground-Water Resources of the Gulf Coast Region, Texas, Bull. 6305, Texas Water Commission & USGS (1963).

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APPENDIX A
OIL SPILLS

The transport of crude oil involves environmental risks as a result of accidents and spills. This section presents an analysis of these risks and the frequency and size of spills that may occur during transport of oil from a foreign port to the SPR storage sites.

Oil Spill Analysis Background

In this analysis only accidental discharges of crude oil were considered. These include spills from vessel casualties, such as collisions with other vessels, rammings of fixed objects and groundings, spills at marine terminals during the offloading and loading of tank vessels, spills during vessel-to-vessel transfers (lightering) and pipeline accidents.

Not considered in this analysis were operational discharges of oil, such as those resulting from the disposal of oily bilge and ballast waters. It has been established that these constitute the bulk of all oil discharges associated with marine operations, as shown in Table A-1. However, recent and pending conventions and regulations will limit these discharges. Pending U.S. Coast Guard regulations and the 1973 IMCO (International Marine Consultative Organization) would prohibit operational discharges in coastal waters and limit discharges in the open sea (>50 miles from shore) to $\frac{1}{30,000}$ of the cargo based on requirements contained in the IMCO* International Convention for the Prevention of Pollution from Ships, 1973, but also include constraints not included in the Convention on the location of segregated ballast spaces.

Specific requirements of 33 CFR 157 concerning operational discharges from U.S. flag vessels are as follows:

- A tank vessel may discharge oily mixtures from machinery space bilges if the vessel is more than 12 miles from the nearest land, proceeding enroute, has in operation an oil discharge monitoring and control system, and is discharging an effluent with an oil content of less than 100 parts per million.
- Tank vessels operating on inland waters and sea-going tank vessels under 150 gross tons, must either retain on board oily mixtures or transfer them to a reception facility.
- Seagoing tank vessels of 150 gross tons or more, may discharge oily mixtures from cargo tanks and cargo pumproom bilges into the sea, if the vessel is more than 50 nautical miles from the nearest land and proceeding enroute, the instantaneous rate of discharge of oil does not exceed 60 litres per mile, and the total quantity of oil discharged does not exceed, for an existing vessel, 1/15,000 of the cargo carried, and for a new vessel, 1/30,000 of the total quantity of the cargo from which the discharge came. The vessel must have in operation, an oil discharge monitoring and control system.

Similar regulations have been proposed for foreign flag tankers in U.S. waters. If these regulations are followed, operational discharges will tend to be widely dispersed over the open ocean.

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*The acronym "IMCO" stands for "Inter-Governmental Maritime Consultative Organization."

In contrast, accidental spills may occur anywhere, especially in coastal and inland waters, including harbors and harbor entrances. This is borne out by Table A-1, which shows the world-wide distribution of accidental oil spills from vessel casualties during the five-year period of 1969-1973. Moreover, accidental spills may result in a large outflow at a single location rather than being widely dispersed over a great distance as for operational discharges. Hence, more significant adverse environmental effects are expected from accidental spills of oil, and this is the reason for the focus of this analysis.

Oil Spill Statistical Data

The oil spill analysis was based on three types of historical data on accidental oil spills collected from several sources:

- o The number of spill incidents during a certain time period;
- o The exposure to spills;
- o The size distribution for spills of the several types considered.

The quotient of the first two factors above give the frequency of accidental spill and the data of the third was used to estimate the size of an average spill. Also, the accident frequency data were combined with spill size distributions to estimate the frequency of spills exceeding a given volume. The frequencies of the several types of accidental spills derived from these data are presented in Table A-2. The size distribution of these spills are presented in Figures A-1, A-2, and A-3 for tank vessel casualties; Figure A-4 for vessel loaded-offloading accidents; and in Figure A-5, pipeline accidents.

Table A-1. Location of 452 Tankship Involvements with Oil Outflow, Tankships over 10,000 DWT

INVOLVEMENT TYPE	PIER	HARBOR	ENTRANCE	COASTAL	SEA
Breakdown	0	1	1	5	3
Collision	5	41	25	45	9
Explosion	5	4	0	6	15
Fire	10	2	0	1	4
Grounding	1	27	40	53	0
Ramming	18	15	5	4	2
Structural Failure	8	9	4	7	64
Other	1	0	0	2	1
Total Coastal and Harbor: 345					
Total at Sea: 98					

Source: (CA-294)

Table A-2. Frequency of Accidental Oil Spills.

A) Vessel Casualty Frequency (Polluting Casualty Only)

Transits in Sea and Coastal Waters

200,000 DWT	Ballasted Voyage	1.24×10^{-7}/mile
	Loaded Voyage	6.24×10^{-8}/mile
50,000 DWT	Ballasted Voyage	3.65×10^{-8}/mile
	Loaded Voyage	1.54×10^{-7}/mile
25,000 DWT	Ballasted Voyage	3.12×10^{-8}/mile
	Loaded Voyage	2.30×10^{-7}/mile

Transits in Mississippi/Ohio Rivers

Barge	Loaded Voyage*	3.816×10^{-7}/mile

Transits in Harbors and Ports

Tanker	4.4×10^{-5}/trip into port
Barge	5.4×10^{-5}/trip into port

Vessel Casualty Frequency During Lightering = .012/year.

B) Accidents

Loading-Offloading Operation

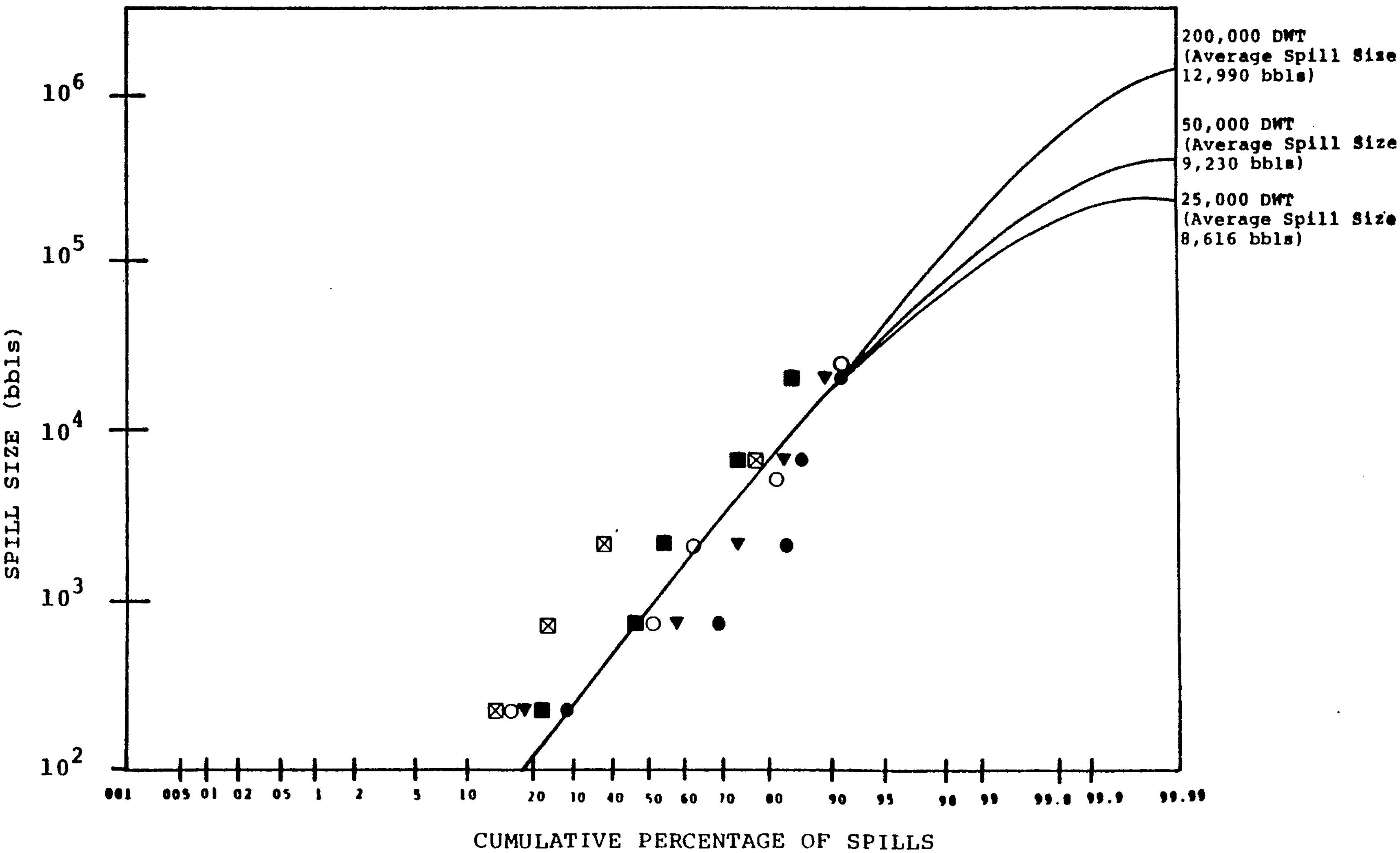
Loading-Offloading	=	13.5×10^{-3}/operation
Other Operation	=	6.9×10^{-3}/port call
Total	=	20.4×10^{-3}/operation

Lightering Operation

Loading-Offloading	=	13.5×10^{-3}/operation
Other Operation	=	13.8×10^{-3}/operation
Total	=	27.3×10^{-3}/operation

Pipelines

Greater than 12 inches in diameter
= 5.3×10^{-2} per 100 miles per year



▼10-30,000 DWT ■30-50,000 DWT ●50-80,000 DWT ○80-180 DWT ⊠180-400,000 DWT

Figure A-1 Distribution of Quantity of Oil Spilled Accidentally from Tankships During Loaded Voyages.

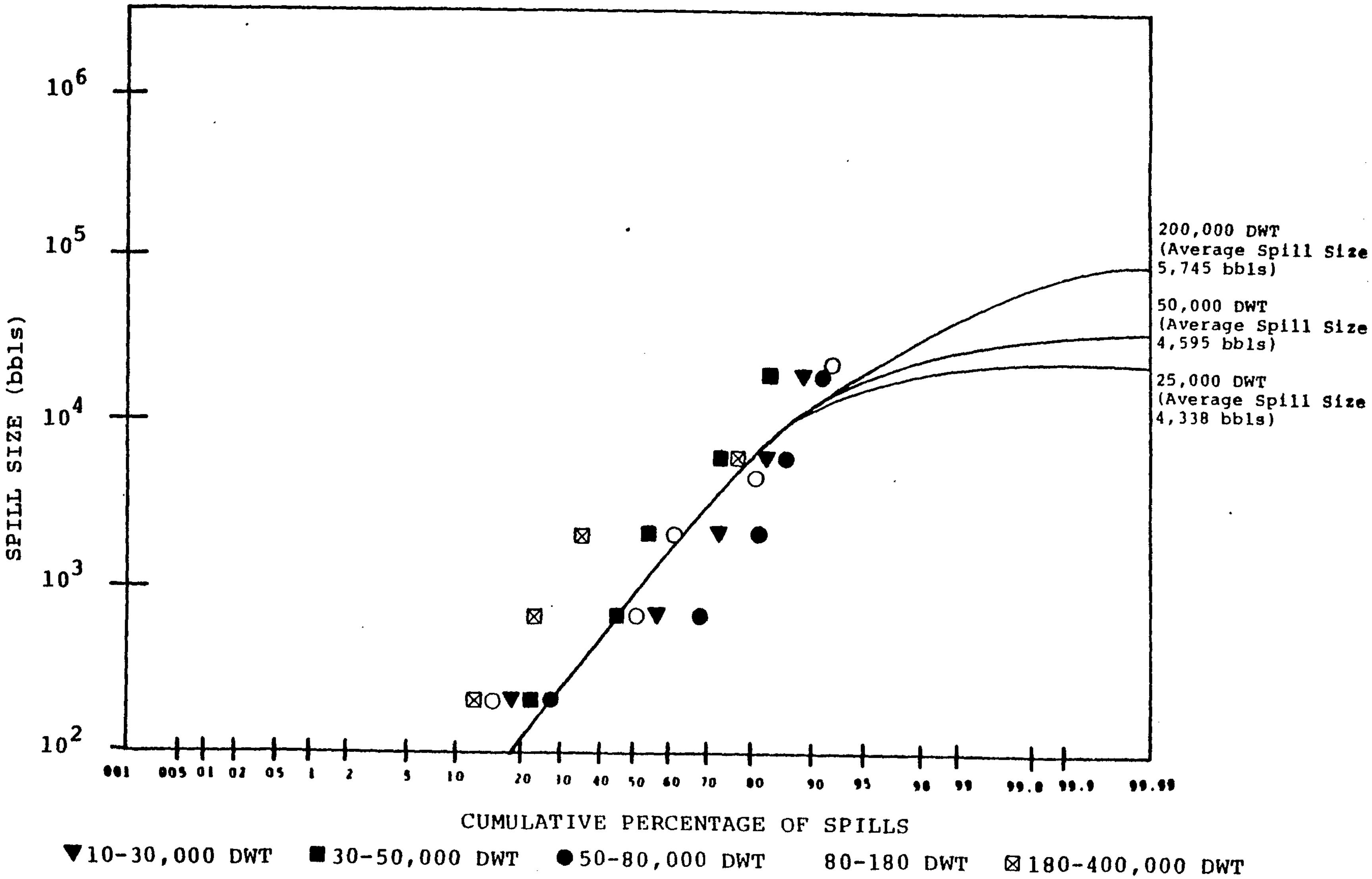


Figure A-2 Distribution of Quantity of Oil Spilled Accidentally from Tankships During Ballasted Voyages.

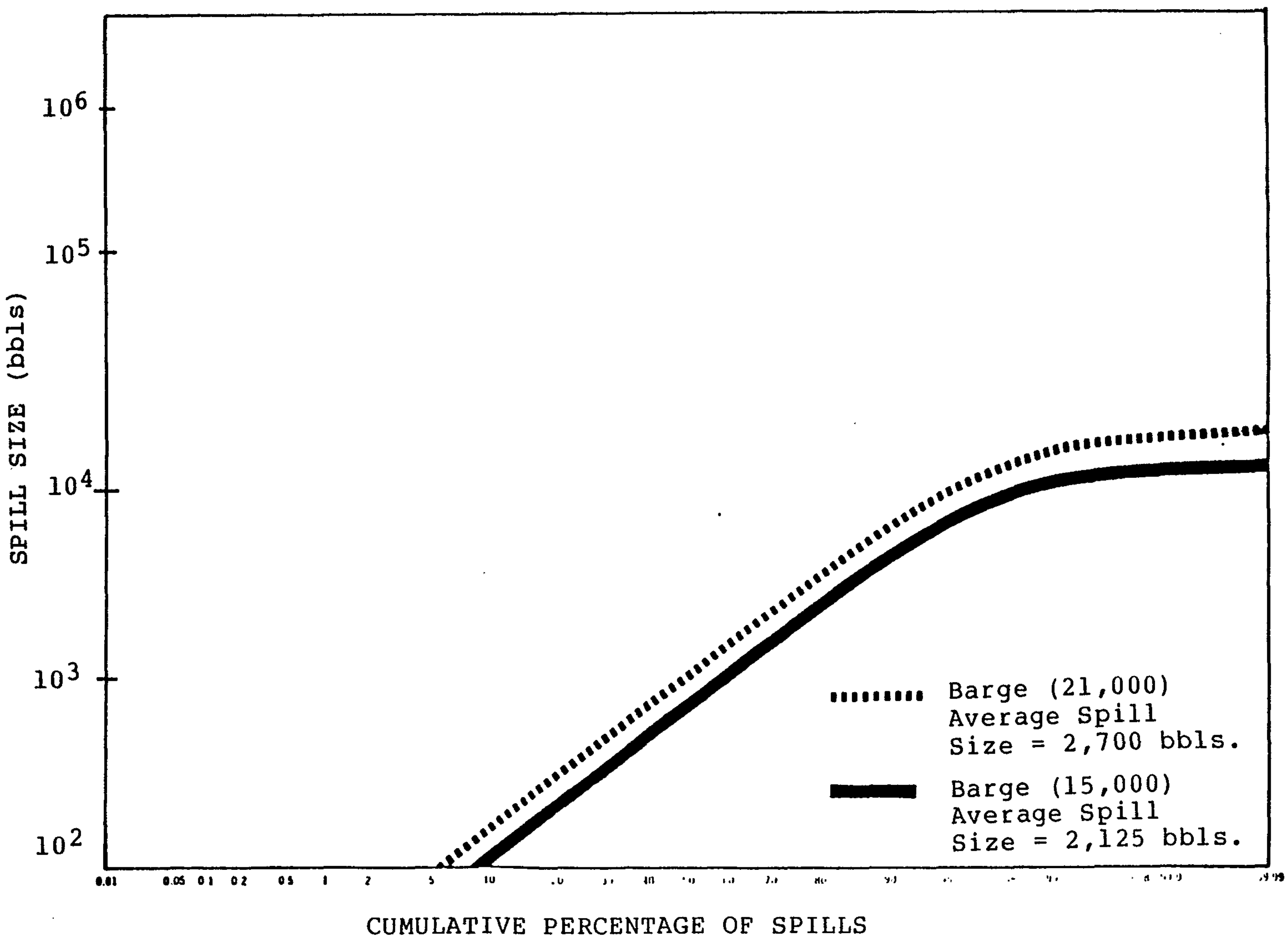


Figure A-3 Distribution of Quantity of Oil Spilled Accidentally from Barges During Loaded Voyages.

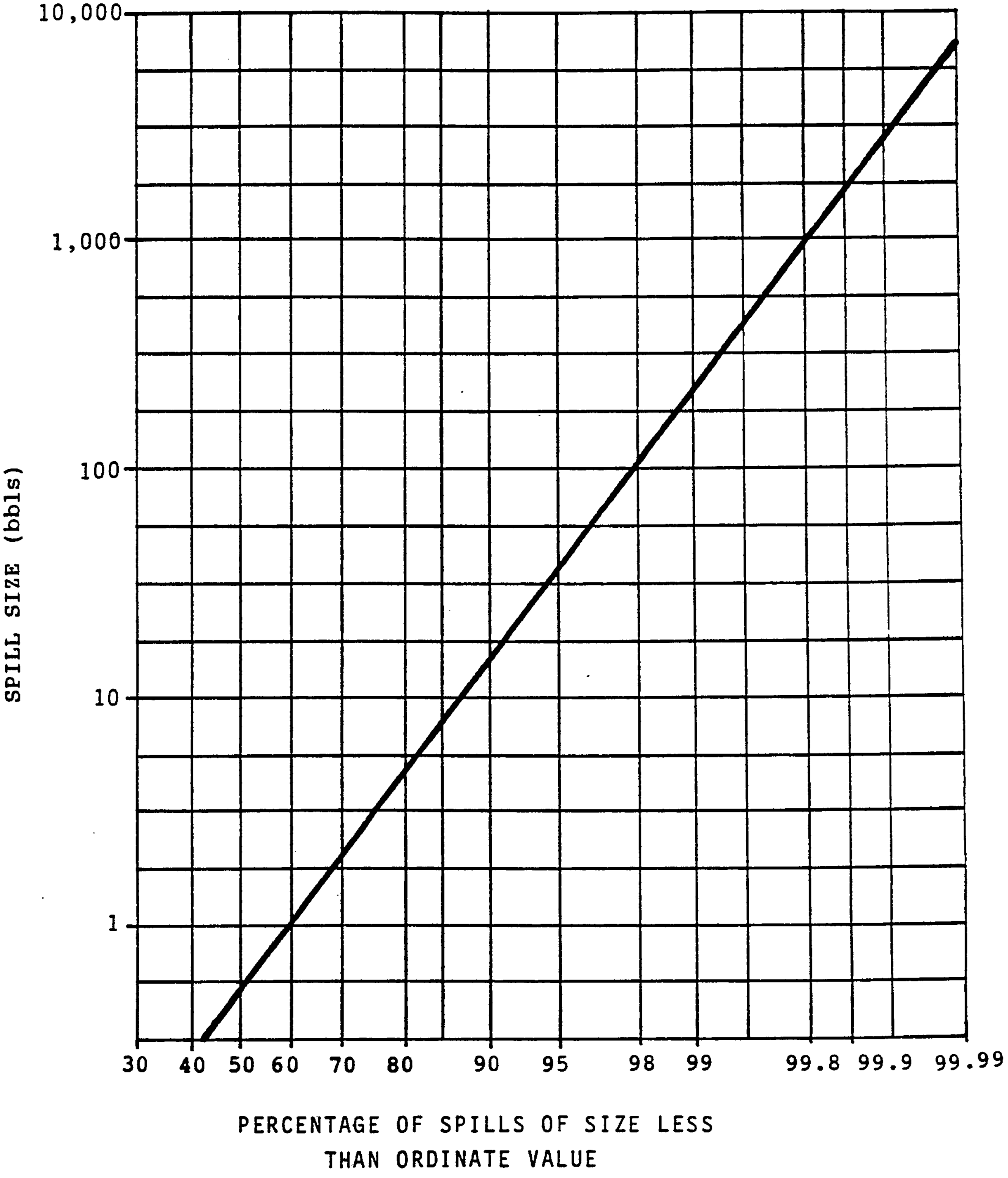


Figure A-4 Distribution of Quantity of Oil Spilled in Accidents During Loading and Offloading Tankships and Tankbarges.

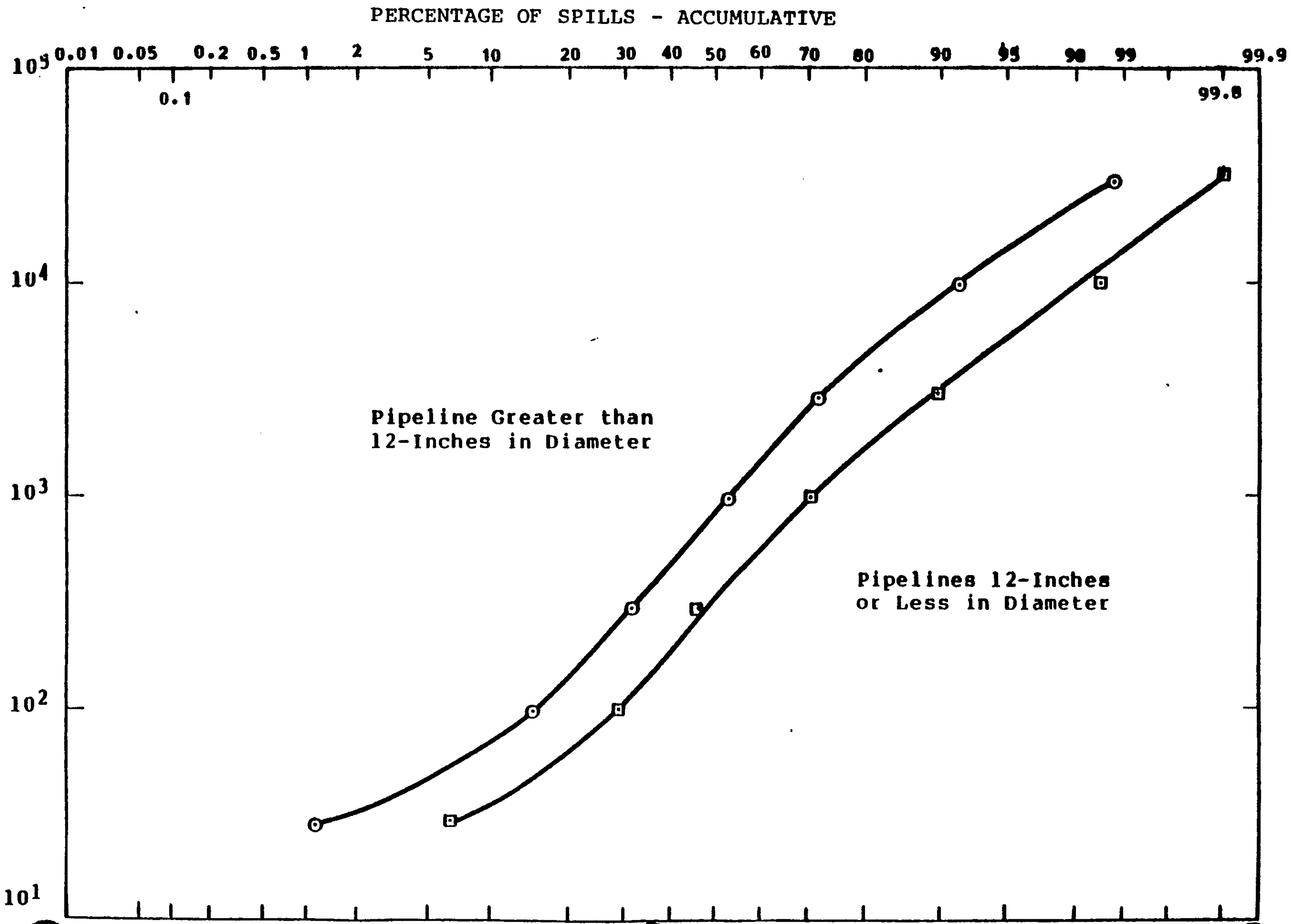


Figure A-5 Size Distribution of Spills From U.S. Terrestrial Pipelines Transporting Liquid.

The sources of the data used are presented in Table A-3. This includes all but the spill frequency for barges in the Mississippi and Ohio Rivers, and the spill frequency associated with a lightering operation.

The fact that the spill frequencies and size distributions were based on extensive historical data gives credence to their general reliability. This is because many of the methods and vessels that will be used to transport SPR oil are much the same as those used in the recent past. On the other hand, as will be discussed subsequently, the FEA may require more stringent procedures and methods which would insure a lower accidental spill rate relative to the historical rate.

It should be noted that the risk of oil spills in the Caribbean deepwater port was estimated using the same frequency values and distribution of size of spills for the U.S. Gulf Coast ports.

Also, the estimation of the risk of oil spills during the actual ship-to-ship transfer of oil (in Scenario B) was made using the spill frequency and the distribution of the size of spills for loading and offloading at conventional docks. This application probably resulted in an overestimation of this risk. The probability of accident during lightering operations is believed to be less than that for loading and offloading operations at conventional docks.

Industry representatives indicate that oil spills during lightering are rare. This operation is unregulated, and since the operation is performed 50 miles or more off the U.S. coast, there are no requirements for reporting oil spills. The mooring and un-mooring of the two ships at

Table A-3. Sources of Data

Vessel Casualties	Accidents and Spill Sizes	Exposure Data
At Sea	U.S.C.G., 1	2
Gulf Coast Harbors and Ports	3	4
Rivers	3	4
Loading-Offloading Operations		
Lightering	Estimated	Estimated
Fixed, Inland Berth	PIRS, 5	Estimated, 4
Deepwater Port	6	6
Pipelines	OPS, 7	Bu Mines, 8

1. Card, J.C., P.V. Ponce and W.D. Snider, "Tankship Accidents and Resulting Oil Outflows, 1969-1973", 1975 Conference on Prevention and Control of Oil Pollution, March, 1975, San Franciso, California.

2. J.J. Henry Co., Inc. "An Analysis of Oil Outflows Due to Tanker Accidents, 1971-1972", Report CG-D-81-74, U.S. Coast Guard, 1973.

3. Commercial Vessel Casualty Data, U.S. Coast Guard.

4. Waterborne Commerce, for the years 1974 and 1975, published annually by the U.S. Army Corps of Engineers.

5. Pollution Incident Reporting system, data file maintained by the U.SA. Coast Guard.

6. Science Applications, Inc. and C.R. Cushing, Co., Inc., "System Safety Analysis Report, Deepwater Port Inspection Methods and Procedures," Draft Report Prepared for U.S. Coast Guard, May 1977.

7. Data obtained from liquid pipeline accident reports on DOT Form 700-1, 1970-1975.

8. Crude-Oil and Refined-Produced Pipeline Mileage in the United States, January 1, 1974, Mineral Industry Surveys, Bureau of Mines, Department of Interior.

the beginning and at the end of the lightering operation provide opportunities for a collision between the vessels and a spill of oil. However, no such casualties have been reported in the Lloyds List or the U.S. Coast Guard Commercial Vessel Casualty Data, and consequently the risk of spills during those phases of the lightering operation must be low.

Industry statements with respect to oil spills is corroborated by U.S. Coast Guard observations. At the invitation of the companies involved, the Coast Guard does overfly lightering operations in the Gulf of Mexico once or twice a day. Also, a Coast Guard observer may be placed oboard the ship to be lightered (usually a VLCC). The impressions gained from these activities are that the current lightering operations are well planned and executed. No significant spills of oil have been observed.

Finally, it may be noted that the uncertainties in the frequencies of spills from the various types of accidents may be as high as a factor of 2. These arise, in part, from the historical data themselves and in part from assumptions that must be made to apply the data.

The uncertainties in the spill size distributions arise primarily in the projection of the fraction of large spills which are at the extreme end or outside the range of the data. This is especially true of pipeline spills. It is estimated that the fraction of spills projected in the upper 2 percentile in Figures A-1 through A-5 could be in error by as a factor of 2. However, this would cause a corresponding uncertainty of no more than 50 percent in the estimates of the average spill sizes. The uncertainty in the fraction of very large spills arises because of the relative infrequency of large-spill accidents and the relati shortness of the time span of the data base. Also, it may be noted that log normal distributions of spill size, which seem to fit the data, have been used in this analysis. In a recent statistical analysis, Devanney and Stewart prefer a gamma distribution for spill size. This distribution is similar to a log normal distribution, but the gamma distribution projects a smaller fraction of large spills, using the same data. Hence, the log normal distribution appears to be conservative in the sense of overestimating the fraction of large spills.

Scenario Analysis

The foregoing accidental spill statistics were applied to estimate the worst case environmental impacts to several geographical areas along the routes over which the SPR crude oil could be transported. Three transport scenarios were considered:

A. Transoceanic shipment of the oil from the Middle East directly into U.S. ports via a mix of 25,000 DWT and 50,000 DWT tankships;

B. Transoceanic shipment via VLCC's to U.S. coastal waters, lightering onto 50,000 DWT tankship and shipment into U.S. ports;

C. Transoceanic shipment via VLCC's to a DWP* in the Caribbean, and transhipment to U.S. ports in 50,000 DWT tankships.

These scenarios are summarized in Table A-4, which also lists the number of shipments, offloadings and loadings involved. Table A-5 lists the mileages of selected shipping routes and pipeline lengths for SPR oil transport. Also, loadings onto barges and shipment by barges in inland waters are included, corresponding to plans to commence an interim fill phase during which pipelines between the storage site and the marine terminal would not have been completed.

* Deepwater Port

TABLE A-4
DELIVERY SCENARIOS (FOR SHIPMENT OF 500 MM BBLS AND 1,000 MM BBLS OF CRUDE OIL)

	Scenario					
	A		B		C	
Operation	500 MM BBLS	1,000 MM BBLS	500 MM BBLS	1,000 MM BBLS	500 MM BBLS	1,000 MM BBLS
Transoceanic Shipment From Middle East	1,111 Trips 25,000 DWT Tankers, and 833 Trips 50,000 DWT Tankers	2,222 Trips 25,000 DWT Tankers, and 1,666 Trips 50,000 DWT Tankers	345 Trips VLCC (200,000 DWT)	690 Trips VLCC (200,000 DWT)	345 Trips VLCC (200,000 DWT)	690 Trips VLCC (200,000 DWT)
Transits Through and Transfers in Gulf of Mexico or Caribbean	1,111 Trips 25,000 DWT Tankers, and 833 Trips 50,000 DWT Tankers	2,222 Trips 25,000 DWT Tankers, and 1,666 Trips 50,000 DWT Tankers	345 VLCC Trips; 1,389 Lighterings onto 50,000 DWT Tankers and 1,389 Trips of These Vessels	690 VLCC Trips; 2,778 Lighterings onto 50,000 DWT Tankers and 2,778 Trips of These Vessels	345 VLCC Offloadings, 1,389 Loadings onto 50,000 DWT Tankers at Caribbean DWP and 2,778 Transits Through Gulf of Mexico and Caribbean	690 VLCC Offloadings, 2,778 Loadings onto 50,000 DWT Tankers at Caribbean DWP and 1,389 Transits Through Gulf of Mexico and Caribbean
Transits of U.S. Harbors and Waterways	1,944 Tanker Trips and 628 Barge Trips	3,888 Tanker Trips and 628 Barge Trips	1,389 Tanker Trips and 628 Barge Trips	2,778 Tanker Trips and 628 Barge Trips	1,389 Tanker Trips and 628 Barge Trips	2,778 Tanker Trips and 628 Barge Trips
Offloading and Loadings at Inland Terminals and Docks	1,944 Tanker Offloadings and 1,256 Barge Loadings and Offloadings	3,888 Tanker Offloadings and 1,256 Barge Loadings and Offloadings	1,389 Tanker Offloadings and 1,256 Barge Loadings and Offloadings	2,778 Tanker Offloadings and 1,256 Barge Loadings and Offloadings	1,389 Tanker Offloadings and 1,256 Barge Loadings and Offloadings	2,778 Tanker Offloadings and 1,256 Barge Loadings and Offloadings

Table A-5
Estimated Mileages of Selected Shipping Routes and Pipeline Lengths for SPR Oil Transport

A. Shipping Routes:

From	To	Nautical Miles of Shipping Route
Persian Gulf (via Suez Canal)	Straits of Florida	6,372
Persian Gulf (via Cape of Good Hope)	Straits of Florida	11,994
Persian Gulf	Caribbean Sea (Lesser Antilles)	10,468
Caribbean Sea (Lesser Antilles)	Bonaire, Caribbean	380
Bonaire, Caribbean	Sun Terminal, U.S.	2,300
Straits of Florida	Sun Terminal, U.S.	900
Lightering Location	Sun Terminal, U.S.	70
Offshore Storage Site	Gulf Coast	10

B. Pipeline Lengths:

Storage Capacity	Pipeline Miles
500 MMB	193
1,000 MMB	253

The numbers of trips and loading-offloading operations were based on the following assumptions:

- o VLCC, 200,000 DWT, transports 1,450,000 bbls per trip;
- o 50,000 DWT tankships transport 360,000 bbls per trip;
- o 25,000 DWT tankships transport 180,000 bbls per trip;
- o Barges in harbors and coastal inland waters transport 21,000 bbls per trip.

Finally, it also was assumed that the barges would transport a total of only 13.2 MMB of oil, the quantity associated with the interim fills for the Texoma and Capline groups of storage sites.

The scenarios considered are the same as those in the original statement except that the fourth scenario, involving a U.S. deepwater port, has been dropped. Such a port may not come into existence until after the initial fill has been completed.

The three shipping scenarios were applied to a baseline and 5 alternative oil storage plans. The baseline case was one of the storage alternatives considered in the original statement, namely the storage of 500 MM bbls of crude oil by 1982 in Gulf Coast salt domes (mines and leached caverns).

The five alternatives are for the storage of 1,000 MM bbls of petroleum (crude oil and products) in various configurations and schedules. The five alternatives are:

<u>Alternative 1</u>: 1,000 MMB by 1985 (representing an incremental increase of 500 MMB and an extension of 3 years).

Alternative 2: 1,000 MMB by 1983 (representing an incremental increase of 500 MMB and one additional year; this would include 100 MMB for the Industrial Petroleum Reserve and could also include 50 MMB in shut-in reserves).

Alternative 3: 1,000 MMB 1983 (same as Alternative 2 without the element of IPR and shut-in reserve).

Alternative 4: 1,000 MMB by 1983 (with 150 MMB located offshore).

Alternative 5: 1,000 MMB by 1983 (including 150 MMB offshore and 20 MMB in regional storage)

(Except for Alternative 5, all shipments would be made to Gulf Coast ports.)

Consideration of these alternatives involve some slight modifications of the three scenarios described above. Alternative 2 involves shipment of only 850 MMB, instead of 1,000 MMB, with a corresponding reduction of the number of vessel trips (417 trips of 50,000 DWT tankers). The number of interim fill barge trips remains the same. Alternative 4 involves the diversion of some of the smaller tankships (417 trips of 50,000 DWT tankers) to a single point mooring for offloading into the offshore storage caverns. Alternative 5 is the same as Alternative 4 except some of the shipments are to East Coast ports.

For each alternative, except as noted for Alternative 5, all of the oil was considered to be stored in salt dome caverns located along the Gulf Coast, especially in the Texoma, Capline and Seaway groups of sites. However, consideration also was given to storage of approximately 100 MMB in either either of two inland sites: salt domes located in northern Louisiana and Mississippi, and rock caverns near the Ohio River.

Areas Impacted by Oil Spills

The risk of accidental oil spills, associated with the marine transport scenarios and alternative storage plans, were analyzed in terms of the potential adverse effects to separate geographical areas. This approach recognizes that some areas are more sensitive to spilled oil than others. The oil shipping routes were divided into five primary areas and three secondary areas. The primary areas are those through which the bulk of the oil would be moved. The secondary areas are those through which much smaller quantities of oil might be shipped. The primary areas are:

- Open ocean, primarily the North Atlantic Ocean and for VLCC transport, the South Atlantic and Western Indian Oceans;
- The waters of the Gulf of Mexico and the Caribbean Sea, in which lightering and offloadings and loadings at a DWP would take place;
- The U.S. Gulf Coast from the Florida Straits to Texas;
- Harbors and inland waters of the U.S. Gulf Coast, including the Channels connecting the harbors the the sea and the storage site;
- Gulf Coast wetlands and other lands near the pipelines connecting the storage site with the marine terminal.

Accidental oil spills affecting the open ocean areas could result from any of several types of vessel casualties including collisions, fires, explosions and structural failure of the vessel. Oil spills affecting the waters of the Gulf of Mexico and the Caribbean Sea could result from all types of vessel casualties and accidents during loading-offloading operations during lightering and at a DWP in the Caribbean. Spills from accidents within 50 miles of the

Gulf Coast, including vessel casualties, and loadings-offloadings at an offshore storage site, were assumed to impact the Gulf Coast. Spills in inland waters include those from tankship casualties, tankbarge casualties and loading and offloading accidents at a marine terminal. The fifth area is assumed to be affected only by spills from pipeline accidents.

The secondary areas are:

- o The upper Mississippi (above Baton Rouge) and Ohio Rivers;
- o East Coast harbors and coastal lands;
- o Interior U.S. lands along pipeline routes.

Tankbarges (15,000 barrels capacity) could be employed to transport oil to an inland storage site. Casualties involving these vessels could pollute the upper Misiissippi and Ohio Rivers. Tankship casualties and offloadings at a marine terminal could pollute East Coast harbors and coastal areas. Such incidents would be associated with the regional storage of 20 MMB of oil.

Finally, as an alternative to barge transport, the transport of oil to inland storage sites could be accomplished by using pipelines, and inland U.S. areas could be polluted by accidental spills from these pipelines.

Oil Spill Risk for Each Area - Interim Fill

In order to determine which combination of scenarios and alternatives could result in the worst case impact, the average total amount of oil expected to be spilled, statistically, was estimated for each of the above geographical areas. The results are shown in Table A-6. These values were computed using the data in the figures and tables presented above:

(Average Total Oil Spilled) = (Average Spill Volume Per Spill) x
(Spill Frequency Per Trip or Mile or Operation) x
(Number of Trips or One Mile Segments or Operation).

Appropriate values for the first factors were obtained from the data in Figures A-1, A-2, A-3, A-4, and A-5; values for the second factor are given by Table A-2; values for the third factor were obtained from Tables A-4 and A-5.

As expected, because only half the amount of oil is transported, the oil spill risk for the baseline 500 MMB is about one half that for 1,000 MMB (Alternatives 1 and 3). The exception is the estimate of pipeline spills. The reason for this is that that spills from the pipelines were assumed to occur even if the pipeline were idle (but full of oil). The length of pipeline is the same for all cases, but the usage time is different (oil pipelines were assumed full during the time span of the appropriate alternative).

The differences between the 5 alternatives for predicted total amount of oil spilled reflect variously the total amount of oil handled and the use of offshore storage sites. Similarly, the differences between scenarios reflect the differences between shipping modes, number and location of offloading-loading operations.

In order to assess the likelihood of a spill of a given size, the frequency of spills were estimated for the worst case for each geographical area. Plots of spill size

TABLE A-6
PREDICTED AVERAGE TOTAL BARRELS OF OIL EXPECTED TO BE SPILLED

Alternative

	Scenarios	1	2	3	4	5	Baseline
At Sea	A	46,843	42,621	46,843	46,843	46,852	24,395
	B	12,604	10,704	12,604	12,604	12,650	6,302
	C	10,999	9,342	10,999	10,999	11,176	5,500
Caribbean and Gulf of Mexico	A	6,250	5,686	6,250	6,250	6,174	3,125
	B	3,221	2,736	3,221	3,221	3,157	1,611
	C	15,863	13,480	15,863	15,863	15,656	7,932
Gulf Coast	A	367	334	367	445	441	184
	B	293	250	293	371	367	147
	C	293	250	293	371	367	147
Inland Waters	A	2,756	2,501	2,756	2,501	2,501	1,600
	B	2,139	1,885	2,139	1,885	1,885	1,292
	C	2,139	1,885	2,139	1,885	1,885	1,292
Pipelines (Applies to all Scenarios)		3,768	2,826	2,826	2,826	2,826	1,800

versus frequency are shown in Figures A-6 through A-10. These curves were obtained as follows:

Frequency of Spill Exceeding a Given Size	=	Frequency of Spill Per Trip or 100 Miles or Operation	x	Fraction of Spills Exceeding a Given Size	x	Number of Trips or One Mile Segments or Operation

Data for the first factor are given in Table A-2. Data for the second factor are shown in Figures A-1, A-2, A-3, A-4, and A-5. Finally, data for the third factor were obtained from Tables A-4 and A-5. Each of the Figures A-6 through A-10 show both the total frequency of spills exceeding a given size and the contribution to the total of the various transport operations which occur in the geographical area.

For the open ocean, the worst case results from the transport of 1,000 MMB of oil via a mix pf 25,000 and 50,000 DWT tankers. The greater number of trips of smaller tankers required to transport the oil, accounts for the prediction of a greater amount of spilled oil. In coastal waters and the open sea, a major spill is defined as 2,380 bbls (100,000 gallons); the frequency of a major spill during transport of 1,000 MMB from Figure A-6, is 1.8.

With respect to spills affecting the U.S. Gulf Coast, and the waters of the Gulf of Mexico and the Caribbean Sea, an arbitrary distinction was made. Spills from all operations occuring within 50 miles of the U.S. Gulf Coast were assumed to impact the Gulf Coast and not the open waters of the Gulf. All operations beyond 50 miles, including lightering operations, were assumed to impact only open waters. With

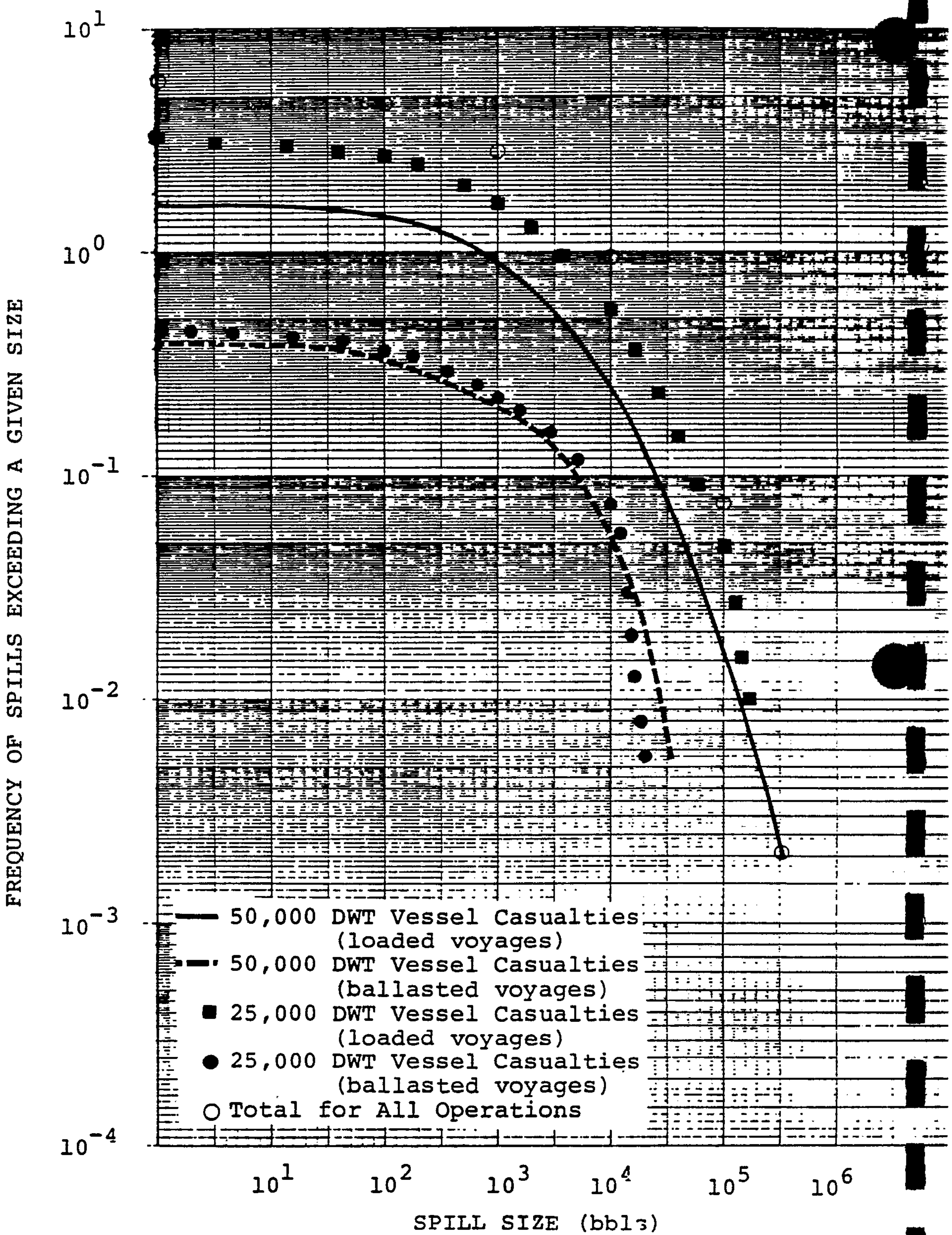


Figure A-6. Worst Case Frequency of Oil Spills in the Open Ocean During Transport of 1,000 MMB (Alternatives 1, 3, 4, 5 and Scenario A).

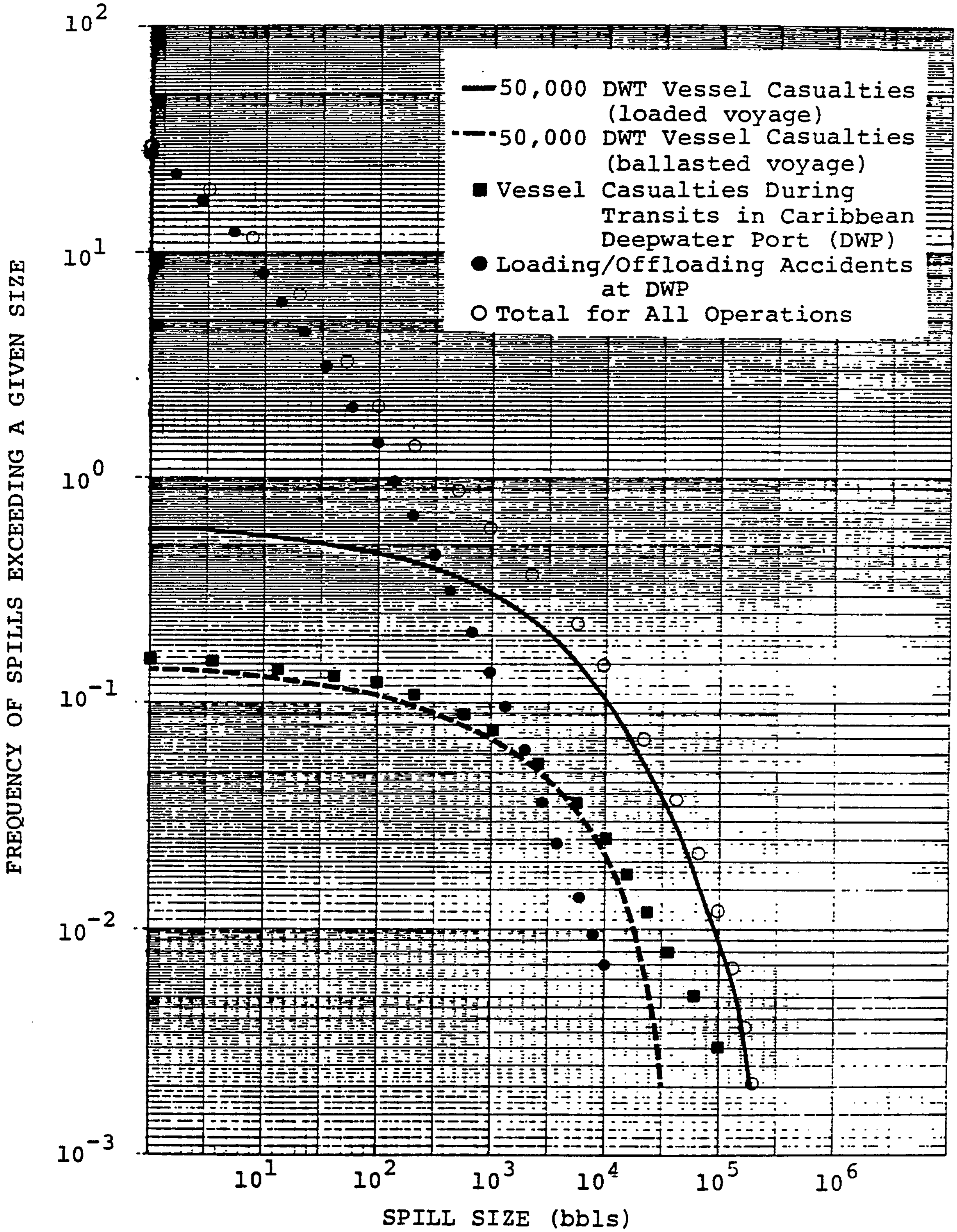


Figure A-7. Worst Case Frequency of Oil Spills in the Gulf of Mexico and Caribbean Sea During Transport of 1,000 MMB (Scenario C, Alternatives 1, 3, 4).

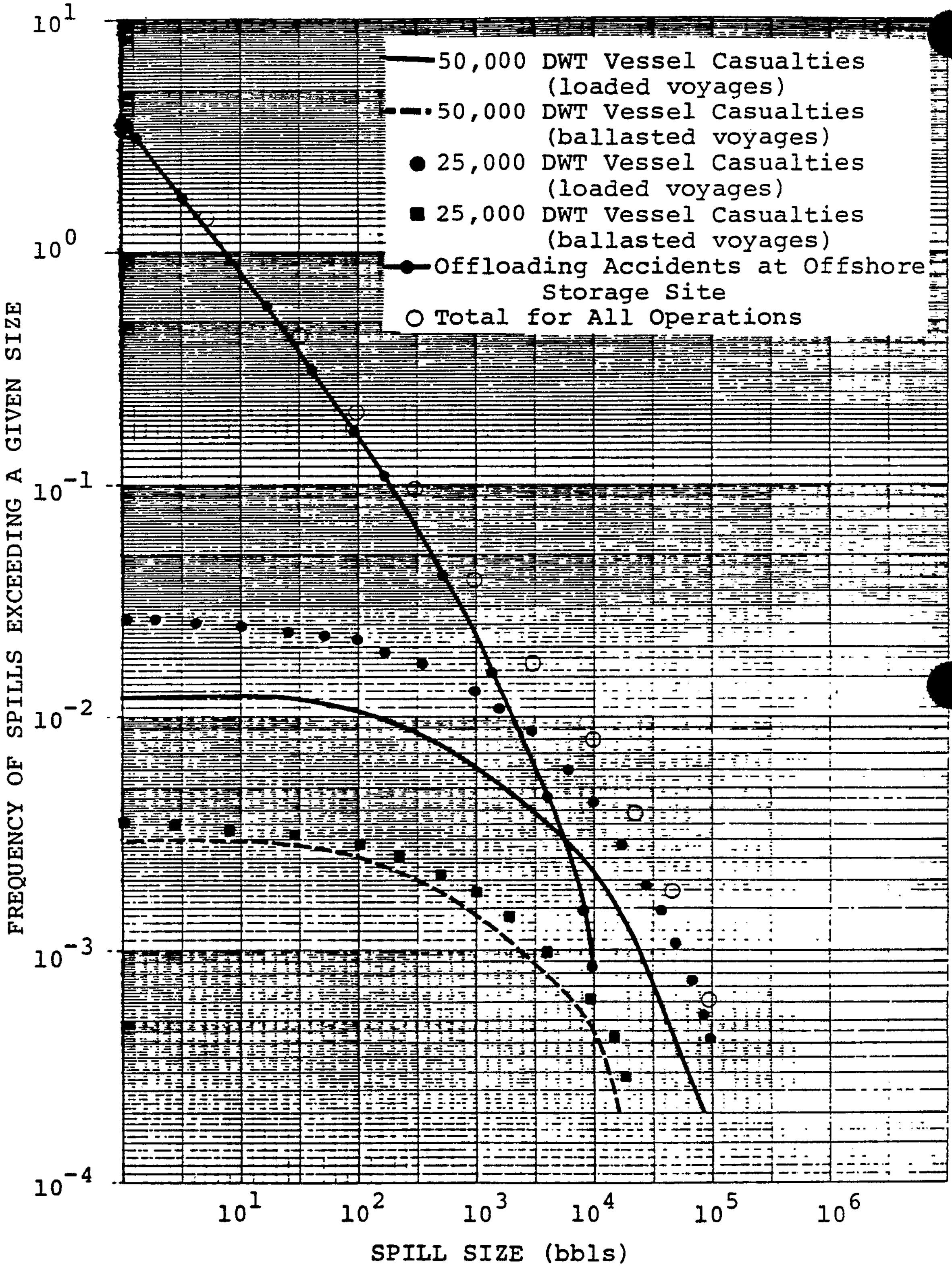


Figure A-8. Worst Case Frequency of Oil Spills Impacting the Gulf Coast During Transport of 1,000 MMB (Scenario A, Alternatives 4 and 5).

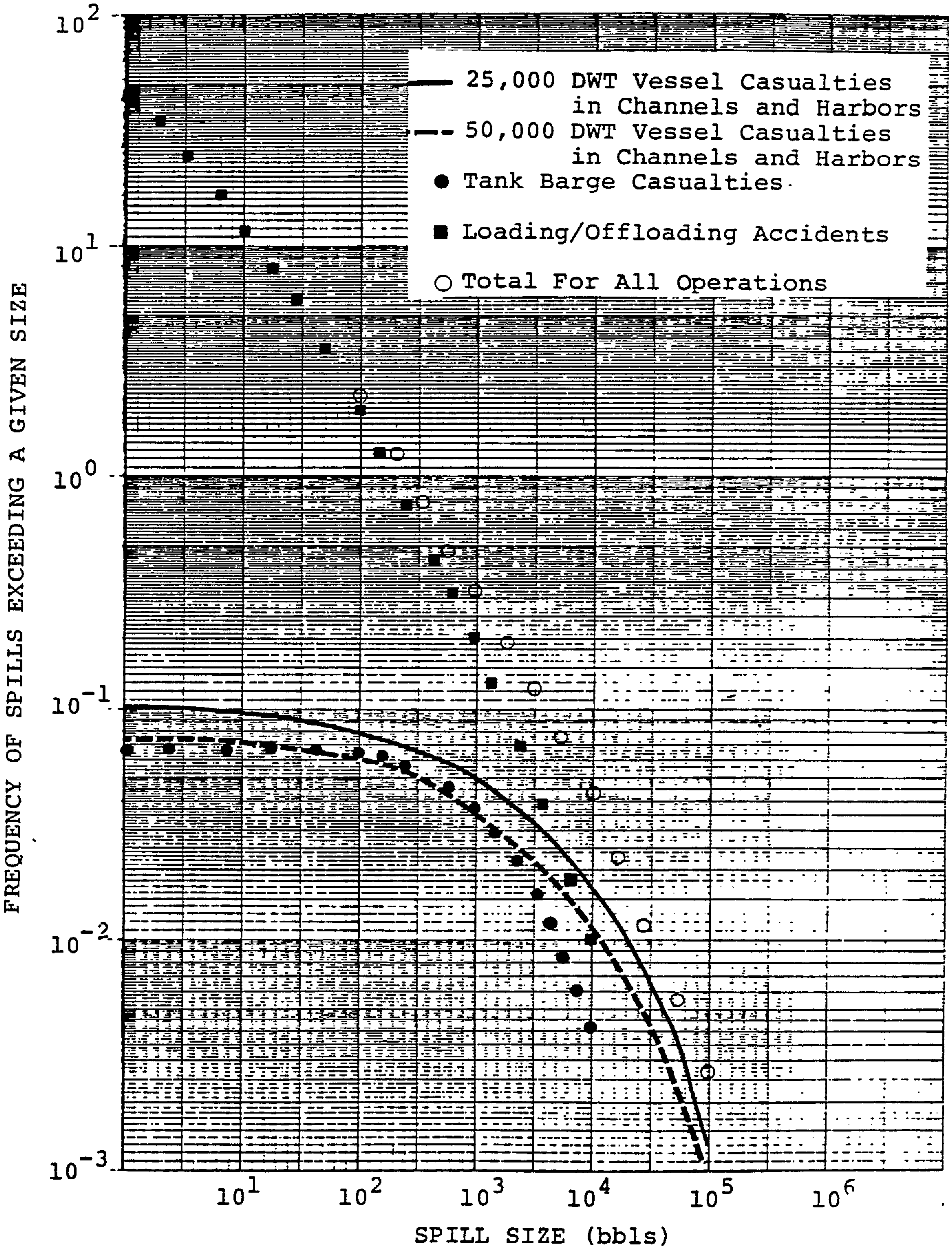


Figure A-9. Worst Case Frequency of Oil Spills at Inland Harbors, Waterways and Docks (Scenario A, Alternatives 1 and 3).

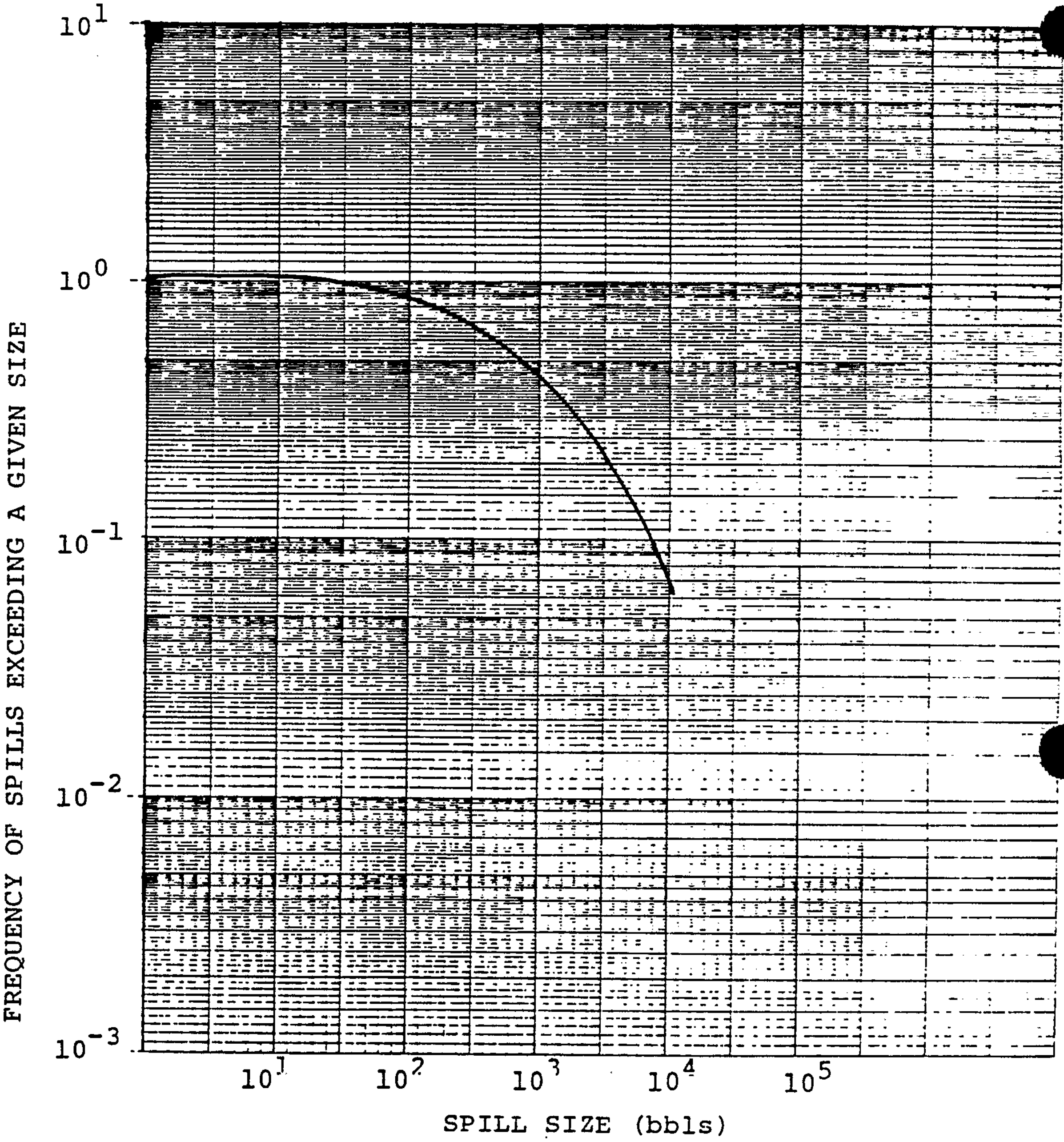


Figure A-10. Frequency of Oil Spills From Pipeline Accidents Near the Gulf Coast During Transport of 1,000 MMB.

this distinction, the worst case impact to Gulf and Caribbean waters results from Scenario C for the transport of 1,000 MMB of oil (alternatives 1, 3, 4). The worst case risk of oil spills for the Gulf Coast results from Scenario A for the transport of 1,000 MMB of oil (alternatives 4 and 5). The corresponding spill frequency curves are shown in Figures A-7 and A-8, respectively. The frequency of major spills (>2,380 bbls) in the Gulf and Caribbean during transport of 1,000 MMB is 0.38, and the major contributor to this is a vessel casualty. For the Gulf Coast, the frequency of a major spill is 0.018, and the contributors are vessel casualties and accidents during offloading at the offshore storage site.

The worst case risk of oil spills to Gulf Coast inland waters is expected from Scenario A, alternatives 1 and 3. The frequency of spills in these waters is shown in Figure A-9. For inland waters, a major spill is that which exceeds 238 barrels (10,000 gal.). According to the figure the frequency of a major spill during transport of 1,000 MMB is 1.0, for which spills during loading and offloading tankvessels are expected to be the major contributor.

Accidental spills from pipelines impacts Gulf Coast land areas and the frequency of these spills is shown in Figure A-10. The frequency of a major spill (>238 bbls) during transport of 1,000 MMB is 0.70.

The oil spill risk for the three secondary areas is presented in Table A-7, which lists the predicted average total oil spilled in each area for certain storage and transportation alternatives. The import of 20 MMB of oil through East Coast ports is predicted to pose a negligible risk of accidental spills to the East Coast. A more significant risk is posed by utilizing rock caverns at great

TABLE A-7

PREDICTED AVERAGE TOTAL OIL SPILL FROM TRANSPORTATION ACCIDENTS
ASSOCIATED WITH CERTAIN STORAGE ALTERNATIVES

	Predicted Average Total Oil Spilled (Barrels)		
Storage Alternative	East Coast Area	Inland Rivers, Ohio and Mississippi	Pipeline Routes
East Coast 20 MM BBLS (Alternative 5)	4 Scenario A 4 Scenario B 4 Scenario C	--	--
Rock Cavern (Kentucky) 100 MM BBLS (Any Alternative)	--	10,926[1] (Barge Transport of 100 MM BBLS)	2,247[2] (Pipeline Transport of 100 MM BBLS)
Inland Salt Domes Mississippi, Louisiana) 100 MM BBLS (Any Alternative)	--	4,526[3] (Barge Transport of 100 MM BBLS)	400[4] (Pipeline Transport of 100 MM BBLS)

1 Based on 6,667 barge trips over 1,500 mile route.
2 Based on 1,206 miles of pipe and a usage time of one year.
3 Based on 6,667 barge trips over a 320 mile route.
4 Based on 215 miles of pipe and a usage time of one year.

distances (>1000 miles) from Gulf Coast ports. The risk of spills from tank-barge casualties is especially large, mainly because of the long distance and, consequently, the greater exposure to accidents. The oil spill risks associated with utillizing salt domes in northern Louisiana and Mississippi are less because these domes are closer to Gulf Coast ports (<350 miles).

Although the risk of oil spills in the Ohio and Mississippi Rivers or overland (pipeline route) is significant, the risk would have to be taken eventually even if all of the SPR oil were to be stored in Gulf Coast salt domes. During a withdrawal phase, more than 100 MMB of SPR oil or products refined from it would have to be transported to the northern midwestern states. In this eventuality, transport by pipelines obviously entails a lower risk of accidental spills.

Risk of Oil Spills - Withdrawal and Refill

The risk of oil spills in the several geographical areas for withdrawal and distribution of SPR oil, and for refill of the storage sites was not analyzed in detail. However, because of the similarity between the initial fill and refill operations, the worst case risk of spills during refills should be approximately the same.

Oil Spill Cause and Event Tree

Event and/or fault trees are most useful methods for logically analyzing failures and accidents, both in qualitative and quantitative terms. Such diagrams provide a visual display of the logic and interrelationships of causes, conditional events, and contributing factors. Such visual displays enable identification of critical causative and contributory factors where the more efficacious preventive and mitigative measures can be applied. Figure A-11 presents a cause and event tree for oil spills into the sea and/or restricted waters. This particular logic diagram has been tailored to be most useful for this case, and is not in the strictest sense either an event tree or a fault tree.

The logic diagram proceeds from left to right in a time ordered sequence. Possible causative factors occurring in the design, construction/fabrication/installation, as well as during the operation of oil transport are identified in columns. Contributory conditions are also shown. The level of detail indicated hereon is not intended to be comprehensive, but to provide an indication of the type of analysis needed in the Development of Environmental Evaluation Criteria and Guidelines for assessment of the Environmental Plans (FEA No. 70174). Such cause and event trees can be developed in sufficient detail, in conjunction with functional staging diagrams as required, to identify the principal causative factors, and to assess the potential of individual preventive and mitigative measures for reducing the risk of oil spillage.

The two principal branches of this cause and event tree of Figure A-11 are those spills resulting from a vessel casualty involving the rupture of tanks and hull, as distinct from those resulting from an accidental discharge through an overflow or piping. For vessel casualties, there are two sub-branches. These are: (1) collision, ramming, grounding and structural failure accidents, and (2) fires and explosions. For accidental discharges, there are three branches. These are: (1) accidental pumping overboard, (2) accidental overflow incidents, and (3) equipment failures. It should be noted that the cause and event tree is constructed so that in tracing an accident event sequence from left to right, one or more causative events/factors may be involved, but each sequence does not necessarily contain an event from all or many of the columns.

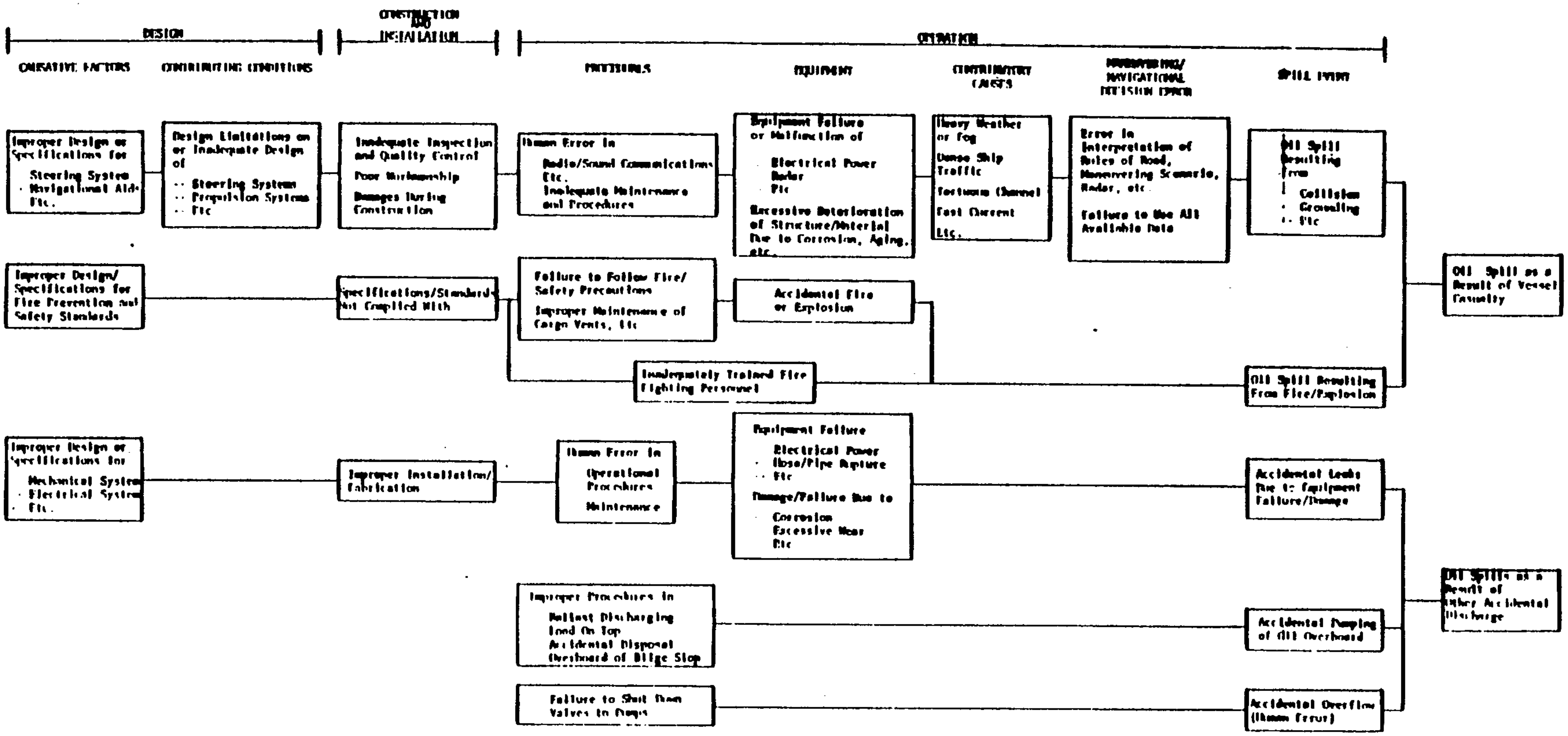


Figure A-11 Cause and Event Tree for Accidental Oil Spillage.

Human error is most frequently the cause for accidental oil spills, during the marine transport and transfer operations. Estimates of the fraction of spills resulting from human error range from 65% up to 90%. Using Figure A-11, tracing spill causes backward from right to left, one can easily see that even material/equipment failures can most frequently be traced back to a human error, although the error may have been during the design or construction of the vessel or equipment.

Figure A-12 provides a similar cause and event tree for the eventual consequences of a spill, which may range from a prompt and effective cleanup operation preventing contamination of shoreline, to a surprise contamination of shoreline without notification or detection. This diagram enables identifcation of mitigative measures subsequent to the spill event.

Measures for Preventing, Mitigating and Reducing Oil Spillage

The desired objective is to prevent, mitigate and reduce oil spillage and consequences of spills within the constraints of available equipment, techniques and procedures, and costs. Historical data are available concerning oil spills resulting from the many causative events shown in the cause and event tree of Figure A-12. Quantitative analysis of such data has been presented and discussed earlier in this Appendix. Such analyses provide useful appraisals of the principal "failure modes" for accidental spills, since techniques for spill reduction should be designed to apply in order of priority to these.

The analysis indicated that the frequencies of major oil spills are significant for marine transport at sea in coastal zones and restricted waterways, as well as for

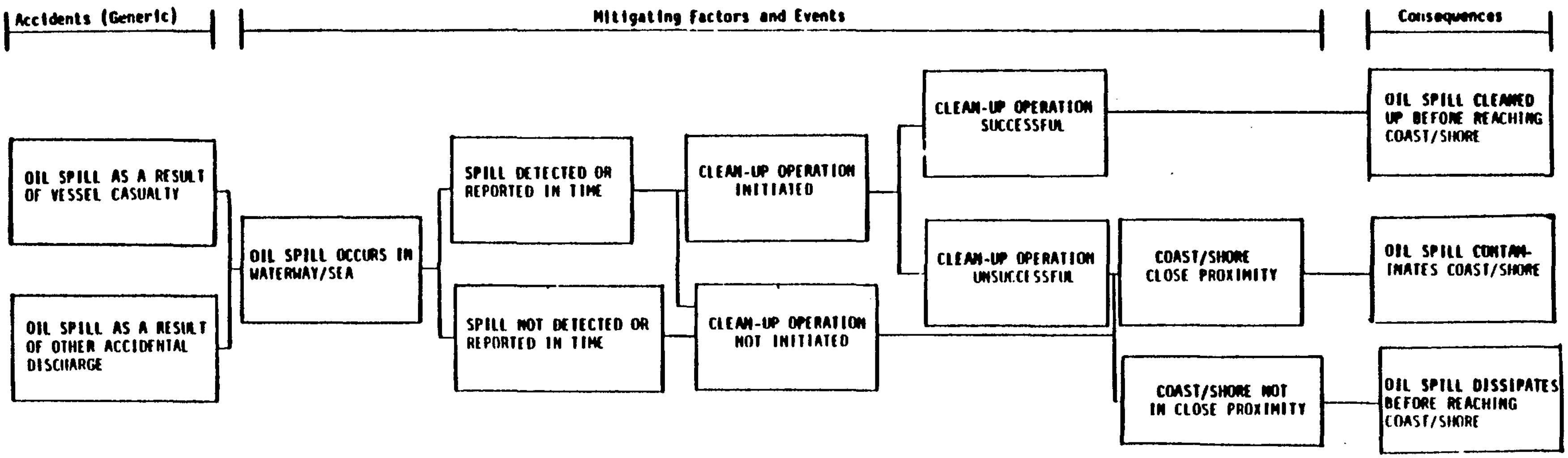


Figure A-12 Cause and Event Tree for Consequences of Oil Spillage.

transfer operations, including lightering and transfers to an onshore marine facility. The cause and event tree shown in Figures A-11 and A-12 has been drawn to show the causative factors for these spill risk cases.

Considering first marine transportation by vessel, it is straightforward to identify the importance of design and construction requirements for hull, cargo and ballast tanks, propulsion and steering systems, for example. The U.S. has long been recognized for being the leader in implementing stringent standards for the design and construction of hull and tanks. Conformance to such stringent standards is one technique for reducing spill risk and mitigating consequences. Another important item easily identifiable is the training and licensing of both officers and crews of vessels. In this regard, both the U.S. and British are recognized leaders for establishing high standards for vessels registered by their flag. Lloyd's statistics concerning percentage of vessel tonnage lost, by flag of registry, demonstrate this leadership. Such statistics enable quantitative determination of the spill reduction to be expected by choosing vessels manned by licensed crews of a particular flag. The quality of licensing procedures, and required experience, have a pronounced effect on the error rates of vessels in maneuvering and navigational situations, as well as the effectiveness in the implementation of procedures such as "Load-On-Top" for tank cleaning, which considerably reduce pollution. The availability of operating navigational aids, radars, and collision avoidance systems aboard vessels can provide prompt and complete information for navigation and maneuvering. Such information can favorably affect the error rate for such decisions by both masters and pilots.

Spillage of oil from barge tows is also a significant concern. Such spillage arises from overflows during transfer operations, from chronic leakage caused by corrosion of the hull and from vessel casualties. These latter occur principally in areas of high barge tow traffic density (since the risk is proportional to the square of the traffic density), and tortuous bends in channels, especially where there are also fast currents to contend with. Barging over long distances in the Mississippi River, for example, presents the potential for high risk of oil spillage. Such transits should be avoided, if at all possible.

The most frequent type of oil spillage during transfer operations is overflow of cargo tanks, which is caused by human errors, such as failing to shut down pump or valves, inadequate sounding procedures, pumping too rapidly while topping off, etc. Oil monitors and alarm systems can be installed to prevent or reduce this type of spillage. Spillage also may occur during transfer operations because of hose ruptures, leaky flanges or gasket failures. Fail-safe probes, such as those used in U.S. Navy tankers, and fail-safe transfer hoses, such as the one developed by SAI,[1] can be employed to effectively prevent or reduce this type of spill.

Since human error is the largest cause of oil spills, the training of personnel in state-of-the-art procedures for reduction of oil spill risks, as well as for fire prevention, during the handling of petroleum and other hazardous materials, is an essential ingredient for a balanceed effort to reduce oil spillage. Such training should be carried out, not only for tankerman (U.S. Coast Guard Publication CG-174, A Manual

1. J. A. Simmons, A. J. Houghton, W. E. Gonso, "A Fail-Safe Transfer Line for Hazardous Fluids," Science Applications, Inc. (1976).

for the Safe Handling of Inflammable and Combustible Liquid and Other Hazardous Products, is an excellent training manual for this purpose), but for personnel at the marine terminals and at storage sites. In view of the high potentia for spill risk reduction, such training programs should be given high priority at all locations.

The risk of subsequent fire and/or explosion because of oil spillage cannot be overlooked. Careful analysis of the equipment required to contain such possible fires, and the training of personnel for such contingencies should also be carried out.

The matter of mitigation once a spill occurs also must be addressed. Equipment is required for cleanup. Trained personnel are required in order that the containment and cleanup operations be successful and timely. Well thought out contingency planning is necessary to provide the procedures and organization to ensure efficiency of the operation.

APPENDIX B

CONSIDERATION OF TANKER LOADING AND UNLOADING EMISSION FACTORS AND THROUGHPUTS

In the entire SPR operation, tanker loading and unloading are the two major sources of hydrocarbon emissions. Loading emissions are attributable to the displacement of the atmosphere of hydrocarbon vapors residing in empty vessel tanks by volatile hydrocarbon liquids being loaded into the vessel tanks. Loading emissions can be separated into (1) the arrival component and (2) the generated component. The arrival component of loading emissions consists of hydrocarbon vapors left in the empty vessel tanks from previous cargos. The generated component of loading emissions consists of hydrocarbon vapors evaporated in the vessel tanks as hydrocarbon liquids are being loaded.

The arrival component of loading emissions is directly dependent on the true vapor pressure of the previous cargo, the unloading rate of the previous cargo, and the cruise history of the cargo tank on the return voyage. The cruise history of a cargo tank may include heel washing, ballasting, butterworthing, vapor freeing, or no action at all.

The generated component of loading emissions is produced by the evaporation of hydrocarbon liquid being loaded into the vessel tank. The quantity of hydrocarbons evaporated is dependent on both the true vapor pressure of the hydrocarbons and the loading rate.

Unloading emissions are hydrocarbon emissions displaced during ballasting operations at the dock subsequent to unloading a volatile hydrocarbon liquid such as gasoline or crude oil. During the unloading of a volatile hydrocarbon liquid, air drawn into the emptying tank absorbs hydrocarbons evaporating from the liquid surface. The greater part of the hydrocarbon vapors normally lies along the liquid surface in a vapor blanket. However, throughout the unloading operation, hydrocarbon liquid clinging to the vessel walls will continue to evaporate and to contribute to the hydrocarbon concentration in the upper levels of the emptying vessel tank.

Before sailing, an empty ship must take on ballast water to maintain trim and stability. Normally, on vessels that are not fitted with segregated ballast tanks, this water is pumped into the empty vessel tanks. As ballast water enters tanks, it displaces the residual hydrocarbon vapors to the atmosphere generating the so termed "unloading emissions".

The tanker loading and unloading emission factors (grams of hydrocarbon vapor per unit throughput) are generally affected by a number of factors, including loading and unloading practice, true vapor pressure, cruise history, previous cargo and chemical and physical properties. These are briefly discussed below.

1. <u>Loading and Unloading Practice</u>

During the loading operation, the initial loading and unloading rate has a significant effect on hydrocarbon emissions due to the splashing and turbulence caused by higher initial loading or withdrawing rates. This splashing and turbulence results in rapid hydrocarbon evaporation and the formation of a vapor blanket. By reducing the initial velocity of entering or withdrawing rates, it is possible to reduce the turbulence and consequently, to reduce the size and concentration of the vapor blanket. Slow final loading rate can also lower the quantity of emissions. This is because when the hydrocarbon level in a marine vessel tank approaches the tank roof, the action of vapors flowing towards the ullage cap vent begins to disrupt the quiescent vapor blanket. Disruption of the vapor blanket results in noticeably higher hydrocarbon concentrations in the vented vapor.

2. True Vapor Pressure

The true vapor pressure (TVP) of a hydrocarbon liquid has a marked impact on the hydrocarbon content of its loading and unloading emissions. TVP is an indicator of a liquid's volatility and is a function of the liquid's Reid Vapor Pressure (RVP) and temperature. Compounds with high TVP exhibit high evaporation rates and consequently, contain high hydrocarbon concentrations in their loading and ballasting vapors. The true vapor pressure of crude oil generally increases as the temperature of crude oil increases.

3. Cruise History

The cruise history of a ship includes all of the activities which a cargo tank experiences during the voyage prior to a loading or unloading operation. Examples of significant cruise history activities are ballasting, heel washing, butterworthing, and gas freeing. Cruise history impacts marine transfer emissions by directly affecting the arrival vapor component. Barges normally do not have significant cruise histories because they rarely take on ballast and do not usually have the manpower to clean cargo tanks.

Ballasting is the act of partially filling empty cargo tanks with water to maintain a ship's stability and trim. Recent testing results indicate that prior to ballasting empty cargo tanks normally contain an almost homogeneous concentration of residual hydrocarbon vapors. When ballast water is taken into the empty tank, hydrocarbon vapors are vented, but the remaining vapors not displaced retain their original hydrocarbon concentration. Upon arrival at a loading dock, a ship discharges its ballast water and draws fresh air into the tank. The fresh air dilutes the arrival vapor concentration by an amount proportional to the volume of ballast used. Although ballasting practices vary from vessel to vessel, the average vessel is ballasted approximately 40%.

The heel of a tank is the residual puddle of hydrocarbon liquids remaining in a tank after emptying. These residual liquids will eventually evaporate and contribute to the arrival component of subsequent vessel-filling vapors. By washing out this heel with water, AMOCO Oil Company found that they were able to reduce the hydrocarbon emissions from subsequent filling operations from 5.7 volume percent to 2.7 volume percent hydrocarbons. Butterworthing is the washing down of tank walls in addition to washing out tank heels. Butterworthing also reduces loading emissions by reducing the arrival component concentration. The hydrocarbon liquids washed from the tanks are stored in a slops tank for disposal onshore.

In addition to heel washing and butterworthing, marine vessels can purge the hydrocarbon vapors from empty and ballasted tanks during the voyage by several gas freeing techniques which include air blowing and removal of ullage dome covers. A combination of tank washing and gas freeing will effectively remove the arrival component of loading emissions.

4. Previous Cargo

The previous cargo conveyed by a tanker also has a direct impact on the arrival component of loading emissions. Cargo ships which carried nonvolatile liquids on the previous voyage normally return with low arrival vapor concentration. EXXON Oil Company tests conducted in Baytown, Texas indicated that the arrival component of empty uncleaned cargo tanks which had previously conveyed fuel oil ranged from 0 volume percent to 1 volume percent hydrocarbons. Cargo tanks with the same cruise history which had previously conveyed gasoline, exhibited hydrocarbon concentrations in the arrival vapors which ranged from 4 percent (by volume basis) to 30 percent and averaged 7 percent.

5. Chemical and Physical Properties

The chemical compositions and molecular weight of crude oil vapors will vary over a wide range. The typical vapor consists predominantly of C_4 and C_5 compounds. The molecular weight ranges from 45 to 100 pound per pound mole with an average of approximately 70. Hydrocarbon vapor loss is a function of both molecular weight of crude oil vapor and vaporization rate of crude oil. Given the same vapor rate, hydrocarbon vapor loss is generally increased as the molecular weight of crude oil vapor increases.

At the same throughputs, the above-mentioned factors could affect tanker loading and unloading emission factors to a certain extent. It was estimated that the loading emission factors could range from 0.55 to 0.58 lb per 1000 gallons of throughput, and the unloading factors from 0.17 to 0.66 lb per 1000 gallons of throughput. Under normal operational conditions, the throughputs will be the most important factor influencing the total emissions from loading and unloading operations. The total emissions of the expanded SPR will be increased. It should be pointed out that reduction in throughputs is the most effective way to control short-term tanker loading and unloading emissions, particularly during air stagnation periods.

APPENDIX C

LETTERS OF COMMENT

... Assistant Secretary for Science and Technology
Washington, D.C. 20230
(202) 377-3111

November 17, 1977

Executive Communications
Room 3309
Federal Energy Administration
Washington, D.C. 20461

Gentlemen:

This is in reference to your draft supplement to the final environmental impact statement concerning the Strategic Petroleum Reserve (FEA/S-77/329). The enclosed comments from the Maritime Administration are forwarded for your consideration.

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We would appreciate receiving ten (10) copies of the final statement.

Sincerely,

Sidney R. Galler
Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

Enclosure--Memo from: Maritime Administration

Maritime Administration
Washington, D.C. 20230

October 13, 1977

MEMORANDUM FOR: Dr. Sidney R. Galler
Deputy Assistant Secretary for Environmental Affairs
Department of Commerce

Subject: Federal Energy Administration - Draft Supplement to the Final Environmental Impact Statement concerning the Strategic Petroleum Reserve (FEA/S-77/329)

The subject document dated September 1977 has been reviewed for comments. This supplement addresses the proposed expansion of the Strategic Petroleum Reserve from 500 million barrels to one billion barrels and assesses the environmental impacts of this proposed expansion. Comments are as follows:

1. Operational Discharges of Oil, page V-44

(a) It is suggested that the second complete paragraph be rewritten as follows:

"Operational discharges of oil, such as those resulting from the disposal of oily bilge waters,tank washings, and ballast waters, were not considered in the analysis of oil spill risks. It has been established that these constitute the bulk of oil discharges associated with tank vessel operations. However, recent national regulations and pending international conventions will limit these discharges. U.S. Coast Guard pollution prevention regulations in Title 33, Part 157, Code of Federal Regulations (33 CFR 157) are intended to control the discharge of oily mixtures from tanker operations and to incorporate construction requirements for new vessels which will reduce spill size in future casualties and improve the survivability of tankers after damage. These regulations are based on requirements contained in the IMCO International Convention for the Prevention of Pollution from Ships, 1973, but also include constraints not included in the Convention on the location of segregated ballast spaces."

"Specific requirements of 33 CFR 157 concerning operational discharges are as follows:

- o A tank vessel may discharge oily mixtures from machinery space bilges if the vessel is more than 12 miles from the nearest land, proceeding enroute, has in operation an oil discharge monitoring and control system, and is discharging an effluent with an oil content of less than 100 parts per million.
- o Tank vessels operating on inland waters and seagoing tank vessels under 150 gross tons must either retain on board oily mixtures or transfer them to a reception facility.
- o Seagoing tank vessels of 150 gross tons or more may discharge oily mixtures from cargo tanks and cargo pumproom bilges into the sea if the vessel is more than 50 nautical miles from the nearest land and proceeding enroute, the instantaneous rate of discharge of oil does not exceed 60 litres per mile, and the total quantity of oil discharged does not exceed, for an existing vessel, 1/15,000 of the cargo carried, and for a new vessel, 1/30,000 of the total quantity of the cargo from which the discharge came. The vessel must have in operation an oil discharge monitoring and control system.

Operational discharges, therefore, tend to be widely dispersed over the open ocean."

(b) The acronym "IMCO" stands for "Inter-Governmental Maritime Consultative Organization."

2. <u>Risk of a Major Spill, page V-47</u>

The last sentence of the first paragraph should read as follows:

"Offshore, the risk of a major spill (more than 2,380 barrels or 100,000 gallons) is about 0.12 per 1,000 MMB of oil transported for coastal areas and between 0.5 and 1.0 for open waters."

3. Containment at Sea, page VI-32

The first paragraph states among other things that "dispersants (although economic and effective in heavy seas) are toxic, and their use must be restricted." It is suggested that more discussion be devoted to the recent development of dispersants with lower levels of toxicity. The use of these dispersants would require prior approval by national authorities but they could prove useful in mitigating the effects of large oil spills in open ocean areas where containment is impossible.

4. Oil Spill Analysis Background, pages A-1 and A-3

The corrections and changes noted in Item 1 herein are applicable here as well.

Kenneth W. Forbes

for GEORGE C. STEINMAN
Chief, Environmental Activities Group
Office of Shipbuilding Costs

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

ER-77/915

NOV 30 1977

Mr. Michael E. Carosella
Associate Assistant Administrator
Federal Energy Administration
Washington, D. C. 20461

Dear Mr. Carosella:

This is in response to your letter of September 26 requesting review of the draft supplement to the final environment statement for the Strategic Petroleum Reserve program.

The supplement points out that a capacity now exists for 370 million barrels (MMB) of oil storage previously proposed. This means that the previous proposal would require 130 MMB of new storage capacity while the new proposal to store 1,000 MMB would require 630 MMB of new storage capacity, which is approximately a fourfold increase in new capacity. This same type of relationship for oil storage capacity requirements could occur for other phases as well. Impacts that previously were projected to be minor, local, and insignificant could possibly now become major, regional, and significant. Consequently, we question the rationale that doubling a program will double the impacts without noticeably altering their direction or significance. There may be a fourfold increase in some impacts, and the timing should also be considered.

It is noted that violations of carbon monoxide and photochemical oxidant standards are frequent on the East Coast (p. IV-22). It should also be mentioned that hydrocarbons are a major contributor to the reaction with sunlight which creates photochemical oxidants. We suggest that the environmental statement should identify the increment of pollutants that may be added as a result of the proposed project.

The discussion of wetlands on pages V-25 and V-26 should take into account Executive Order 11990, signed by President Carter on May 24, 1977. The Order directs Federal agencies to avoid wherever possible

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the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. We are especially concerned about possible impacts to wetlands because of their value as a recreational resource and the uniqueness of their habitat. Careful consideration should be given to the implementation of any part of the Strategic Petroleum Reserve program which would involve the modification of wetlands.

We are also concerned about possible infringement by man-made canals upon recreational lands funded under the Land and Water Conservation Fund Act of 1965, as amended. Section 6(f) of the Act states, "No property acquired or developed with assistance under this section shall, without the approval of the Secretary, be converted to other than public outdoor recreation uses. The Secretary shall approve such conversion only if he finds it to be in accord with the then existing comprehensive statewide outdoor recreation plan and only upon such conditions as he deems necessary to assure the substitution of other recreation properties of at least equal fair market value and of reasonably equivalent usefulness and location."

As pointed out on page V-47, the doubling of the proposed capacity for the Strategic Petroleum Reserve program will result in a doubling of the risk of a major oil spill sometime during the life of the project. We remain concerned about the possibility of spills in wetlands areas which are utilized for local recreational activities and urge that the latest available technologies be implemented in order to minimize this possibility.

We hope these comments will be helpful.

Sincerely,

David Ushio, Acting Deputy Assistant
SECRETARY for Policy, Budget and
Administration

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC 8 1977

OFFICE OF THE ADMINISTRATOR

Department of Energy
Executive Secretariat
Box QH
Room 3317
12th & Pennsylvania Avenue, N.W.
Washington, D.C. 20461

Dear Sir or Madam:

In accordance with our responsibilities under section 309 of the Clean Air Act, as amended, the Environmental Protection Agency has completed its review of the Department of Energy's draft supplement to the programmatic final environmental impact statement (EIS) for the strategic petroleum reserve (SPR) program. Our detailed comments are enclosed.

EPA has previously reviewed the SPR programmatic draft and final EIS's as well as all of the site-specific petroleum reserve EIS's issued to date. An acceleration in the timetable for petroleum reserve site selection, preparation and filling has made necessary a supplemental DOE environmental analysis of the entire SPR program. EPA's review of the accelerated program has identified several environmental concerns not anticipated at the time of our review of the more phased SPR implementation schedule. These concerns are as follows:

a) Data presented by DOE need to be strengthened to support a more effective evaluation of the impacts of disposing produced or displaced brines by deep well injection. Deep well injection activities associated with the SPR program will be regulated in accordance with the Underground Injection Control (UIC) program of the Safe Drinking Water Act (P.L. 93-523) as detailed in EPA's draft regulations issued August 31, 1976. DOE should provide in the Final Supplement sufficient data from its current testing and analysis program before initiating specific emplacement, mining or disposal operations.

b) EPA notes that the Clean Air Act amendments of August 7, 1977 establish new requirements under the program for the prevention of significant deterioration (PSD) of air quality. These new requirements widen the applicability of PSD to all criteria pollutants. In addition, petroleum storage and transfer facilities are now "designated source categories" under PSD. Each of these new aspects of the PSD program as they relate to the SPR program should be addressed in the Final Supplement.

c) DOE should strengthen the Final Supplement section addressing the Spill Prevention Control and Countermeasure (SPCC) Plan. We urge DOE to acknowledge in the Final Supplement that a SPCC Plan which meets the requirements of 40 CFR Part 112 (Oil Pollution Prevention, Non-Transportation Related Onshore and Offshore Facilities) will be prepared within six months after each petroleum storage facility begins operations. Each plan should be fully implemented by DOE or its contractors no later than one year after petroleum storage operations begin.

d) EPA wishes to express its strong environmental concern for the impacts which the expanded and accelerated SPR program may have on wetland areas along the Texas and Louisiana coasts. We recognize that the President's Executive Order 11990 (Protection of Wetlands) does not apply to this program because of the exemptions provided in section 8 of the Order. However, EPA urges DOE to more fully address, in the Final Supplement, proposed and alternative storage sites with respect to their potential for adverse wetlands impact. Selected project sites should be the most practicable among alternatives and DOE, through its contractors, should provide for those mitigating measures necessary to minimize impact on the wetlands environment, particularly in the selection of any pipeline rights-of-way. Wherever possible, wetland areas should be avoided. Mitigative measures for construction in wetlands are available and EPA staff is willing to help define and oversee their implementation. For future SPR projects not covered by the Executive Order exemption, EPA will implement this order to the fullest extent to preserve and protect the wetlands. We urge DOE to contact EPA for consultation and recommendations in the selection of any future SPR sites not already identified or covered by the Draft Supplement programmatic EIS. DOE should announce its intentions in this respect within the Final Supplement.

Finally, EPA notes that inland salt domes are under consideration by DOE for inclusion in an Industrial Petroleum Reserve. We question why these inland sites were not addressed as possible sites for the proposed SPR expansion as discussed in the "alternatives" section of the Draft Supplement EIS. Utilization of inland sites would necessitate only minimal use of wetland areas and would particularly avoid the potential for wetlands degradation as a result of oil spills. This issue should be addressed in the Final Supplement.

As a result of our review, and in accordance with EPA procedure we have rated the modified Strategic Petroleum Reserve Program ER (Environmental Reservations) and have categorized the Draft Supplement EIS category 2 (Insufficient Information). We request additional information in the Final Supplement on air quality impacts, wetlands mitigating measures and underground brine injection plans as well as on those issues identified in our enclosed comments.

We have appreciated the opportunity to review and comment on this draft supplement. If you have any questions regarding our comments, we would be pleased to discuss them with you.

Sincerely yours,

Peter L. Cook
Acting Director
Office of Federal Activities (A-104)

Enclosure

THE ENVIRONMENTAL PROTECTION AGENCY'S
COMMENTS ON THE
DRAFT SUPPLEMENT TO THE FINAL
ENVIRONMENTAL IMPACT STATEMENT
ON THE
STRATEGIC PETROLEUM RESERVE PROGRAM

Water Quality

1. The Draft Supplement states that the proposed SPR expansion will require large quantities of surface water for construction and operation of the expanded facilities. If intake structures will be required, the Final Supplement should provide adequate information to allow EPA to determine that the best technology to minimize environmental impacts will be implemented in the design of these structures.

2. The proposed Strategic Petroleum Reserve projects involve hydrocarbon storage by emplacement of crude oil into salt domes, solution mining of the salt domes to create or enlarge existing storage capacity, and, in some cases, disposal of the produced or displaced brines by deep well injection. These types of operations will be regulated in accordance with the Underground Injection Control (UIC) program of the Safe Drinking Water Act (Public Law 93-523), as detailed in EPA's Draft regulations dated August 31, 1976.

Under these Draft regulations, the data presented in the Draft Supplement need to be strengthened to support an effective evaluation of the environmental impact of the injection operations. DOE should provide sufficient data to EPA from its current testing and analysis program before initiating any of the emplacement, mining, or disposal operations. Since Louisiana and Texas are expected to assume primary enforcement authority of the Underground Injection Control Program, the data and analyses provided should be consistent both with those requirements proposed in EPA Administrator's Decision Statement #5 (39 CFR:69) (or those required under the superseding UIC regulations, when they become applicable), and those required for permit application under Statewide Order 29-B of the Louisiana Department of Conservation, Oil and Gas Division as well as the requirements of the Texas Railroad Commission, Oil and Gas Division. In addition, DOE should afford EPA and both State regulatory agencies close coordination in all phases of data requirements, collection, and presentations. Also, selected technical data should be provided to the public in a form of a "by request" appendix to the Final Supplement. We request DOE to note its intentions to accommodate the above recommendations in the text of the Final Supplement.

3. The discussions of operational discharges of oil from tankers on pages v-44 and A-1, while correct, do not fully describe the status of control measures being developed. These discussions refer to pending U.S. Coast Guard regulations and the 1973 Marine Pollution Convention of IMCO (Intergovernmental Maritime Consultative Organization).

The 1969 amendments to the 1954 International Convention for the Prevention of Pollution of the Sea by Oil have been adopted, but the 1973 Convention has not. This limits the total quantity of discharge oil to 1/15,000 of the total cargo-carrying capacity at an instantaneous rate of discharge of 60 litres per mile and a distance of greater than 50 miles from shore. The 1973 Convention would place additional restrictions on oil tankers that would further reduce the quantities of both operational and accidental damages. This includes reception facilities, retention of oil on board, segregated ballast and requirements minimizing outflow from side and bottom damage. The Convention may not be adopted in time to affect the SPR, but if it is, it could affect the statistical analysis in Appendix A of the EIS. Thus, the discussion of these items should be expanded in the Final Supplement.

4. EPA strongly recommends that the method of brine disposal involving use of the displaced brine as a chemical feed stock be used wherever practicable. Discussion on this recommendation should be addressed in the Final Supplement.

5. The Draft Supplement indicates that pipelines serving the SPR salt domes sites will be coated externally with an asphalt-san mixture or coal tar enamel for corrosion protection. The pipelines will also contain sacrificial zinc anodes to lessen internal corrosion. The Final Supplement should discuss whether these corrosion preventive measures could cause any adverse impacts to groundwater quality in the project areas.

6. The Draft Supplement needs to be strengthened in its address of the Spill Prevention Control and Countermeasure (SPCC) Plan required under 40 CFR 112 (Oil Pollution Prevention,

Non-Transportation Related Onshore and Offshore Facilities). The Final Supplement should acknowledge DOE's intention toward developing a SPCC Plan which meets the requirements of 40 CFR 112 within six months after a storage facility begins operations. DOE should provide that the SPCC plan shall be fully implemented no later than one year after facility operation begins.

7. The Draft Supplement does not address any discharges or treatment of domestic wastewater for the proposed SPR expansion. If such discharges will exist, the point of discharge, the type of treatment and possible impacts to the receiving stream should be identified and addressed in the Final Supplement. In addition, DOE should indicate if application for a National Pollutant Discharge Elimination System (NPDES) permit has been made. Discussion on this matter should also be included in the Final Supplement.

Air Quality

1. The accelerated SPR program expands the storage of oil from 500 MMB to 1 billion barrels of oil. The expanded program as documented in the Draft Supplement to the EIS will also increase hydrocarbon emissions from the use of above ground tanks as well as fill and withdrawal operations. This may cause localized violations of the Federal air quality standard for hydrocarbons in areas that are already experiencing violations of this standard. The Supplement does portray these occurrences in general; however, the compatibility of the program storage with the existing State Implementation Plans for attaining and maintaining air quality standards will require specific site-detailed analysis. Site specific EIS's for SPR storage locations should address this question in detail.

2. In addressing ambient air quality standards, the Final Supplement should recognize that the Clean Air Act, amended on August 7, 1977, has changed past Prevention of Significant Deterioration (PSD) Regulations. The changes significant to this project are: a) that PSD regulations no longer apply only to particulate and sulfur dioxide emissions, but to all criteria pollutants, (i.e., Sulfur Dioxide (SO_2), Total Suspended Particulate (TSP), Non-Methane Hydrocarbon (NMHC), Nitrous Oxides (NO_x), Carbon Monoxide (CO), and Photochemical Oxidants (O_3)), and b) that PSD designated source categories have been expanded from 19 to 28 sources, one of which is

petroleum storage and transfer facilities. The effect of these changes upon the project should be addressed in the Final Supplement.

3. In addressing Federal Clean Air Regulations, the Draft Supplement states that EPA's emission offset policy excludes new sources with "actual" emissions totaling less than 100 tons per year. However, this amount will be based upon "potential" emissions and not "actual" emissions. Clarification of this matter and its possible effect upon SPR projects should be included in the Final Supplement.

4. In discussing possible mitigative measures in eliminating hydrocarbon emission venting from the underground storage caverns, we suggest that condensation units in lieu of a flare system be used. The condensation unit would not only provide less potential for explosion of the volatile gases within storage but would also provide fuel conservation by allowing the condensed emissions to be returned to storage.

5. The statement on page V-10 that hydrocarbon emissions which result from VLCC-tanker operation will not be as significant as those occurring at dock may be correct; however, the emissions may add to already intolerable air quality conditions which exist in the Gulf Coast near the three terminal areas of Capline, Seaway and Texoma. DOE should address this issue in particular light of the accelerated filling schedule proposed.

6. In Appendix B, page 5, the last line should read as follows: "Hydrocarbon vapor loss is generally increased as the molecular weight of the crude oil decreases" (emphasis added).

Wetlands

EPA expresses its strong environmental concern for the impacts which the expanded and accelerated SPR program may have on wetland areas along the Texas and Louisiana coasts. We recognize that the President's Executive Order 11990 (Protection of Wetlands) does not apply to this program because of the exemptions provided in section 8 of the Order. However, EPA urges DOE to more fully address, in the Final Supplement, proposed and alternative storage sites with respect to their potential for wetlands impact.

Selected project sites should be the most practicable among alternatives and DOE, through its contractors, should provide for those mitigating measures necessary to minimize project impact on the wetlands environment, particularly in the selection of any pipeline rights-of-way. Wherever possible, wetland areas should be avoided. Mitigative measures for construction in wetlands are available, and EPA staff is willing to help define and oversee their implementation.

For future SPR projects not covered by the Executive Order exemption, EPA will implement this order to the fullest extent to preserve and protect the wetlands. We urge DOE to contact EPA for consultation and recommendations in the selection of any future SPR sites not already identified or covered by the Draft Supplement programmatic EIS. DOE should announce its intentions in this respect within the Final Supplement.

Alternatives

1. In the discussion of alternative actions to the SPR expansion, the statement is made that current studies by DOE could influence a decision regarding the need for an Industrial Petroleum Reserve as an alternate part of the SPR. Inland salt domes for storage sites located in the Northern Louisiana Interior Basin and the East-Central Louisiana Mississippi Interior Basin are being considered. With this information, EPA questions why these inland sites were not addressed as possible sites for the currently proposed SPR expansion in the alternative section of this Draft Supplement. The utilization of inland sites would necessitate minimal use of wetland areas and would provide for less probability of destruction of wetlands through oil spills. This question should be addressed by DOE in the Final Supplement.

2. As possible alternate salt dome crude oil storage sites for future storage reserves and expansion, the Final Supplement should consider the possibility and practicability of using off-shore salt domes lying within the Gulf of Mexico. Feasibility and potential impacts should be discussed in the Final Supplement.

Other Considerations

In discussing land use for the proposed SPR expansion, the Draft Supplement states that approximately 2260 acres or 3.5 square miles of land distributed throughout the Gulf coastal states will be used. To assist in effectively evaluating overall environmental impacts, the statement would be strengthened if this total amount of land was identified and categorized into segmented amounts according to existing land use, and state location. This would assist EPA in evaluating the overall impact of the proposed expansion.

Arizona Solar Energy
Research Commission
1700 W. Washington Room 502
Phoenix, Arizona 85007

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

State Application Identifier (SAI)

10/12/77 State AZ No. 77-80__04

Economic Sec.
Mineral Res.
Indian Affairs
Game & Fish
Ag. & Hort.
Az. Mining Ass'n
Arid Lands Studies
Environmental Studies
Archaeological Research
SW Minerals Exploration
Transportation
Museum of Northern Arizona
Renewable Natural Resources

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OEPAD
R. King

6 Regions

OCT 1977
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Ariz. Solar Energy
Research Comm.

project is referred to you for review and comment. Please evaluate as to:

1. the program's effect upon the plans and programs of your agency
2. the importance of its contribution to State and/or areawide goals and objectives
3. its accord with any applicable law, order or regulation with which you are familiar
4. additional considerations

return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted abo[ve]
contact the clearinghouse if you need further information or additional time for review.

No comment on this project
Proposal is supported as written
Comments as indicated below

Comments (Use additional sheets if necessary)

Have Arizona's salt deposits been considered as possible sites for petroleum storage?

C-16

Signature J. F. Warnock

Date 10/1_/7_

Dr. R. Gwinn Vivian
Arizona State Archaeologist
Arizona State Museum
Tucson, AZ 85721

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

10/12/77 State AZ No. 77-80-0047

Economic Sec.
Mineral Res.
Indian Affairs
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No comment on this project
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Comments as indicated below

ents: (Use additional sheets if necessary)

i-site inspection to determine probability of adverse impact on cultural
sources should precede land modification and developments. The application
iould be denied until evidence of such inspection is provided.

C-17

er's Signature [signature]

Date October 24, 1977

Associate Archaeologist

Telephone 884-1761

SIGNOFF

Lde

OMB Approval No. 29–R0218

FEDERAL ASSISTANCE

2. Applicant's application — a. Number — b. Date 19 Year Month Day

3. State application identifier — a. Number AZ 77-80-0047 — b. Date Assigned 19 Year month day

1. Type Of Action (Mark appropriate box)
- ☐ Preapplication
- ☐ Application
- ☐ Notification Of Intent (Opt.)
- ☐ Report Of Federal Action

Leave Blank DEC 2 1977 Jo Ann Youngblood

4. Legal Applicant/Recipient

a. Applicant Name : Federal Energy Administration
b. Organization Unit : Strategic Petroleum Reserve Office
c. Street/P.O. Box :
d. City : Washington e. County :
f. State : D. C. g. Zip Code : 20461
h. Contact Person (Name & telephone no.) : Michael E. Carosella, Associate Assistant Administrator

5. Federal Employer Identification No.

6. Program (From Federal Catalog)
a. Number 80●001
b. Title St. Energy Conservation Prog

FEA, Office of Energy Cons. And Environment

7. Title and description of applicant's project

Strategic Petroleum Reserve

The Fed Energy Admin proposes to implement the strategic Perleum Reserve, Title I, Part B of the Energy Policy and Conservation Act of 1975 (P.L. 94-163). The purpose of the reserve is to mitigate the economic impacts of any future interruptions of petroleum imports.

8. Type of applicant/recipient
A–State G–Special Purpose District
B–Interstate H–Community Action Agency
C–Substate District I–Higher Educational Institution
D–County J–Indian Tribe
E–City K–Other
F–School District
(Specify) Federal
Enter appropriate letter K

9. Type of assistance
A–Basic Grant D–Insurance
B–Supplemental Grant E–Other
C–Loan
Enter appropriate letter(s) ☐☐

10. Area of project impact (Names of cities, counties, states, etc.)
Statewide, Arizona

11. Estimated number of persons benefiting

12. Type of application
A–New C–Revision E–Augmentation
B–Renewal D–Continuation
Enter appropriate letter ☐

13. Proposed Funding

a. Federal	$	.00
b. Applicant		.00
c. State		.00
d. Local		.00
e. Other	1	.00
f. Total	$ 1	.00

14. Congressional Districts Of:
a. Applicant Multi.
b. Project Multi.

15. Type of change For 12c or 12e
A–Increase Dollars F–Other Specify
B–Decrease Dollars
C–Increase Duration
D–Decrease Duration
E–Cancellation
Enter appropriate letter(s) ☐☐☐

16. Project Start Date 19 Year month day

17. Project Duration Months

18. Estimated date to be submitted to federal agency 19 Year month date

19. Existing federal identification number

20. Federal agency to receive request (Name, city, state, zip code)

21. Remarks added ☐Yes ☐No

Section I - Applicant / Recipient Data

22. The Applicant Certifies That
a. To the best of my knowledge and belief, data in this preapplication/application are true and correct, the document has been duly authorized by the governing body of the applicant and the applicant will comply with the attached assurances if the assistance is approved
b. If required by OMB Circular A-95 this application was submitted, pursuant to instructions therein, to appropriate clearinghouses and all responses are attached

	No response	Response attached
(1)	☐	☐
(2)	☐	☐
(3)	☐	☐

23. Certifying representative
a. Typed name and title
b. Signature
c. Date signed 19 Year month day

Section II - Certification

24. Agency name

25. Application received 19 Year month day

26. Organizational Unit

27. Administrative office

28. Federal application identification

29. Address

30. Federal grant identification

31. Action taken
- ☐ a. Awarded
- ☐ b. Rejected
- ☐ c. Returned for amendment
- ☐ d. Deferred
- ☐ e. Withdrawn

32. Funding

a. Federal	$	.00
b. Applicant		.00
c. State		.00
d. Local		.00
e. Other		.00
f. Total	$	.00

33. Action date 19 Year month day

34. Starting date 19 Year month day

35. Contact for additional information (Name and telephone number)

36. Ending date 19 Year month day

37. Remarks added ☐Yes ☐No

38. Federal agency A–95 action
a. In taking above action, any comments received from clearinghouses were considered. If agency response is due under provisions of Part 1, OMB Circular A-95, it has been or is being made.
b. Federal Agency A-95 Official (Name and telephone number)

Section III - Federal Agency Action

424-101 Standard Form 424 Page 1 (10-75)

Mr. Ralph Kingery
OEPAD
1700 W. Washington, Rm. 505
Phoenix, Arizona 85007

State Application Identifier (SAI)

10/12/77 State AZ No. 77-80-004

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Sec.
Mineral Res.
Indian Affairs
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Az. Mining Ass'n
Arid Lands Studies
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Archaeological Research
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6 Regions

roject is referred to you for review and comment. Please evaluate as to:

the program's effect upon the plans and programs of your agency
the importance of its contribution to State and/or areawide goals and objectives
its accord with any applicable law, order or regulation with which you are familiar
additional considerations

return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted abov
contact the clearinghouse if you need further information or additional time for review.

No comment on this project
Proposal is supported as written
Comments as indicated below

ments (Use additional sheets if necessary)

C-19

ency Signature Ralph Kingery Date 10/19/77

Planner 271-5004

Mr. Andrew L. Bettwy
Comm., Department of Land
1624 W. Adams St., 4th Floor
Phoenix, Arizona 85007

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

State Application Identifier (SAI)
10/12/77 State AZ No. 77-80 0

Economic Sec.	ARIS	Power	Atty Gen
Mineral Res.	Health	Land	Admin.
Indian Affairs	Water	Parks	Sola En
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Environmental Studies			Emergen
Archaeological Research			Cent fc
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Museum of Northern Arizona			
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✓ No comment on this project
[ ] Proposal is supported as written
[ ] Comments as indicated below

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OCT 13 1977
STATE LAND DEPT.
768

Comments (Use additional sheets if necessary)

The State Land Dept approves of this project

Reviewer's Signature Peggy Snow Date

C-20

Northern Arizona Council of Governments
P.O. BOX 57 • FLAGSTAFF, AZ - 86001 • (602) 774-1895

WILLIAM C. WADE
EXECUTIVE DIRECTOR

Regional A-95 Review

TO: Ms. Jo Youngblood
Arizona State Clearinghouse
1700 W. Washington, Room 505
Phoenix, AZ 85007

RE: Project: FEA, Strategic Petroleum Reserve Office
Strategic Petroleum Reserve
S.A.I. #: 77-80-0047

The Northern Arizona Council of Governments (NACOG) has completed its A-95 Review and Comment upon the above project. Action taken on this project notification is as follows:

☐ Proposal supported as described on the SF-424 and any attachments.

☐ Proposal is supported with certain recommendations, provisions, etc.

X No comment.

☐ Proposal is not supported.

Please be aware that NACOG reserves the prerogative of making additional comments should new information become available to the Agency.

The Northern Arizona Council of Governments has appreciated this opportunity to review and comment on this project.

Thank you,

W C Wade

William C. Wade
Executive Director

Date: Nov. 1, 1977

THIS A-95 REVIEW IS SUPPORTED IN PART BY A HUD 701 PLANNING GRANT.

Dept. of Education
1535 W. Jefferson
Phoenix, AZ 85007

✓ 10/12/77 State AZ No. 77-8[illegible]0

Economic Sec.	APIS	Power	Atty G
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Game & Fish	AORCC		Energy Pr
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Az. Mining Ass'n			Revenue
Arid Lands Studies			Education
Environmental Studies			Emergency
Archaeological Research			Center for Af
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Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

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No comment on this project
Proposal is supported as written
Comments as indicated below

ments: (Use additional sheets if necessary)

ewer's Signature Barbara J. Dacs Date 10-1[illegible]

John J. DeBolske, Exec. Dir.
Maricopa Ass'n of Governments
1820 W. Washington Street
Phoenix, AZ 85007
0971

10/12/77 State AZ No. 77-80-004

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Sec.
Mineral Res.
Indian Affairs
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Ag. & Hort.
Az. Mining Ass'n
Arid Lands Studies
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APIS
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ontact the clearinghouse if you need further information or additional time for review.

No comment on this project
Proposal is supported as written
Comments as indicated below

nents (Use additional sheets if necessary)

C-23

Signature Ken Driggs
STAFF

Date 10/14/77

Telephone

Dr. Hermann K. Bleibtreu, ...
Museum of Northern Arizona
P. O. Box 1389
Fort Valley Road
Flagstaff, AZ 86001

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Date: 10/12/77
Ack:
State AZ No. 77-80-...

Economic Sec. | ARIS | Power | Atty Gen
Mineral Res. | Health | Land | Admin
Indian Affairs | Water | Parks | Solar Ene...
Game & Fish | AORCC | | Energy P...
Ag. & Hort. | Bureau of Mines | | Oil & Gas
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( ) additional considerations

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...contact the clearinghouse if you need further information or additional time for review.

( ) No comment on this project
( ) Proposal is supported as written
( ) Comments as indicated below

...Comments: (Use additional sheets if necessary)

DO NOT WISH TO COMMENT.

C-24

...'s Signature [signature]

Date Oct. 25, 1977

Curator of Anthropology

Telephone

Mr. Wesley E. Steiner,
State Water Commission
222 N. Central Ave., Suite 800
Phoenix, Arizona 85004

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

10/12/77 State AZ No. 77-80-001

Economic Sec | ARIS | Power | Atty Gen
Mineral Res | Health | Land | Admin
Indian Affairs | Water | Parks | Solar Energy
Game & Fish | AORCC | | Energy Pro
Ag. & Hort. | Bureau of Mines | | Oil & Gas C
Az. Mining Ass'n | | | Revenue
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Archaeological Research | | | Center for
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Museum of Northern Arizona | | | R. King
Renewable Natural Resources | | | G. Regions

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No comment on this project
Proposal is supported as written.
Comments as indicated below

ments: (Use additional sheets if necessary)

C-25

ewer's Signature Martin E. Wurks Date 10-17-77

Planner 258-7561

Michael A. Ramnes, Director
Arizona State Parks Board
1688 W. Adams Room 109
Phoenix, Arizona 85007

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

10/12/77 State AZ No. 77 8

Economic Sec. ARIS Power Atty Gen
Mineral Res. Health Land Admin.
Indian Affairs Water Parks Solar En
Game & Fish AORCC Energy
Ag. & Hort. Bureau of Mines Oil & Gas
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No comment on this project
Proposal is supported as written
Comments as indicated below

ments: (Use additional sheets if necessary)

C-26

ewer's Signature Allen Gross Date Oct 17

OPR 271-4174

Mr. Robert Jantzen, Director
Game and Fish Dept.
2222 W. Greenway
Phoenix, Arizona 85023

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

10/12 State AZ No. 77-80-004

Economic Sec. | ARIS | Power | Atty Gen
Mineral Res. | Health | Land | Admin.
Indian Affairs | Water | Parks | Solar Energ
Game & Fish | AORCC | | Energy Prog
Ag. & Hort. | Bureau of Mines | | Oil & Gas C
Az. Mining Ass'n | | | Revenue
Arid Lands Studies | | | Education
Environmental Studies | | | Emergency
Archaeological Research | | | Center for
SW Minerals Exploration | | | [illegible] Affa
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Museum of Northern Arizona | | | R. King
Renewable Natural Resources | | | 6 Regions

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contact the clearinghouse if you need further information or additional time for review.

No comment on this project
Proposal is supported as written
Comments as indicated below

[illegible]ments: (Use additional sheets if necessary)

C-27

[illegible] Signature: [signature] Date: Oct 17, 1977

Supv. Planning & Eval Supv Telephone: 942-3000

Tom Lynch, Chief
Energy Programs
Room 507
1700 W. Washington
Phoenix, Arizona 85007

State Applic...

10/12/77 State AZ No. 77-80 4

Arizona State Clearinghouse
1700 West Washington Street, Room 507
Phoenix, Arizona 85007

Economic Sec.	ARIS	Power	Atty Gen
Mineral Res.	Health	Land	Admin.
Indian Affairs	Water	Parks	Solar Ener
Game & Fish	AORCC		Energy Pro
Ag. & Hort.	Bureau of Mines		Oil & Ga C
Az. Mining Ass'n			Revenue
Arid Lands Studies			Education
Environmental Studies			Emergency
Archaeological Research			Center for Aff
SW Minerals Exploration			OEPAD R. n
Transportation			6 Regions
Museum of Northern Arizona			
Renewable Natural Resources			

OCT 1977
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Energy Programs

roject is referred to you for review and comment. Please evaluate as to:

the program's effect upon the plans and programs of your agency
the importance of its contribution to State and/or areawide goals and objectives
its accord with any applicable law, order or regulation with which you are familiar
additional considerations

return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted abo
contact the clearinghouse if you need further information or additional time for review.

No comment on this project
Proposal is supported as written
Comments as indicated below

ments (Use additional sheets if necessary):

C-28

Signature [signature]

Date 10-14-7

271-2

~~Mr.~~ James R. Carter, Director
Agriculture & Horticulture Dept.
421 Capitol Annex West
Phoenix, Arizona 85007

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

State Application Identifier (SAI)

10/12/77 State AZ No. 77-80-004

Economic Sec. | ARIS | Power | Atty Gen
Mineral Res. | Health | Land | Admin.
Indian Affairs | Water | Parks | Solar Energ
Game & Fish | AORCC | | Energy Prog
Ag. & Hort. | Bureau of Mines | | Oil & Gas C
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Museum of Northern Arizona
Renewable Natural Resources

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No comment on this project
Proposal is supported as written
Comments as indicated below

RECEIVED
OCT 13 1977
ARIZONA COMMISSION OF AGRICULTURE & HORTICULTURE

Comments (Use additional sheets if necessary)

C-29

Reviewer's Signature: James R. Carter Date 10-14-77

Mr. John Bannister
Oil & Gas Conservation Comm.
1645 W. Jefferson, Suite 420
Phoenix, Arizona 85007

State Application Identifier (SAI)

10/12/77 State AZ No. 77-80[illegible]4

Economic Sec. | ARIS | Power | Atty Gen
Mineral Res. | Health | Land | Admin.
Indian Affairs | Water | Parks | Solar Energ
Game & Fish | AORCC | | Energy Pro
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Archaeological Research | | | Center for P Affa
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Transportation
Museum of Northern Arizona
Renewable Natural Resources

6 Regions

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

RECEIVED
OCT 13 1977
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( ) additional considerations

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( ) No comment on this project
(/) Proposal is supported as written
( ) Comments as indicated below

ments: (Use additional sheets if necessary)

C-30

[Review]er's Signature John Bannister Date 10-13-

[illegible]

Div. of Emergency Services
5636 East McDowell Road
Phoenix, Arizona 85008

10/12/77 State AZ No. 77-80-0047

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Sec.
Mineral Res.
Indian Affairs
Game & Fish
Ag. & Hort.
Az. Mining Ass'n
Arid Lands Studies
Environmental Studies
Archaeological Research
SW Minerals Exploration
Transportation
Museum of Northern Arizona
Renewable Natural Resources

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Solar Energy
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6 Regions

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o comment on this project
oposal is supported as written
omments as indicated below

nts: (Use additional sheets if necessary)

r's Signature George B Jordan
Director of Emergency Services

Date Oct 13, 1977

Telephone 273-9880

C-31

Mr. Les Ormsby, Admin.
Arizona Power Authority
1810 West Adams Street
Phoenix, Arizona 85005

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

State Application Identifier (SAI)

10/12/77 State AZ No. 77-80 04

Economic Sec.	ARIS	Power	Atty Ge
Mineral Res.	Health	Land	Admin.
Indian Affairs	Water	Parks	Solar Energ
Game & Fish	AORCC		Energy ro
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Az. Mining Ass'n			Revenue
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SW Minerals Exploration			Aff
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o comment on this project

roposal is supported as written

omments as indicated below

nts: (Use additional sheets if necessary)

C-32

er's Signature L O Ormsby

Date 10/13/77

Mr. Roland H. Sharer
State Liaison Officer, AORCC
4433 N. 19th Ave., Suite 203
Phoenix, Arizona 85015

State Application Identifier (SAI)

10/12/77 State AZ No. 77-80-0047

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Sec. | ARIS | Power | Atty Gen
Mineral Res. | Health | Land | Admin.
Indian Affairs | Water | Parks | Solar Energy
Game & Fish | AORCC | | Energy Prog
Ag. & Hort. | Bureau of Mines | | Oil & Gas Co
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Museum of Northern Arizona | | | 6 Regions
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Contact the clearinghouse if you need further information or additional time for review.

No comment on this project.
Proposal is supported as written.
Comments as indicated below.

Comments: (Use additional sheets if necessary)

C-33

Reviewer's Signature: R H Sharer Date: Oct 17, 1977

State Liaison Off. 271-5013

Mr. David Landrith, Exec.
Director, SEAGO
118 Arizona Street
Bisbee, Arizona 85603

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

State Application Identifier (SAI) 77-367
10/12/77 State AZ No. 77-80-[illegible]47

Economic Sec.
Mineral Res.
Indian Affairs
Game & Fish
Ag. & Hort.
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Arid Lands Studies
Environmental Studies
Archaeological Research
SW Minerals Exploration
Transportation
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Renewable Natural Resources

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roposal is supported as written
omments as indicated below

ents: (Use additional sheets if necessary)

C-34

r's Signature: [signature] - Manager Date: 10-17-[illegible]

Environmental & Economic Planning Telephone: 602-432-[illegible]

Mr. Clinton M. Pattea
Executive Secretary
Indian Affairs Commission
1645 West Jefferson St.
Phoenix, AZ 85007

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

State Application Identifier (SAI)

10/12/77 State AZ No. 77-80-0047

Economic Sec.
Mineral Res.
Indian Affairs
Game & Fish
Ag. & Hort.
Az. Mining Ass'n
Arid Lands Studies
Environmental Studies
Archaeological Research
SW Minerals Exploration
Transportation
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...omments as indicated below

...ents: (Use additional sheets if necessary)

C-35

...'s Signature Clinton M. Pattea Date 10-18-77

Dr. William H. Dresher, Director
Arizona Bureau of Geology &
Mineral Technology
University of Arizona
Tucson, Arizona 85721

State Application Identifier (SAI)

10/12/77 State AZ No. 77-80-[illegible]4[illegible]

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Sec.	ARIS	Power	Atty Gen
Mineral Res.	Health	Land	Admin.
Indian Affairs	Water	Parks	Solar Energy
Game & Fish	AORCC		Energy Prog
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Environmental Studies			Emergen[illegible]
Archaeological Research			Center fo[illegible] P[illegible] Affa[illegible]
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Museum of Northern Arizona			
Renewable Natural Resources			

COLLEGE OF MINES UNIVERSITY OF ARIZONA

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...urn THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date nota[illegible] bov[illegible]
...ntact the clearinghouse if you need further information or additional time for review.

...comment on this project
...oposal is supported as written
...mments as indicated below

...nts: (Use additional sheets if necessary)

C-36

...'s Signature William H. Dresher Date 10-25-77
William H. Dresher
Director
Telephone 884-1943

Dr. James Becker
Center for Public Affairs
Arizona State University
Tempe, Arizona 85281

State Application Identifier (SAI)

10/12/77 State AZ No. 77-80-0047

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Sec.
Mineral Res.
Indian Affairs
Game & Fish
Ag. & Hort.
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Arid Lands Studies
Environmental Studies
Archaeological Research
SW Minerals Exploration
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comment on this project
posal is supported as written
mments as indicated below

-s: (Use additional sheets if necessary)

C-37

-'s Signature R. J. Becker Date 10/21/77

Dir. Center for Public Affairs 965-3926

...tion Section
Transportation Planning Division
Arizona Dept. of Transportation
206 South 17th Avenue, Room 310
Phoenix, Arizona 85007

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

10/12/77 State AZ No. 77-80-...4

Economic Sec.
Mineral Res.
Indian Affairs
Game & Fish
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Arid Lands Studies
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Museum of Northern Arizona
Renewable Natural Resources

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comment on this project
...posal is supported as written
...mments as indicated below

...ts: (Use additional sheets if necessary)

C-38

...'s Signature ...

Date 10/26/...

Telephone 261-72...

Mr. Roger Root, Acting Chief
Office of Planning
Dept. of Econ. Security
1717 W. Jefferson
Phoenix, Ariz. 85007

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

State Application Identifier (SAI) OCT 13 1977

10/12/77 State AZ No. 77-80-004

Economic Sec ✓ | ARIS | Power | Atty Gen
Mineral Res. | Health | Land | Admin.
Indian Affairs | Water | Parks | Solar Energ
Game & Fish | AORCC | | Energy Pro
Ag. & Hort. | Bureau of Mines | | Oil & Gas C
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✓ No comment on this project
Proposal is supported as written
Comments as indicated below

ents: (Use additional sheets if necessary)

C-39

ver's Signature Hollis Chough OES/BSP Date 10/10/77

Hollis Chough, Acting Manager

Dr. Suzanne Dandoy, Director
Department of Health Services
1740 West Adams Street
Phoenix, Arizona 85007

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

10/12/77 State AZ No. 77-80-0 4

Economic Sec.
Mineral Res.
Indian Affairs
Game & Fish
Ag. & Hort.
Az. Mining Ass'n
Arid Lands Studies
Environmental Studies
Archaeological Research
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No comment on this project
Proposal is supported as written
Comments as indicated below

ments: (Use additional sheets if necessary)

C-40

ewer's Signature R. Bruce Scott

ASSISTANT DIRECTOR
ARIZONA DEPT OF HEALTH SERVICES
DIV. OF ENVIRONMENTAL HEALTH SERVICES

Date OCT 2 7 197

Telephone

Central Az. Ass'n of Gov'ts.
512 E. Butte Avenue
Florence, Arizona 85232

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

10/12/77 State AZ No. 77-80-0047

Economic Sec. | ARIS | Power | Atty Gen
Mineral Res. | Health | Land | Admin.
Indian Affairs | Water | Parks | Solar Energy
Game & Fish | AORCC | | Energy Prog
Ag. & Hort. | Bureau of Mines | | Oil & Gas Cor
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Renewable Natural Resources

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... comment on this project
...oposal is supported as written
...mments as indicated below

...ts: (Use additional sheets if necessary)

C-41

...'s Signature D.M. Childs Date 11/4/77

...man and Natural Resources Director Telephone 868-5878

ARIZONA
OFFICE
OF THE
GOVERNOR

OFFICE OF
ECONOMIC PLANNING AND DEVELOP

1700 West Washington • Executive Tower • Room 505 • Phoenix, Arizona

December 12, 1977

Mr. Michael E. Carosella,
Associate Assistant Administrator
Federal Energy Administration
Strategic Petroleum Reserve Office
Washington, D. C. 20461

Re: Strategic Petroleum Reserve
S.A.I. #77-80-0047

Dear: Mr. Carosella,

Enclosed is a copy of a response concerning the above project which was received by us after our Signoff to you.

Sincerely,

Jo Youngblood/ss

Mrs. Jo Youngblood, Supervisor
Arizona State Clearinghouse
JY: ss
Encl.

OMB Approval No. 29–R0218

FEDERAL ASSISTANCE

1. Type Of Action (Mark appropriate box)	☐ Preapplication ☐ Application ☐ Notification Of Intent (Opt.) ☐ Report Of Federal Action	
2. Applicant's application	a. Number	b. Date 19 Year Month Day
Leave Blank		
3. State application identifier	a. Number AZ 77-80-0047	b. Date Assigned 19 Year month day

Section I - Applicant / Recipient Data

4. Legal Applicant/Recipient
- a. Applicant Name : Federal Energy Administration
- b. Organization Unit : Strategic Petroleum Reserve Office
- c. Street/P.O. Box :
- d. City : Washington
- e. County :
- f. State : D. C.
- g. Zip Code : 20461
- h. Contact Person (Name & telephone no.) : Michael E. Carosella, Associate Assistant Administrator

5. Federal Employer Identification No.

6. Program (From Federal Catalog)
- a. Number 18.001
- b. Title St. Energy Conservation Prog

FEA, Office of Energy Cons. And Environment

7. Title and description of applicant's project

Strategic Petroleum Reserve

The Fed Energy Admin proposes to implement the strategic Peroleum Reserve, Title I, Part B of the Energy Policy anc Conservation Act of 1975 (P.L. 94-163). The purpose of the reserve is to mitigate the economic impacts of any future interruptions of petroleum imports.

8. Type of applicant/recipient

A–State, B–Interstate, C–Substate District, D–County, E–City, F–School District, G–Special Purpose District, H–Community Action Agency, I–Higher Educational Institution, J–Indian Tribe, K–Other

(Specify) Federal — Enter appropriate letter [K]

9. Type of assistance

A–Basic Grant, B–Supplemental Grant, C–Loan, D–Insurance, E–Other — Enter appropriate letter(s) ☐☐

10. Area of project impact (Names of cities, counties, states, etc.): Statewide, Arizona

11. Estimated number of persons benefiting:

12. Type of application

A–New, B–Renewal, C–Revision, D–Continuation, E–Augmentation — Enter appropriate letter ☐

13. Proposed Funding

a. Federal	$	.00
b. Applicant		.00
c. State		.00
d. Local		.00
e. Other	1	.00
f. Total	$ 1	.00

14. Congressional Districts Of: a. Applicant Multi. b. Project Multi.

15. Type of change For 12c or 12e

A–Increase Dollars, B–Decrease Dollars, C–Increase Duration, D–Decrease Duration, E–Cancellation, F–Other Specify — Enter appropriate letter(s) ☐☐☐

16. Project Start Date 19 Year month day

17. Project Duration Months

18. Estimated date to be submitted to federal agency 19 Year month date

19. Existing federal identification number

20. Federal agency to receive request (Name, city, state, zip code)

21. Remarks added ☐ Yes ☐ No

Section II - Certification

22. The Applicant Certifies That

a. To the best of my knowledge and belief, data in this preapplication/application are true and correct, the document has been duly authorized by the governing body of the applicant and the applicant will comply with the attached assurances if the assistance is approved.

b. If required by OMB Circular A-95 this application was submitted, pursuant to instructions therein, to appropriate clearinghouses and all responses are attached.

	No response	Response attached
(1)	☐	☐
(2)	☐	☐
(3)	☐	☐

23. Certifying representative — a. Typed name and title — b. Signature — c. Date signed 19 Year month day

Section III - Federal Agency Action

24. Agency name

25. Application received 19 Year month day

26. Organizational Unit

27. Administrative office

28. Federal application identification

29. Address

30. Federal grant identification

31. Action taken
- ☐ a. Awarded
- ☐ b. Rejected
- ☐ c. Returned for amendment
- ☐ d. Deferred
- ☐ e. Withdrawn

32. Funding

a. Federal	$	.00
b. Applicant		.00
c. State		.00
d. Local		.00
e. Other		.00
f. Total	$	.00

33. Action date 19 Year month day

34. Starting date 19 Year month day

35. Contact for additional information (Name and telephone number)

36. Ending date 19 Year month day

37. Remarks added ☐ Yes ☐ No

38. Federal agency A–95 action

a. In taking above action, any comments received from clearinghouses were considered. If agency response is due under provisions of Part 1, OMB Circular A-95, it has been or is being made.

b. Federal Agency A-95 Official (Name and telephone number)

424-101 Standard Form 424 Page 1 (10-75)

Mr. Frank Servin, Exec. Dir.
District IV Council of Gov'ts
377 South Main St., Room 202
Yuma, Arizona 85364

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

State Application Identifier (SAI)

10/12/77 State AZ No. 77-80 0

Economic Sec. | APIS | Power | Atty G
Mineral Res. | Health | Land | Admin.
Indian Affairs | Water | Parks | Solar E er
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its accord with any applicable law, order or regulation with which you are familiar
additional considerations

eturn THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted a
ontact the clearinghouse if you need further information or additional time for review.

lo comment on this project
roposal is supported as written
omments as indicated below

ents: (Use additional sheets if necessary)

er's Signature Frank S. Servin

Date 12-9-

Mr. Frank Servin, Exec. Dir.
District IV Council of Gov'ts
377 South Main St., Room 202
Yuma, Arizona 85364

Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

State Application Identifier (SAI) Mollhenn [illegible] 12/14/77
10/12/77 State AZ No. 77-80-0047

Economic Sec.
Mineral Res.
Indian Affairs
Game & Fish
Ag. & Hort.
Az. Mining Ass'n
Arid Lands Studies
Environmental Studies
Archaeological Research
SW Minerals Exploration
Transportation
Museum of Northern Arizona
Renewable Natural Resources

ARIS
Health
Water
AORCC
Bureau of Mines

Power
Land
Parks

Atty Gen
Admin.
Solar Energy
Energy Prog
Oil & Gas Co:
Revenue
Education
Emergency S
Center for Pu Affai
OEPAD-R. Kinge:
6 Regions

...ject is referred to you for review and comment. Please evaluate as to:

the program's effect upon the plans and programs of your agency
the importance of its contribution to State and/or areawide goals and objectives
its accord with any applicable law, order or regulation with which you are familiar
additional considerations

...turn THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above.
...ontact the clearinghouse if you need further information or additional time for review.

...o comment on this project
...roposal is supported as written
...omments as indicated below

...ents: (Use additional sheets if necessary)

...ver's Signature Frank S. Servin

Date 12-9-77

ARIZONA
OFFICE OF THE GOVERNOR

OFFICE OF
ECONOMIC PLANNING AND DEVELOP[ME]NT
1700 West Washington • Executive Tower • Room 505 • Phoenix, Arizona 500

December 13, 1977

Mr. Michael E. Carosella
Associate Assistant Administrator
Federal Energy Administration
Strategic Petroleum Reserve Office
Washington, D. C. 20461

Re: Strategic Petroleum Reserve
S.A.I. #77-80-0047

Dear: Mr. Carosella,

Enclosed is a copy of a response concerning the above project which was received by us after our Signoff to you.

Sincerely,

Mrs. Jo Youngblood, Supervisor
Arizona State Clearinghouse
JY: ss
Encl.

Dept. of Revenue
State Capitol Bldg.
Phoenix, AZ 85007

From: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

State AZ No.

✓

Economic Sec.	APIS	Power	Atty Gen
Mineral Res.	Health	Land	Admin.
Indian Affairs	Water	Parks	Solar Energy
Game & Fish	AORCC		Energy Prog
Ag. & Hort.	Bureau of Mines		Oil & Gas Cons
Az. Mining Ass'n			Revenue
Arid Lands Studies			Education
Environmental Studies			Emergency Serv
Archaeological Research			Center for Pub Affairs
SW Minerals Exploration			OEPAD-R. Kingery
Transportation			6 Regions
Museum of Northern Arizona			
Renewable Natural Resources			

RECEIVED
OCT 13 1977
DEPARTMENT OF REVENUE

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

☐ No comment on this project
☐ Proposal is supported as written
☐ Comments as indicated below

Comments: (Use additional sheets if necessary)

[illegible handwriting]

C-47

Reviewer's Signature .... Date ....

Title .... Telephone ....

MEMORANDUM

TO: Lynn Ford, Executive Assistant

FROM: Sam Cohen, Tax Analyst

DATE: December 7, 1977

SUBJECT: Strategic Petroleum Reserve, Title I, Part B, of the Energy Policy and Conservation Act of 1975 (P.L. 94-163) AZ 77-80-0047

The Federal Energy Administration, Strategic Petroleum Reserve Office, Washington, D.C. proposes to implement Title I, Part B, of the Energy Policy and Conservation Act of 1975 (Public Law 94-163. The purpose of the reserve is to mitigate the economic impacts of any future interruptions of petroleum imports.

A study of the impact of environmental aspect was made and the storage of 150 million barrels of oil by December 1978 and 500 million barrels of oil by December 1982 is scheduled. The program under the law is essential for the energy problems that we are facing today and in the future. The Department of Revenue should have no objections to this proposal and should be inclined to approve it. No Federal funding approval has been requested.

SC/ts

RECEIVED
OCT 10 1977

STATE OF FLORIDA

Department of Administration

Division of State Planning

660 Apalachee Parkway · IBM Building

TALLAHASSEE

32304

(904) 488-2371

OCT 21 1977

RECEIVED

SAI NO.

G Whittle, Jr
PLANNING DIRECTOR

Reubin O'D. Askew
GOVERNOR

Lt. Gov. J. H. "Jim" Williams
SECRETARY OF ADMINISTRATION

TO: Harmons Shields
Dept. of Natural Resources
Crown Bldg.
Tallahassee, Fla. 32304

DATE: 10-6-77

DUE DATE: 10-21-77

FROM: Bureau of Intergovernmental Relations

SUBJECT: SAI: 78-0658E

Please review and comment to us on the above draft Environmental Impact Statement, copy attached. In reviewing the statement, you should consider possible effects that actions contemplated could have on matters of concern to your agency.

If you feel that a conference is needed for discussion of the project or resolution of conflicts, or if you have questions concerning the statement, please call Mr. Walt Kolb at (904) 488-2401. Please check the appropriate box below, attach any comments on your agency's stationery and return to this office or telephone "no adverse comments" by the above due date.

On that date, we intend to consider all review comments received and develop a state position on the project. In both telephone conversation and written correspondence, please refer to the above SAI number.

Sincerely,

Loring Lovell, Chief
Bureau of Intergovernmental Relations

Enclosure

****

TO: Bureau of Intergovernmental Relations

FROM: Department of Natural Resources

SUBJECT: DEIS Review and Comments

[X] No Comments [ ] Comments Attached

Signature: James B. Smith Date: Oct. 19, 1977

Title: Administrative Assistant

We request that you forward us copies of the final environmental impact statement prepared on this project.

Sincerely,

R. G. Whittle, Jr.
Director

RGWjr/WOK/ba

Enclosure

cc: Mr. Joseph W. Landers, Jr.
Mr. Loring Lovell
Mr. Harmon Shields
Mr. Walter O. Kolb

STATE OF FLORIDA

Department of Administration

Division of State Planning

660 Apalachee Parkway - IBM Building

TALLAHASSEE

32304

(904) 488-1115

L.G. Whittle, Jr.
STATE PLANNING DIRECTOR

Reubin O'D. Askew
GOVERNOR

Lt. Gov. J. H. "Jim" Williams
SECRETARY OF ADMINISTRATION

November 9, 1977

Strategic Petroleum Reserve Office
Federal Energy Administration
Washington, D. C. 20461

Dear Sir:

Functioning as the state planning and development clearinghouse contemplated in U. S. Office of Management and Budget Circular A-95, we have reviewed the draft Supplement to the Final Environmental Impact Statement:

Strategic Petroleum Reserve SAI 78-0658E

During our review we referred the environmental impact statement to the following agencies, which we identified as interested: The Department of Environmental Regulation, the Department of Natural Resources, and the State Energy Office. Agencies were requested to review the statement and comment on possible effects that actions contemplated could have on matters of their concern. A letter of comment on the statement is enclosed from the Department of Natural Resources and the State Energy Office has indicated no comments on this document.

Based upon our review of this document we have no comments at this time. However, we may wish to submit comments regarding this program at a future date.

In accordance with the Council on Environmental Quality guidelines concerning statement on proposed federal actions affecting the environment, as required by the National Environmental Policy Act of 1969, and U. S. Office of Management and Budget Circular A-95, this letter, with attachments, should be appended to the final environmental impact statement on this project.

STATE OF ILLINOIS
EXECUTIVE OFFICE OF THE GOVERNOR
BUREAU OF THE BUDGET
SPRINGFIELD 62706

November 28, 1977

Mr. Michael E. Carosella
Associate Assistant Administrator
Executive Communications
Room 3309
Federal Energy Administration
Washington, D. C. 20461

Dear Mr. Carosella:

RE: Draft Supplement to the Final Environmental Impact Statement for the Strategic Petroleum Reserve (SPR)(FES 76-2), DEIS #77-09-301

Pursuant to the National Environmental Policy Act (NEPA), OMB Circular A-95 (revised) and the administrative policy of the State, the referenc subject has been reviewed by the appropriate State agencies. No commen were made on the referenced subject.

Thank you for your assistance.

Respectfully yours,

T. E. Hornbacker, Director
Illinois State Clearinghouse

TEH:mc

STATE OF IOWA

Office for Planning and Programming

523 East 12th Street, Des Moines, Iowa 50319 Telephone 515/281-3711

ROBERT D. RAY
Governor

ROBERT F. TYSON
Director

STATE CLEARINGHOUSE

PROJECT NOTIFICATION AND REVIEW SIGNOFF

Date Received: October 4, 1977 State Application Identifier: 770010

Review Completed: October 25, 1977

APPLICANT PROJECT TITLE:
Draft Supplement to Final Environmental Impact Statement, Strategic Petroleum Reserve

APPLICANT AGENCY: Federal Energy Administration
Address Washington, D. C. 20461
Attention: Michael E. Carosella

FEDERAL PROGRAM TITLE, AGENCY AND CATALOG NUMBER: Federal Energy Administration

AMOUNT OF FUNDS REQUESTED:
NA

PROJECT DESCRIPTION:
Draft Supplement to the Final Environmental Impact Statement for Strategic Petroleum Resource, FES 76-2.

The State Clearinghouse makes the following disposition concerning this application:

/ X / No Comment Necessary. The application must be submitted as received by the Clearinghouse with this form attached as evidence that the required review has been performed.

/ / Comments are Attached. The application must be submitted with this form plus the attached comments as evidence that the required review has been performed.

STATE CLEARINGHOUSE COMMENTS:

CH-14 Rev. 9-75

Federal Funds Coordinator

ROBERT D. BELL
SECRETARY

JULIAN [illegible]RC
GOVE[illegible]

COMMONWEALTH OF KENTUCKY
DEPARTMENT FOR NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION
OFFICE OF THE SECRETARY
FRANKFORT, KENTUCKY 40601
TELEPHONE (502) 564-3350

November 14, 1977

Executive Communications
Room 3309
Federal Energy Administration
Washington, D.C. 20461

RE: Late Comments on the Draft Supplement to the Final Environmental Impact Statement on the Strategic Petroleum Reserve (77-32)

Dear Sirs:

The enclosed comments were received by our office on the above mentioned Environmental Impact Statement. Even though these comments have arrived late, hopefully, they will be considered in the preparation of the Final Supplement on the Strategic Petroleum Reserve.

Sincerely,

Robert D. Bell
Secretary

dm

Enclosure

AND ENVIRONMENTAL PROTECTION
NOV 11 2 10 PM '77
OFFICE OF THE SECRETARY

ROBERT D BELL
SECRETARY

JULIAN M CARROLL
GOVERNOR

COMMONWEALTH OF KENTUCKY
DEPARTMENT FOR NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION
BUREAU OF ENVIRONMENTAL PROTECTION
JOHN A. ROTH
COMMISSIONER
FRANKFORT, KENTUCKY 40601

M E M O R A N D U M

October 18, 1977

TO: Environmental Review
Office of Planning and Research

THROUGH: John A. Roth, Commissioner
Bureau of Environmental Protection

FROM: John T. Smither, Director
Division of Air Pollution Control

SUBJECT: 77-32, Draft Supplement to the
Strategic Petroleum Reserve

A review has been made by the Kentucky Division of Air Pollution Control of the draft supplement to the FEIS for this Strategic Petroleum Reserve.

The statement does not identify the specific site where these additional 500 MM barrels of crude petroleum will be stored. We will certainly be interested to know if storage capacity at Central Rock Mine (Fayette County) will be increased from 14 mm barrels. Also, we would like to know if the terminal capacity at Tates Creek will be increased.

In spite of good objectives associated with the SPR, the amount of hydrocarbon emissions throughout SE U.S.A. will delay attainment of the photochemical oxidant standards.

We thank you for giving us the opportunity to review this statement.

JTS:PD:kl

RECEIVED

OFFICE OF
PLANNING AND RESEARCH

State of Missouri
OFFICE OF ADMINISTRATION
Jefferson City 65101

Joseph P. Teasdale
Governor

Gary O. Passmore, Director
Division of Budget and Planning

November 8, 1977

Mr. Michael E. Carosella
Associate Assistant Administrator
Special Programs
Strategic Petroleum Reserve
Executive Communications
Room 3309
Federal Energy Administration
Washington, D. C. 20461

Dear Mr. Carolsella:

Subject: 77100026

The Division of Budget and Planning, as the designated State Clearinghouse, has coordinated a review of the above referred draft environmental impact statement with various concerned or affected state agencies pursuant to Section 102(2)(c) of the National Environmental Policy Act.

None of the state agencies involved in the review had comments or recommendations to offer at this time.

We appreciate the opportunity to review the statement and anticipate receiving the final environmental impact statement when prepared.

Sincerely,

George Lineberry
Chief, Grants Coordination

State of New Jersey
DEPARTMENT OF COMMUNITY AFFAIRS

PATRICIA Q. SHEEHAN
COMMISSIONER

363 WEST STATE STREET
POST OFFICE BOX 2768
TRENTON, N.J. 08625

October 27, 1977

Mr. Michael E. Carosella
Associate Assistant Administrator
Special Programs
Strategic Petroleum Reserve
Federal Energy Administration
Washington, D.C. 20461

RE: OSRC-FY-78-333

Dear Mr. Carosella:

In accordance with the U.S. Office of Management and Budget Circular A-95 Revised, your Environmental Impact Statement for Strategic Petroleum Reserve designated application OSRC-FY-78-333, has met the State of New Jersey's Clearinghouse requirements.

We have circulated this Project Notification to the appropriate State agencies, none of which have voiced any objections.

Very truly yours,

Richard A. Ginman
State Review Coordinator

RAG:br

STATE OF NEVADA
GOVERNOR'S OFFICE OF PLANNING COORDINATION
CAPITOL BUILDING, ROOM 45
CAPITOL COMPLEX
CARSON CITY, NEVADA 89710
(702) 885-4865

November 15, 1977

Executive Communications
Room 3309
Federal Energy Administration
Washington, D.C. 20461

RE: SAI NV #78800020 - Draft Supplement to the Final EIS
Strategic Petroleum Reserve

Gentlemen:

Thank you for the opportunity to review the above mentioned project.

The State Clearinghouse has processed the Environmental pact Statement and has no comment. Based on the information contained therein and the responses of interested parties, the proposal, as of this date, is found not to be in conflict with the State's plans, goals, or objectives.

Sincerely,

Bruce D. Arkell
State Planning Coordinator

BDA/pf

STATE OF NEW MEXICO

STATE PLANNING OFFICE

GREER BUILDING
505 DON GASPAR AVE.
SANTA FE 87503
(505) 827-2073

LEILA ANDREWS
STATE PLANNING OFFICER

JERRY APODACA
GOVERNOR

November 18, 1977

Executive Communications
Room 3309
Federal Energy Administration
Washington, D. C. 20461

Gentlemen:

Thank you for the opportunity to comment on the Strategic Petroleum Reserve draft environmental impact statement. We have sent copies of the statement to the following State agencies: Environmental Improvement Agency, Energy Resources Board, and Public Service Commission. Comments are enclosed from the Environmental Improvement Agency.

Since the reserve would not be stored in New Mexico, and at this point, would not be transported through New Mexico, we have no comment.

Sincerely,

Kate Wickes

Kate Wickes
Resources Planning

KW:JEH

Enclosure

State of New Mexico
HEALTH and SOCIAL SERVICES DEPARTMENT

MEMORAND

To: Kate Wickes, S.P.O.

Date: 11 07

From: Charles A. Marquez

RE: Draft Supplement to the FEA Strategic Petroleum Reserve

Subject: This proposed action will not, in its present form, affect New Mexico directly. None of the oil would be stored any closer New Mexico than Texas (Gulf Coast) or Louisiana (East Coast). Therefore, we have no comments at this time.

North Carolina
Department of Administration
116 West Jones Street Raleigh 27603

James B. Hunt, Jr., Governor
Joseph W. Grimsley, Secretary

Division of Policy Development
Elmer Johnson, Administrator
(919) 733-4131

November 4, 1977

Mr. Michael E. Carosella
Associate Assistant Administrator
Special Programs
Strategic Petroleum Reserve
Executive Communication, Room 3309
Federal Energy Administration
Washington, D. C. 20461

Dear Mr. Carosella:

Re: SCH File No.167-77; Draft Supplement to the Final EIS Strategic Petroleum Reserve

The State Clearinghouse has received and reviewed the above referenced project. As a result of this review, the State Clearinghouse finds that no comment is necessary on this project at this time.

Sincerely,

Chrys Baggett

Chrys Baggett (Mrs)
Clearinghouse Supervisor

CB:mw

NORTH DAKOTA STATE PLANNING DIVISION
STATE CAPITOL—NINTH FLOOR—BISMARCK, NORTH DAKOTA 58505
701-224-2818

November 4, 1977

STATE INTERGOVERNMENTAL CLEARINGHOUSE "LETTER OF COMMENT"
ON PROJECT REVIEW IN CONFORMANCE WITH OMB CIRCULAR NO. A-95

To: Federal Energy Administration

STATE APPLICATION IDENTIFIER: 7710069836

Mr. Barton R. House
Deputy Assistant Administrator
for Operations
Federal Energy Administration
2000 M Street, NW
Washington, D.C. 20461

Dear Mr. House:

Subject: Draft Supplement to the Final Environmental Impact Statement by the Federal Energy Administration for Strategic Petroleum Reserve.

This Draft EIS was received in our office October 6, 1977.

In the process of the A-95 review, the attached comments were received from the Attorney General's Office and ND Geological Survey.

This document and attachment constitute the comment of the State Intergovernmental Clearinghouse, made in compliance with OMB Circular No. A-95. The ND State Intergovernmental Clearinghouse requests the opportunity for complete re-review of applications for renewal or continuation grants or applications not submitted to or acted on by the funding agency within one year after the date of this letter.

Sincerely yours,

Bonnie A. Banks

Mrs. Leonard E. Banks
Associate Planner

LEB/mm

Attachment

NDSIC FORM B (9/71)

PNRS NO.

Date Recei·

10-1.

RECEIVED OCT 14 19 State Planning Division

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58501

ENVIRONMENTAL IMPACT STATEMENT TO BE REVIEWED

TO: Mr. Gary Helgeson
Attorney General's Office
State Capitol

ISSUED BY: Federal Energy Administration

DATE: October 11, 1977

NAME OF PROJECT: Draft Supplement to the Final EIS for Strategic Petroleum Reserve

The attached Environmental Impact Statement is referred to your agency for review and possible comments. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check one of the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse within 10 days from date of receipt. If no response is received within 15 days of date of notification it will be assumed you have no comment.

- [x] No comment
- [ ] Meeting desired with applicant
- [ ] Comments submitted herewith

1. Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use reverse side or separate sheets if necessary) "No comment" does not mean the EIS is considered satisfactory or unsatisfactory.

2. Reasons why meeting is desired with applicant:

Reviewer's Signature: Gary Helgeson Date: 10-13

Title: Asst Atty Gen Tele: 2712

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58501

Date Received: OCT 27 State Planning Division

ENVIRONMENTAL IMPACT STATEMENT TO BE REVIEWED

TO: Mr. Erling Brostuen
~~ND Geological Survey~~
UND
~~Grand Forks, ND 58201~~

ISSUED BY: Federal Energy Administration

DATE: October 11, 1977

NAME OF PROJECT: Draft Supplement to the Final EIS for Strategic Petroleum Reserve

The attached Environmental Impact Statement is referred to your agency for review and possible comments. If you consider it satisfactory, please check the box labeled "no comment." Otherwise, please check one of the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse within 10 days from date of receipt. If no response is received within 15 days of date of notification it will be assumed you have no comment.

- [ ] No comment
- [X] Comments submitted herewith
- [ ] Meeting desired with applicant

....

1. Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use reverse side or separate sheets if necessary)

The massive salt beds of the Williston Basin should be considered as alternative sites for solution salt cavity storage of the SPR. This would help to insure crude availability to the northern tier refineries.

2. Reasons why meeting is desired with applicant:

Reviewer's Signature: Erling A. Brostuen   Date: Oct 2

Title: Geologist   Tele: 777-22

STATE OF OKLAHOMA

State Grant-In-Aid Clearinghouse

5500 N. WESTERN OKLAHOMA CITY, OKLAHOMA 73118 (405) 840-2811

November 4, 1977

Executive Communications
Room 3309
Federal Energy Administration
Washington, D. C. 20461

RE: 05J704--Draft Supplement to the final environmental impact statement for the Strategic Petroleum Reserve

Dear Sir:

The environmental information for the above referenced project has been reviewed in accordance with OMB Circular A-95 and Section 102 (2) (C) of the National Environmental Policy Act by the state agencies charged with enforcing environmental standards in the State of Oklahoma.

The state agencies, comprising the Pollution Control Coordinating Board, have reviewed the proposed project and agree that no adverse environmental impact is anticipated. Therefore, the state clearinghouse requires no further review.

Sincerely,

Don N. Strain
Director

DNS:mt

ROBERT W. STRAUB
GOVERNOR

Executive Department
INTERGOVERNMENTAL RELATIONS DIVISION
ROOM 306, STATE LIBRARY BLDG., SALEM, OREGON 97310

December 5, 1977

Michael E. Carosella
Associate Assistant Administrator
Special Programs
Strategic Petroleum Reserve
Federal Energy Administration
Washington, D.C. 20461

Dear Mr. Carosella:

RE: Strategic Petroleum Rese
PNRS 7710 4 140

Thank you for submitting your draft Environmenta Impact Statement for State of Oregon review and comment.

Your draft was referred to the appropriate state agencies. The consensus among reviewing agencies was that the draft adequately described the environmental impact o: your proposal.

We will expect to receive copies of the final statement as required by Council of Environmental Quality Guidelines.

Sincerely,

Donald L. Jones
Administrator

DLJ:cb

STATE PLANNING BUREAU
State Capitol
Pierre, South Dakota 57501
605/224-3661

South Dakota Office of Executive Management

November 14, 1977

The Strategic Petroleum Reserve Office
Federal Energy Administration
Washington, DC 20461

RE: Draft Supplement to the Final Environmental Impact Statement (EIS 040278); Strategic Petroleum Reserve

Dear Sir:

The State Clearinghouse has distributed for review the above stated draft EIS. The attached comments were received from the Department of Health.

Please supply any information you might have relating to his request to: Mr. Ed DeAntoni, Secretary
South Dakota Department of Health
Foss Building
Pierre, SD 57501
(605) 224-3361

Thank you for the opportunity to review and comment on the statement.

Sincerely,

Steve Merrick
Commissioner
STATE PLANNING BUREAU

jrv
Enclosure
cc: Ed DeAntoni

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401

268 401 Building
December 6, 1977

Mr. Michael E. Carosella
Associate Assistant Administrator
Special Programs
Federal Energy Administration
Washington, DC 20461

Dear Mr. Carosella:

We have reviewed several specific draft and final environmental impact statements on this subject and rather than addressing each, we will make a generic comment as follows:

> Our interests in the Strategic Petroleum Reserve Program stems from the possibility of eventual materials storage in salt domes. As we stated in comments on the generic final environmental statement, the salt domes under construction are generally not favorably located for radioactive material storage sites. The Department of Energy (formerly ERDA) has selected sites for investigation and has initiated test drilling for radioactive material storage sites. We expect that DOE has chosen the most suitable sites in the Gulf Coast area. Provided that sites are selected from the area covered by the generic and site specific examinations, we anticipate no conflict with national goals.

Sincerely,

Harry G. Moore, Jr., Ph.D
Acting Director of Environmental Planning

OFFICE OF THE GOVERNOR

DOLPH BRISCOE
GOVERNOR

November 2, 1977

Mr. Michael E. Carosella
Associate Assistant Administrator
Special Programs
Executive Communications
Room 3309
Federal Energy Administration
Washington, D.C. 20461

Dear Mr. Carosella:

The Draft Supplement to the Final Environmental Impact Statement - Strategic Petroleum Reserve has been reviewed by the Budget and Planning Office and interested State agencies.

The comments of the reviewing agencies are enclosed for your use in the preparation of the final supplement to the environmental impact statement. If this office can be of further assistance, please contact us.

Sincerely,

Roy Hogan, Assistant Director
Budget and Planning Office

Enclosures

EXECUTIVE OFFICE BUILDING • 411 WEST 13TH STREET • AUSTIN, TEXAS 78701

TEXAS DEPARTMENT OF AGRICULTURE
REAGAN V. BROWN, COMMISSIONER / P. O. BOX 12847 / AUSTIN, TEXAS 71
AN EQUAL OPPORTUNITY EMPLOYER

RECEIVED

OCT 24 1977

Budget/Planning

MEMORANDUM

DATE: October 21, 1977

TO: Ward C. Goessling, Jr.

FROM: Ray Prewett

RE: Draft Supplement to the Final Environmental Impact Statement: Strategic Petroleum Reserve

We have reviewed the Draft Supplement to the Final Environmental Impact Statement: Strategic Petroleum Reserve.

With regards to the selection of future SPR sites, we support the idea that a careful review should be made to avoid taking of unique or prime agricultural land. In general, however, we believe the benefits from the SPR will outweigh the costs; we therefore, offer no objections to the proposed expansion.

TEXAS
PARKS AND WILDLIFE DEPARTMENT

COMMISSIONERS
PEARCE JOHNSON
Chairman, Austin
JOE K. FULTON
Vice-Chairman, Lubbock
JOHN M. GREEN
Beaumont

HENRY B. BURKETT
EXECUTIVE DIRECTOR
4200 Smith School Road
Austin, Texas 78744

COMMISSIONERS
LOUIS H. STUMBERG
San Antonio
JAMES R. PAXTON
Palestine
PERRY R. BASS
Fort Worth

RECEIVED
OCT 31
Budget/...

October 28, 1977

Mr. Ward C. Goessling, Jr., Coordinator
Natural Resources Section
Governor's Budget and Planning Office
Executive Office Building
411 West 13th Street
Austin, Texas 78701

Re: Draft Supplement Environmental Impact Statement - Strategic Petroleum Reserve

Dear Mr. Goessling:

This agency has reviewed the document cited above, and offers the following comments for consideration by the Federal Energy Administration.

Because of the large scope of operations under the program, the draft supplement addresses impacts in a necessarily general manner. Future preparation of "Environmental Action Reports" on specific sites is mentioned on page VI-38, however. Since it is anticipated that these reports will contain detailed information, and proposed procedures for construction and operation of each site, review and comment upon the reports would be desirable.

In regard to alternative brine disposal techniques for use in the Texas coastal area, it is recommended that injection of the brine into subsurface aquifers be utilized to the maximum possible extent in order to minimize discharges to surface waters or the Gulf of Mexico.

The opportunity to review and comment upon this document is appreciated.

Sincerely,

HENRY B. BURKETT
Executive Director

HBB:BDK:lmw

TEXAS DEPARTMENT OF WATER RESOURCES
1700 N. Congress Avenue
Austin, Texas

TEXAS WATER DEVELOPMENT BOARD
A. L. Black, Chairman
Robert B. Gilmore, Vice Chairman
Milton T. Potts
John H. Garrett
George W. McCleskey
Glen L. Roney

Charles E. Nemir
Executive Director, Acting

TEXAS WATER COMMISSION
Joe D. Carter, Chairman
Dorsey B. Hardeman
Joe R. Carroll

October 20, 1977

RECEI E
OCT 25
Budget/Plann

Mr. Charles D. Travis, Director
Governor's Budget & Planning Office
Executive Office Building
411 West 13th Street
Austin, Texas 78701

Re: Federal Energy Administration -- Draft Supplement to the Final Environmental Impact Statement -- Strategic Petroleum Reserve (FES 76-2), September 1977.

Dear Mr. Travis:

In response to your October 6th memorandum, the Texas Department of Water Resources staff has reviewed the referenced draft document on the potential incremental environmental impacts of the proposed expansion of the Federal Strategic Petroleum Reserve Project storage capacity from 500 million barrels (MMB) to 1,000 MMB by 1982. The federal Energy Policy and Conservation Act of 1975 (EPCA), Title I, Part B, Strategic Petroleum Reserve (SPR), provided for the creation of strategic reserves. The SPR development schedule established in the EPCA and addressed in both the SPR Plan which was effective on April 18, 1977, and in the related Final Environmental Impact Statement of December 1976, provided for the storage of 150 MMB of oil by December 1978 and 500 MMB by December 1982. However, under SPR Plan Amendment #1, which became effective on June 21, 1977, the development schedule was accelerated to store 500 MMB of oil by the end of 1980. To date, the major areas considered for the Federal storage project are the Gulf Coast Region (for storage of crude oil in salt dome formations and, the East Coast Region (for storage of refined petroleum and petroleum products).

P.O. Box 13087 Capitol Station • Austin, Texas 78711 • Area Code 512/475-3187

Our review of the referenced document is restricted to the portions which pertain to the storage sites located in the State of Texas, and to matters within the purview of our agency statutory responsibilities involving State water. The following technical staff review comments are offered:

1. The 65th Legislature of the State of Texas consolidated the Texas Water Quality Board, the Texas Water Development Board, and the Texas Water Rights Commission, creating the Texas Department of Water Resources, effective September 1, 1977. Based on our current analysis, we confirm the review comments made by the three pre-merger agencies relative to the Federal Energy Administration's Draft Environmental Impact Statement, Strategic Petroleum Reserve DES 76-2, dated June 1976. These comments were transmitted by letter of September 20, 1976 from the Office of the Governor to the Federal Energy Administration. Indications are that the Federal Energy Administration has given and will continue to give consideration to earlier review comments. Specifically, statement is made in Section V. A. 1. a. (Gulf Coast Region, Coastal Subregion, Geology), page V-2 of the referenced document that important generic geological concerns, including subsidence, seismic stability, and engineering stability were discussed in detail in the Final Environmental Impact Statement (FES 76-2) of December 1976. In addition, statement is made in Section V. A. 1. b (Gulf Coast Storage Region, Coastal Subregion, Hydrology and Water Quality), page V-2, -3 that a discussion of the analyses performed to determine the impacts of brine disposal in the Gulf of Mexico was included in FES 76-2, and that this work recently was supplemented with modelling efforts performed by the National Oceanic and Atmospheric Agency for the Federal Energy Administration. And, the results of these supplemental, additional study efforts are said to support the results reported in FES 76-2. The subsequent two comments are to provide necessary emphasis and elaboration on previous review comments submitted by the pre-merger water agencies of Texas.

2. (Reference Section V. A. 1. b., pages V-2, -3.) -- We wish to emphasize that one of the major water quality policies of the State has been to disallow any direct discharge of brine into the State's waters. This policy is particularly applicable to any proposed brine discharges within the State's three-league seaward boundary and especially to estuaries having fish and shellfish nursery areas. Therefore, we support the Federal Energy Administration's rigorous efforts to explore all viable methods of brine disposal including usage by local industry, deepwell injection, and disposal to the Gulf of Mexico. And, we concur that final site-specific brine disposal method determinations should be based on the geographical location of the site with respect to the Gulf of Mexico, the proximity of saline aquifers, estuarine productivity, and relative costs of alternative brine disposal methods.

3. (Reference: Section V. A. 1. b., page V-3, and Section VIII. B., pages VIII-2, and -3.) -- The report duly notes that the large quantities of surface water (i.e., approximately 183 billion gallons of water from the area during construction of the cavities and up to 25 billion gallons during displacement operations) required for the construction and operation of storage caverns in salt domes is a significant concern. Further, the report notes that there are "...few undedicated fresh surface water supplies in the Gulf Coast region...." In view of the foregoing findings, we reiterate one of our early comments made relative to DES 76-2, June 1976 that a special analysis of project impacts on vested surface water rights be prepared.

We appreciated the opportunity to review and comment on the referenced document. Please let me know if you believe we can be of further assistance.

Sincerely,

Dick Whittington for

Charles E. Nemir
Acting Executive Director

COMMONWEALTH of VIRGINIA

SUSAN T. WILBURN
ACTING ADMINISTRATOR

Council on the Environment

903 NINTH STREET OFFICE BUILDING
RICHMOND 23219
804-786-4500

November 1, 1977

Mr. Michael E. Carosella
Associate Assistant Administrator
Special Programs
Stretegic Petroleum Reserve
Federal Energy Administration
Washington, D. C. 20461

SUBJECT: Strategic Petroleum Reserve

Dear Mr. Carosella:

The Virginia Council on the Environment has completed its review of the subject Supplement to the Draft Environmental Impact Statement. The following State agencies participated in that review:

State Water Control Board
State Department of Health
Soil and Water Conservation Commission
Department of Conservation and Economic Development
Virginia Energy Office

Based upon our review of the document and the comments that we received, we have no objections to the proposal at this time. With respect to the environmental impact of such implementation, the potential problems in this area do not seem to be of such gravity as to outweigh the considerable advantages to be gained by establishing a strategic petroleum reserve. Although the establishment of a strategic petroleum reserve would not be a panacea for the present potentially very serious situation, it would help to lessen considerably the effects of future interruptions of petroleum imports. We would recommend that reasonable steps be taken to mitigate any adverse impacts that might occur.

Thank you for the opportunity to review this document. If you have any questions, please do not hesitate to contact me.

Sincerely,

Susan T. Wilburn

Susan T. Wilburn

STW:RFW:dja

cc: Honorable Earl J. Shiflet, Secretary of Commerce and Resources
Mr. J. Boyd Spencer, Virginia Energy Office

STATE OF WEST VIRGINIA

GOVERNOR'S OFFICE
OF
ECONOMIC AND COMMUNITY DEVELOPMENT

CHARLESTON 25305

JOHN D. ROCKEFELLER IV
GOVERNOR

DONALD D. MOYER
DIRECTOR
DANIEL S. GREEN
MANAGER
PROGRAM SUPPORT SERVICES

October 19, 1977
File: PNRS-F

Mr. Michael E. Carosella
Associate Assistant Administrator
Special Programs
Strategic Petroleum Reserve
Executive Communications
Room 3309
Federal Energy Administration
Washington, DC 20461

Re: Federal Energy Administration - Strategic Petroleum Reserve - Draft Supplement to the Final Environmental Impact Statement

Dear Mr. Carosella:

Receipt is acknowledged of the Draft Supplement for the above referenced project.

The State Clearinghouse has reviewed this document in accordance with provisions of the National Enviromental Policy Act of 1969 (Public Law 91-190) and Guidelines of the Council on Environmental Quality, and has no comments.

Sincerely,

Daniel S. Green
Manager
Program Support Services

DSG:am

cc: Donald D. Moyer

National Wildlife Federation

1412 16TH ST., N.W., WASHINGTON, D.C. 20036 Phone 202—797-6800

November 14, 1977

Executive Communications
Room 3309
Federal Energy Administration
Washington, D.C. 20461

Re: Comments of the National Wildlife Federation on "Draft Supplement to the Final Environmental Impact Statement" on Strategic Petroleum Reserve, FES 76-2 (Sept. 1977)

To Whom It May Concern:

The comments of the National Wildlife Federation ("NWF") on the Draft Supplement to FES 76-2 fall into the following areas of concern:

1) That the Draft understates the risks of oil spill damage to sensitive wetlands in connection with use of Gulf Coast salt domes;

2) That the Draft understates the advantages of inland salt domes as a means of minimizing such risks; and

3) That the Draft reflects no willingness to consider deferring further commitment of resources to not-yet-developed coastal salt domes, pending fuller consideration of inland alternatives.

1. Wetland Damage Associated With Coastal Salt Domes

The Draft considers oil spill risks at pp. V-42 - V-76 (as well as in Appendix A). Although implicitly recognizing that oil spill risks and impacts may depend more upon the location of the spill than upon either the frequency or magnitude of spillage, the Draft makes no attempt to assess the overall hazard potential associated with various spill locations, or to compare and contrast these potentials in connection with inland versus coastal SPR storage sites. Indeed, even in terms of estimating the frequency (incorrectly equated with "risk" in Table V-12) of oil spills in various "impact areas," the Draft is very misleading. For example, the analysis at pp. V-45 - V-48 assumes that oil spills affecting Gulf Coast wetlands will all be associated with "pipelines connecting a storage site with a marine terminal." Since the spill frequency for pipeline transport is the lowest of all transport modes, this assumption permits transport-associated oil spillage in wetlands to be shrugged off as "small" (i.e., "0.1 gallons spilled per 1,000 MMB transported"). What is obscured by the analysis, however, is the fact that transport in "[h]arbors and inland waters of the U.S. Gulf Coast including the Channels connecting the harbors with the sea and the storage site" also has major potential for wetland-impacting oil spillag (depending upon the ease of water exchange between the spill site and adjacent wetlands). The Final Supplement should, therefore, attempt an overall assessment (preferably employing worst-case assumptions) of the oil spill hazard potential (with special emphasis on wetland and estuarine impacts) associated with coastal and inland SPR storage sites. Incidentally, the estimated incidence of a major spill for pipeline accidents in inland areas of the Gulf Coast is incorrectly stated (at V-47) to be "0.1 gallons spilled per 1,000 MMB transported"; the correct figure (from Table V-12) would be either "0.1 MMB per 1,000 MMB transported," or "0.1 gallons per 1,000 gallons transported."

2. Advantages of Inland Versus Coastal Salt Domes

The Draft discusses the feasibility of oil storage in salt domes of the inland Gulf Region (i.e., northern Louisiana and southern Mississippi) at pp. III-3 - III-7, V-31 - V-37, and V-59. However, while the Draft notes numerous potential problems with such inland sites (e.g., III-5: increased risk of oil spills for certain barge transits; V-31: increased construction and maintenance costs associated with construct of additional pipelines, and increased potential for ship casualties; V-32: brine disposal would be a serious problem in northern Louisiana; V-34 - V-35: deep well injection of brine in northern Louisiana would probably require the use of slower injection rates, more injection wells and a larger injection field), it inappropriately fails to emphasize the considerable environmental advantages attendant upon use of inland versus coastal salt domes in the Gulf Region. Thus, the Draft notes (at V-35) that "[t]he only differences [between inland and coastal salt domes] involve the type of habitat where the activities would occur" (emphasis added) and that "[d]redging impacts [at inland domes] would be somewhat lessened as less wetlands habitat would be disturbed than in coastal regions." In fact, the potential for adversely impacting sensitive and ecologically critical wetland areas may be drastically less with use of inland rather than coastal salt dome storage sites. Not only would construction activities associated with wetland-poor inland sites involve far less disturbance of wetlands than for wetland-rich coastal areas, but one might expect oil spillage associated with handling and transport to result in less contact with and impact on wetlands for inland as opposed to coastal salt dome locations. Accordingly, the Final Supplement should take pains to contrast in some detail the nature, number, and distribution of wetlands in association with inland versus coastal Gulf Coast salt domes. It should also examine closely the opportunities for impacting wetlands associated with various inland and coastal alternatives. (This analysis should seek, for example, to distinguish risks to wetlands associated with water-borne transport of oil in a waterway such as the Mississippi River, which is largely isolated from adjacent wetlands by dikes, from those presented by other inland waterways where the opportunity for exchange with wetlands may be much greater).

This analysis, and the remaining discussion of the inland salt dome alternatives, would be greatly aided by a better map than that found in the Draft at p. III-6. In particular, a map should be provided which shows the location of each of the following, in addition to the other information found in Figure III-1: the Exxon pipeline, Capline, the port of St. James, Vicksburg, Vidalia, Old River, Red River, Ouachita Black River, Gulf Intracoastal Waterway. Each of these items is mentioned on pp. III-4 - III-5, but is nowhere to be found on the accompanying map.

The discussion of "Mitigating Measures" (beginning at p. VI-1) would, similarly, greatly benefit from a discussion of reduced wetland losses associated with increased reliance on inland salt dome storage sites. As the Draft states (p. VI-2), "ecological impacts can be mitigated by selecting sites ... away from highly productive wetlands .. .."

3. Irreversible and Irretrievable Commitment of Resources to Coastal Salt Dome Sites

Although NWF is pleased that the Draft Supplement addresses inland salt dome sites in Northern Louisiana and southern Mississippi, we are distressed that such consideration has come so late in the game. Of even greater concern is the prospect that work at coastal salt domes is proceeding so rapidly that the opportunity for minimizing the use of such domes in favor of more inland sites will be correspondingly limited or foreclosed. We appreciate the strategic desirability of implementing a large SPR at the earliest possible time. However, we firmly believe that the potential for seriously damaging the vital coastal wetlands of Louisiana and Texas (as an unintended side-effect of the SPR program) is sufficiently great as to justify slowing the program's pace to the extent necessary to permit maximum possible use of inland salt domes for as much as possible of the proposed storage reserve. Major resource commitments have already been made to several coastal salt dome sites.

National Wildlife Federation

Executive Committee
November 14, 1977
Page Four

We strenuously urge (and we believe NEPA requires) that commitme[illegible] additional coastal sites be withheld until the evaluation of inland salt dome alternatives has been completed.

The opportunity to present these views is appreciated.

Sincerely,

Kenneth S. Kamlet
Counsel

cc: Mr. Michael F. Carosella (By Hand Deliver 11/1[illegible]7)
Associate Assistant Administrator
Special Programs
Strategic Petroleum Reserve
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