DOE/EA-1061

# Environmental Assessment for Decommissioning the Strategic Petroleum Reserve Weeks Island Facility



## Iberia Parish, Louisiana

**U.S. Department of Energy**



**December 1995**

**ERRATA**

The publication number of this document is incorrectly printed on the cover and title page. The correct number is DOE/EA-1051.

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# Environmental Assessment for Decommissioning the Strategic Petroleum Reserve Weeks Island Facility

## Iberia Parish, Louisiana

**U.S. Department of Energy**
**Washington, DC 20585**



**December 1995**

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**Finding of No Significant Impact for Decommissioning the Strategic Petroleum Reserve Weeks Island Facility**

The Department of Energy (DOE) has prepared an environmental assessment (EA), DOE/EA-1051, for the proposed decommissioning of the Strategic Petroleum Reserve (SPR) Weeks Island Facility. Under the proposed decommissioning the empty oil storage chambers of the facility would be filled with saturated brine, residual oil would be recovered to the extent practicable, and the service shafts and boreholes would be plugged. The existing service buildings would be razed and the land would be returned to its natural state, or the facilities would be transferred to another owner. The crude oil pipeline connecting the Weeks Island Facility to the St. James Terminal would be sold in whole or in part, or abandoned in accordance with U.S. Corps of Engineers procedures. Long term monitoring wells would be established at the top of the salt dome to verify groundwater character and containment of trapped oil.

Based on the analyses in DOE/EA-1051, DOE has determined that the proposed action is not a major Federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C.4321, et seq.). Therefore, the preparation of an Environmental Impact Statement (EIS) is not required, and the DOE is issuing this Finding of No Significant Impact (FONSI).

Issued at New Orleans, this 1st day of December, 1995.

William C. Gibson
Project Manager
Strategic Petroleum Reserve

Copies of the EA are available from:

Mr. Hal Delaplane
Strategic Petroleum Reserve (FE-423)
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585
(202) 586-4730

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

For further information on the DOE NEPA process, contact:

Ms. Carol Borgstrom
Director, Office of NEPA Policy and Assistance (EH-42)
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585
(202) 586-4600 or (800) 472-2756

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## LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| bbl | Barrel |
| DOE | Department of Energy |
| ES&H | Environmental Safety and Health |
| GSA | General Services Administration |
| ICW | Intracoastal Waterway |
| km | Kilometer |
| LA DEQ | Louisiana Department of Environmental Quality |
| m | Meter |
| MMB | Million barrels |
| MSL | Mean Sea Level |
| NAAQS | National Ambient Air Quality Standards |
| NFRAP | No Further Remedial Action Planned |
| NOx | Nitrogen Oxide |
| ODP | Ozone Depletion Potential |
| RCRA | Resource Conservation and Recovery Act |
| ROW | Right of Way |
| SPR | Strategic Petroleum Reserve |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| VOC | Volatile Organic Compound |

## 1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

The Strategic Petroleum Reserve (SPR) is a large crude oil stockpile under the control of the President of the United States. The SPR's mission is to reduce vulnerability to economic, national security, and foreign policy consequences of energy supply interruptions by adding to crude oil supplies in the United States, therefore, discouraging supply disruptions due to political, military, or natural causes. The Strategic Petroleum Reserve is mandated by the amended Energy Policy and Conservation Act and by the comprehensive energy plans of all Administrations since 1975 in recognition of the long term dependence of the United States on imported crude oil and petroleum products.

The SPR Weeks Island site is one of five underground salt dome crude oil storage facilities operated by the Department of Energy (DOE). As shown on Figure 1-1, the Weeks Island facility is located in Iberia Parish, Louisiana, on the eastern edge of Weeks Bay, approximately 23 kilometers (km) (14 miles) south of New Iberia and 150 km (95 miles) southwest of New Orleans. Weeks Island was a salt mine developed by Morton International Incorporated (Morton) through the dry-mining of salt using the room and pillar method. DOE acquired two levels of the worked-out portion of the mine from Morton in 1977 and converted these to long-term static crude oil storage chambers. The mine was filled to its 73-million-barrel capacity in 1982 and since then has remained in an operational readiness mode.

The SPR Weeks Island facility is on the southwest slope of the salt dome and occupies six parcels totaling about 4.3 surface hectares (10.6 acres). The storage chambers occupy 160 subsurface hectares (400 acres) of salt. The SPR Weeks Island facility is connected to DOE's St. James terminal on the Mississippi River by a 36-inch 110 km (67 mile) crude oil pipeline, also shown in Figure 1-1. A central plant contains the administration, control, and service buildings, an electrical substation, the pipeline terminus with three mainline pumps, and crude oil metering and handling facilities. The rest of the facility includes the fill site, a storage yard with a heliport, fire protection systems (water tank, pumps, and a halon system), service shaft, and production shaft on separate small parcels. When DOE was converting the old mine to oil storage, Morton continued operations by developing the adjacent Markel Mine from a travelway extending from the Weeks Island Mine. The Markel Mine was a temporary salt works that was operated until Morton could sink shafts and develop a new mine northwest of DOE's oil storage. Morton subsequently abandoned the Markel Mine. Although it was sealed off from DOE's storage chambers and is unconnected to Morton's current works, the Markel Mine is still accessible from DOE's travelways. An aerial view of the DOE site and adjacent Morton operations is presented in Figure 1-2.

The purpose of the proposed action is to decommission the Weeks Island crude oil storage facility after the oil inventory has been transferred to other SPR facilities. Water intrusion into the salt dome storage chambers and the development of two sinkholes located near the aboveground facilities has created uncertain geophysical conditions. Thus, DOE has concluded that the integrity of the Weeks Island underground storage chambers cannot be assured, and therefore, the chambers are unsuitable for environmentally safe, long-term storage of crude oil on the scale of SPR facilities. DOE plans to transfer the 73 million barrels of crude oil in storage at Weeks Island to other SPR sites in Louisiana and Texas and then decommission the "empty" facility beginning about October 1996.

**FIGURE 1-1**
**Location of Proposed Action**

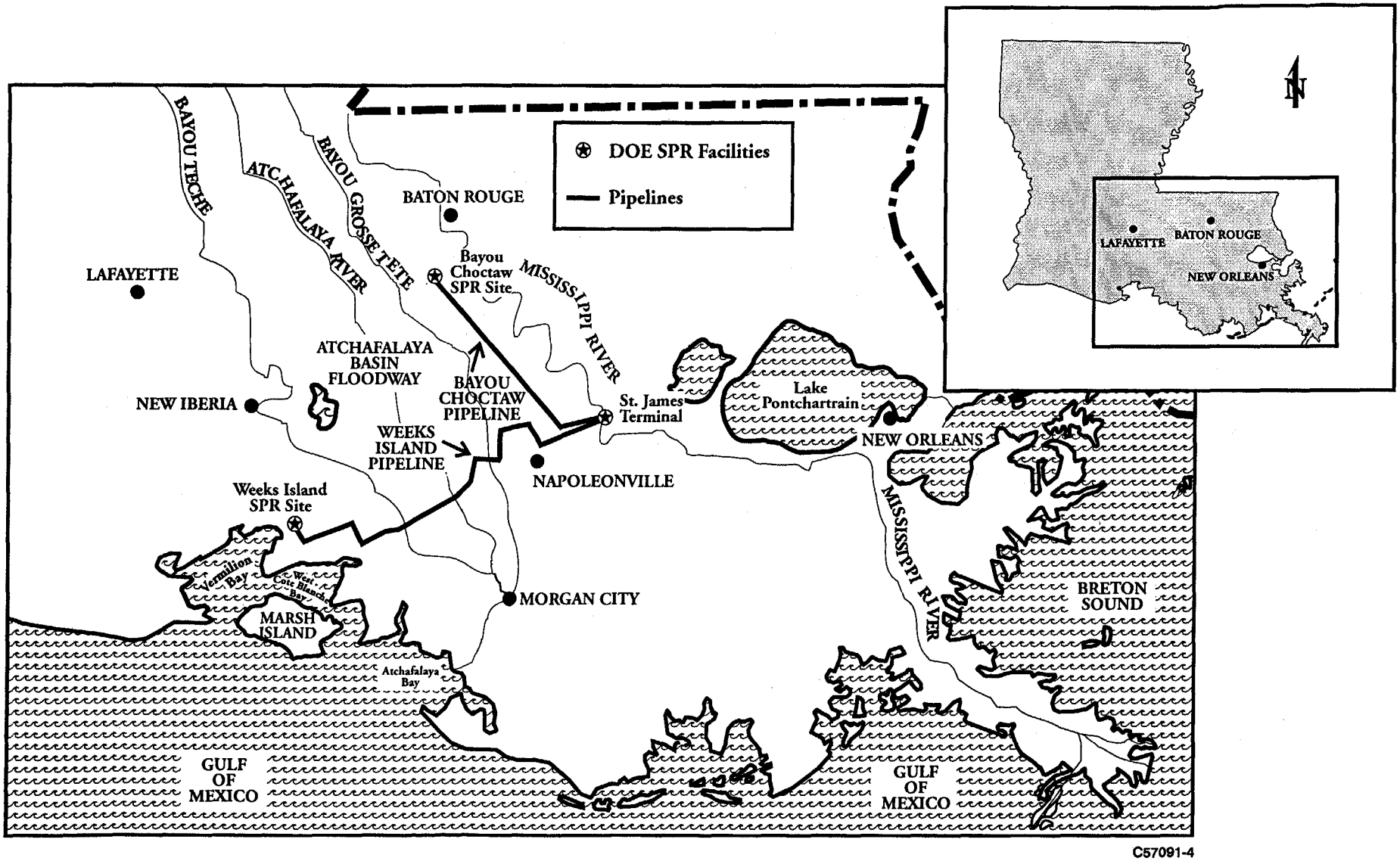
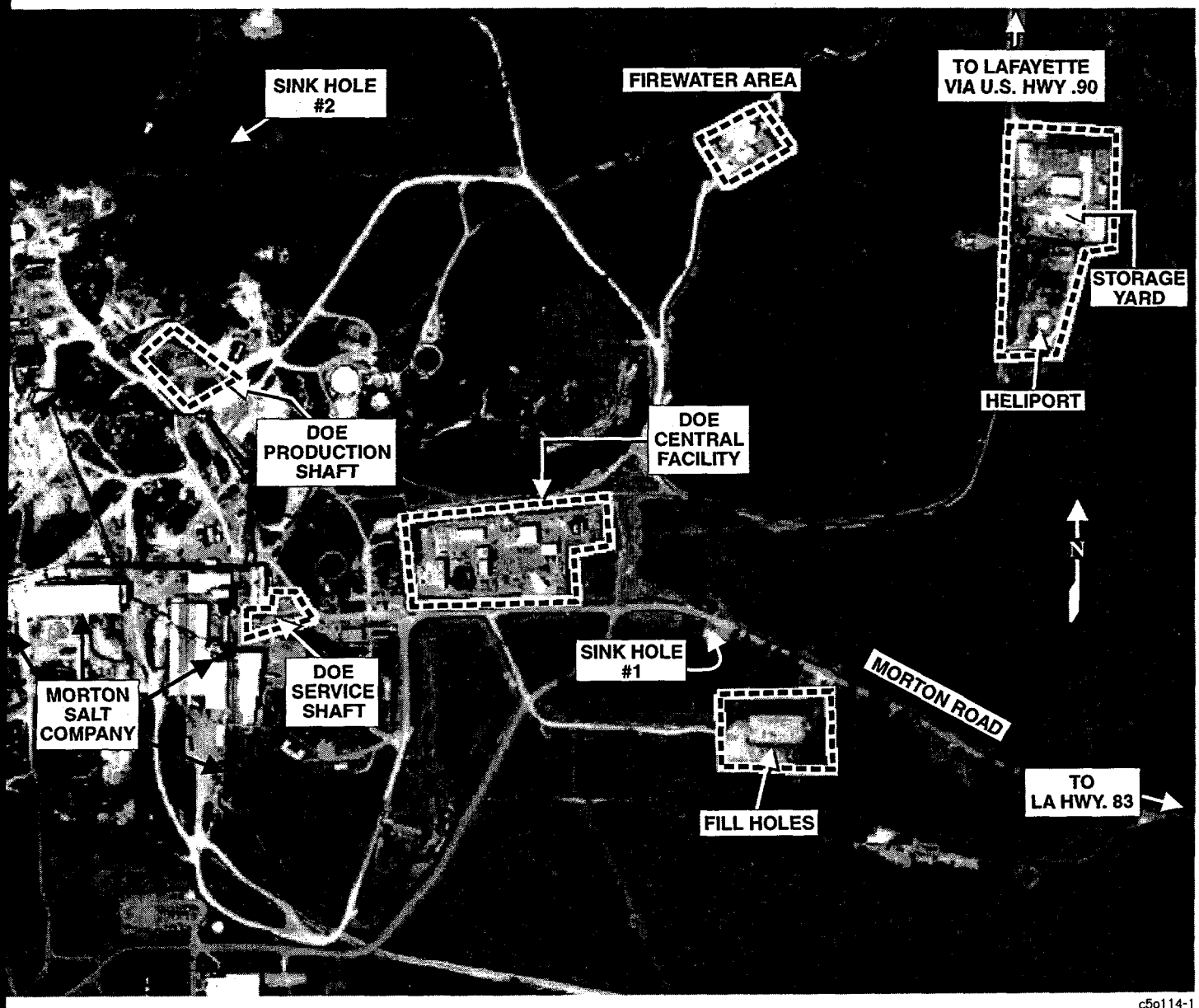


**FIGURE 1-2**
**Aerial Photograph of Weeks Island Facility**




**DOE parcels are delineated by dashed lines. All remaining industral areas are Morton operations.**

Once the oil is pumped out, up to 700,000 barrels of oil are expected to remain in the mine in pockets, irregularities, and clinging to surfaces. If the mine were left empty, water could continue to leak in and flood the mine. As it flooded, water would wash and lift oil from surfaces and float it to the roof of each storage level where it would collect. Some of the residual oil at the upper level roof could then escape up the leak pathway out of the salt dome into aquifers that lead under Gulf waters. In addition, the uncontrolled nature of the flooding could exacerbate surface subsidence and impact Morton's operations. For these reasons, DOE proposes to stabilize the empty mine by controlled flooding of the chambers with saturated brine and plugging of the mine shafts and boreholes to the surface. Surface structures would be razed, salvaged, or transferred to another party for other use. Filling the mine with saturated brine would not only minimize the potential for structural failures, but also enable recovery of 95 percent to 98 percent of the residual 300,000 to 700,000 barrels of oil by skimming operations.

**Background**

In May 1992, a sinkhole was discovered on the south side of the Morton access road, southeast of the DOE surface facilities, at a location that is vertically aligned with the outer edge of the oil storage chamber. The subsurface storage area of the facility is outlined in Figure 1-3. The sinkhole, which resulted from water dissolving the top of the salt, was continuously monitored, backfilled with sand, and then observed to grow at a rate of 1.9 cubic meters ($m^3$) per day (2.5 cubic yards per day). In early 1993, brine was discovered accumulating in the fill hole sump at rates exceeding 380 liters (l) per hour (100 gallons per hour). Groundwater leaks are not uncommon in salt mines, and DOE has experienced seepage into areas located above the oil storage chambers at Weeks Island. In the past, leaks have been successfully stopped or substantially slowed by grouting from within the subsurface workings. However, it has not been feasible to grout the existing sinkhole leak because the oil chambers are filled with either crude oil or inert gas in the vicinity of the leak.

In May 1994, DOE initiated an intensive geotechnical investigation of the sinkhole and surrounding areas' geology and hydrology. This diagnostic program included an array of exploratory boreholes, surface seismic reflection survey, a cross-well seismic tomography (i.e., single plane seismic imaging) survey, a vertical seismic profile, near-surface gas mapping, downhole groundwater flow measurement, tracer dye injection, and a surface self-potential survey. The diagnostic program confirmed the initial hypothesis of a groundwater leak into the mine on the basis of: an apparent depression of the water table below the sinkhole; discovery of a sediment-filled crevasse 22 m (72 feet) below the top of salt; and saline water and sediment movement downwards at rates of 88 and 20 centimeters (cm) per day (2.5 to 0.5 feet per day), respectively.

By August 1994, the inflow rate had increased to more than 460 l per hour (120 gallons per hour). To slow the rate of salt dissolution and thereby sinkhole growth and to reduce groundwater inflow, DOE began to inject brine into the crevasse below the sinkhole.

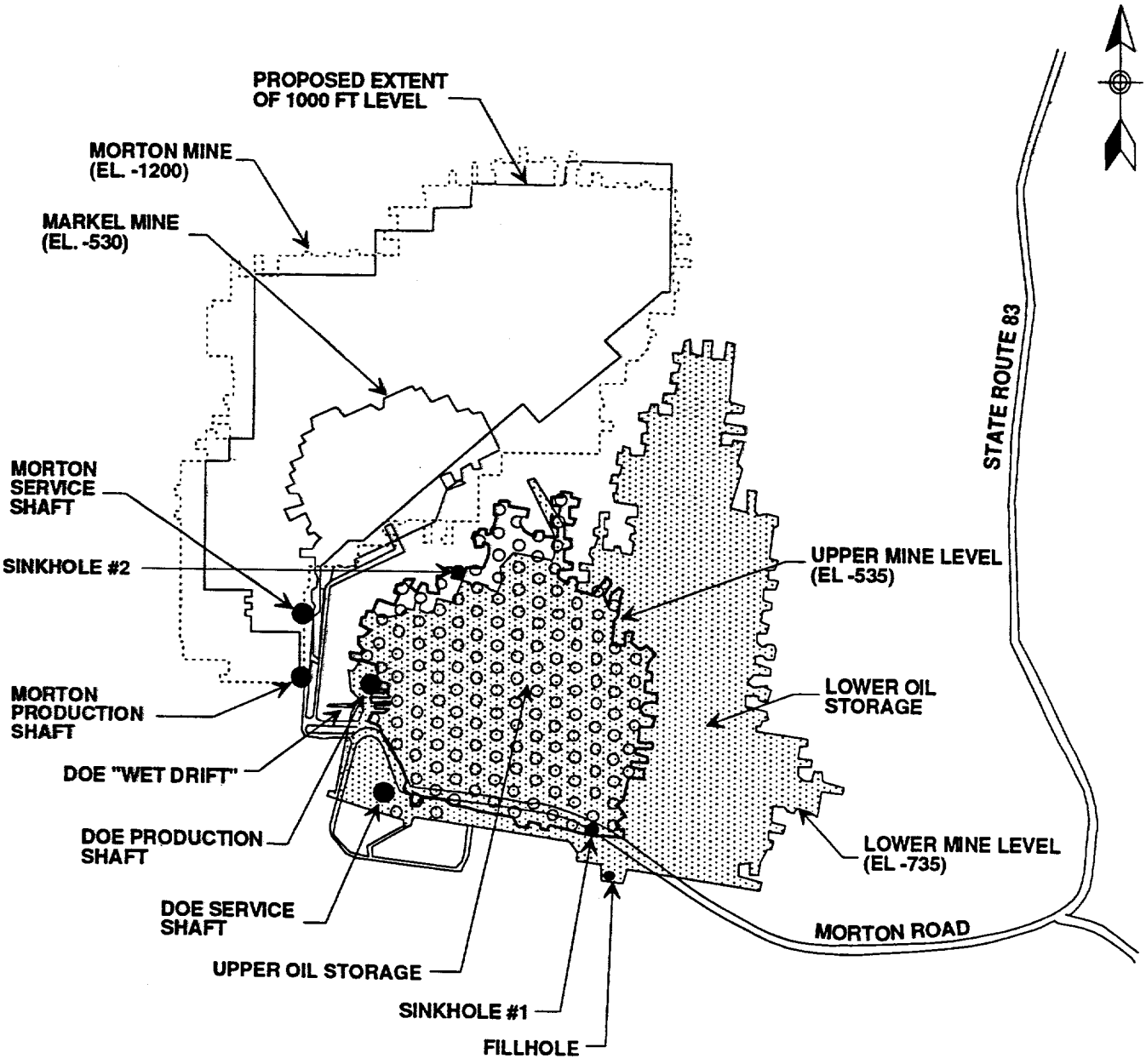
Data obtained from the diagnostics program led to the conclusion that the mine was not suitable for continued long-term SPR oil storage and that the facility should be decommissioned. An uncontrollable groundwater inflow into the storage chambers could result in leaching of salt along the leak path and lead to accelerated rates of water inflow and leak path enlargement. This could result in structural failure of the mine, surface collapse, and displacement of crude oil into the overlying aquifer and/or surface waters leading toward Vermilion Bay and the Gulf of Mexico.

DOE determined these risks to be unacceptable considering the volume of crude oil in storage. A decision was made to relocate the crude oil inventory to the Big Hill, Texas and Bayou Choctaw, Louisiana storage sites under the authority of mission readiness reviewed in the Capline Group Salt Domes' Environmental Impact Statement[1]. DOE publicly announced this decision on December 15, 1994.

The SPR has continued further diagnostic studies. Data obtained continue to be used to further define the leak path and surrounding hydrogeology. A second minor sinkhole was discovered in March 1995 and is shown in Figures 1-2 and 1-3. The stability of backfilled material in this sinkhole indicates that it is not a major leak pathway into the storage cavern at this time.

There could potentially be an increase in the water inflow rate of the mine during decommissioning. The primary concern would be with the roof of the upper mine level which has a lower horizontal compressive stress and more direct access to the groundwater above the dome. Continuous monitoring of fluid levels in the mine and groundwater levels in the piezometer wells would provide a warning of increased inflows. Contingency plans available to help control groundwater inflow during fluid filling include raising the mine pressure and grouting the top of the salt from the surface through a network of boreholes. Ground freezing is in progress around the leak to restrict groundwater inflow and to act as a freeze plug to prevent collapse of the sinkhole during oil transfer. Supplemental grouting (accessing the top of the salt dome via surface wells) would be conducted, if necessary.

**FIGURE 1-3**
**Weeks Island Subsurface Plan View**



## 2.0 PROPOSED ACTION AND ALTERNATIVES

For subsurface facilities, the preferred alternative is to fill the storage chambers with saturated brine in a controlled manner, recover as much of the residual oil as possible, and plug the shafts and boreholes. Saturated brine (at greater than 85 percent saturation) cannot dissolve more salt to any degree of significance, making it the most inert material available relative to the storage chamber's integrity. For each of these activities, DOE is considering a variety of approaches (e.g., options for various fill levels, brine generation alternatives, and residual oil removal options) which are detailed below. The Weeks Island subsurface facilities are shown in Figure 2-1.

For the surface facilities, two general alternatives are available: raze the existing buildings and return the land to a natural state; or transfer the existing facilities (via sale, lease, or donation) to another occupant. These options are explored in more detail in Section 2.2.

The alternatives for the 110 km (67 mile) concrete-coated buried pipeline also depend in part on expressions of interest from commercial users. If interest exists, all or part of the pipeline may be sold. Other alternatives include removing the pipeline, or abandoning the line in accordance with U.S. Army Corp of Engineers procedures and Coastal Zone Management considerations (e.g., filling the line with water and leaving it buried in place).

The general sequence and scope of activities would be similar under any decommissioning alternative. Filling of the mine with brine and recovering residual oil would take approximately 15 months. Mine and surface facility decommissioning would require approximately 12 additional months.

### 2.1 Alternatives for Subsurface Facilities

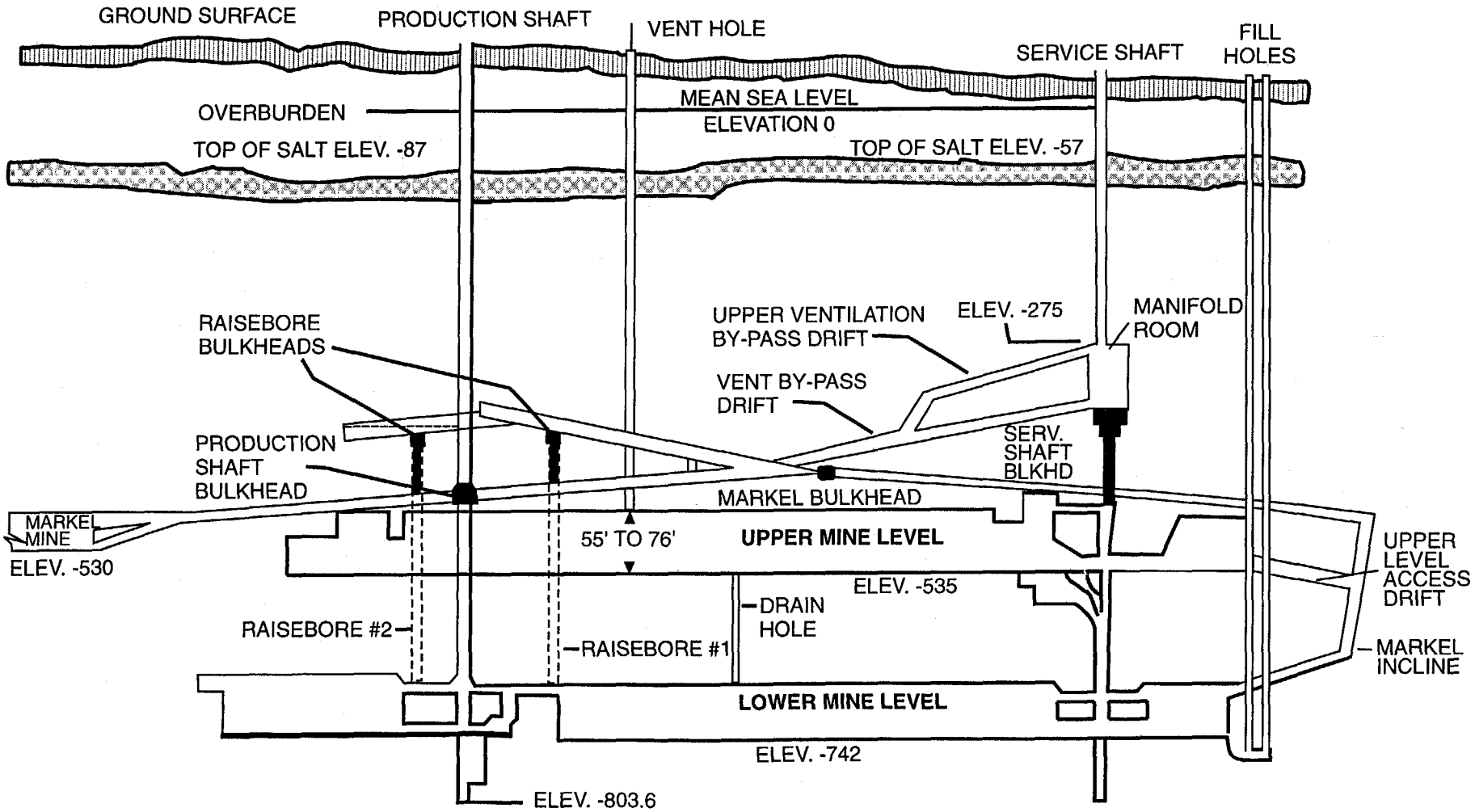
Decommissioning of Weeks Island site would commence with controlled flooding of the oil storage chambers with saturated brine, recovering the residual oil, and subsequently plugging the production and service shafts, fill holes, and vent in accordance with State regulations (i.e., Louisiana State Order 29B).

Because brine is significantly more dense than water or oil, it would exert greater pressure on the mine walls and roof and would offer greater stabilization against structural stresses. In addition, filling the mine with a dense brine would shut off the downward flow of groundwater thereby preventing further salt dissolution, growth of the crevasse, and structural failure of the mine. For maximum geophysical stabilization, DOE would prefer to flood the Markel Mine and travelways as well as the oil storage area and manifold room. This would require the consent and participation of Morton because the Markel Mine is Morton property.

During brine fill, the residual oil would float to the liquid surface where approximately 95 percent of it would be recovered by skimming and/or drilling into trapped oil pockets. The skimming would be performed at two intervals: first, as the brine level approaches the lower level roof and later, as the brine level approaches the upper level roof followed by drilling, if necessary. Total estimated unrecoverable oil would be approximately 10,000 to 30,000 barrels.

After brine fill is complete, the shafts would be abandoned and filled to the surface with grout above concrete bulkheads. A wire line packer would be installed in the vent hole at

**FIGURE 2-1**
**Weeks Island Subsurface Facilities**
**(Elevations in Feet)**

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elevation -78 m Mean Sea Level (MSL) (-255 feet). The vent hole would be filled above the packer with expanding cement grout to ground surface. One of the two fill holes would be plugged in a similar fashion; the suspended casings would be removed and a wire line packer would be installed at elevation -78 m MSL (-255 feet). The borehole above the packer would be filled by injecting an expanding cement grout to ground surface. The second fill hole would be used to relieve the pressure buildup from salt creep closure of the mine. The casing, which extends from the surface down to a sump at the bottom of the mine, would be perforated over an interval of several feet in the saline aquifer at the top of the salt. Above the perforation, the casing would be grouted to the surface. This would control mine pressure by allowing brine displacement from the bottom of the mine out into the saline aquifer. This is a proven method in the State of Louisiana. Monitoring wells would be placed at the top of the salt dome to verify groundwater character and monitor the containment of trapped oil and brine.

In the event that Morton does not participate in the controlled flooding of Markel Mine, then Morton could develop new travelways to Markel Mine from their ongoing operations.

One proposed brine source is to enlarge two existing caverns at the SPR Bayou Choctaw facility. Brine would be transported to Weeks Island via pipeline at an average rate of 200,000 barrels per day. Pipeline transport would occur by interconnecting the brine and oil systems at Bayou Choctaw, moving the brine via the 36-inch, 60 km (37 mile) pipeline from Bayou Choctaw to St. James, and then to Weeks Island via the 36-inch, 110 km (67 mile) pipeline from St. James. Brine cannot be leached from the DOE site at Weeks Island because of the underlying oil filled caverns, but an optional brine source under evaluation is commercial brine from a new leached cavern on the Weeks Island salt dome. Another alternative that could emerge later in project development is the purchase of brine produced at another salt dome by a commercial supplier. A commercial supplier would likely produce brine by leaching at one of the following salt domes: Chacahoula, Napoleonville, Cote Blanche, Jennings, Jefferson Island, or Clovelly, all of which are in coastal Louisiana. Brine would possibly be transported via pipeline through the existing DOE pipeline, as in the proposed action, and the impacts would generally be comparable should a spill occur although the distance for brine transport would be substantially shorter thus reducing spill risk.

### 2.2 Alternatives for Surface Facilities

A public meeting to solicit input for future uses of this facility was held in March 1995 in New Iberia, Louisiana (see Appendix A). It was suggested at the meeting that the site be donated for salt dome geological research with a special interest in "post closure" uses for Louisiana's coastal salt domes where subsidence and other geophysical concerns have occurred subsequent to mineral extraction. The viability of this use will depend on the sponsor making appropriate application to DOE; however, this suggestion does not influence environmental issues addressed in this assessment. Morton has expressed potential interest in reacquiring the surface acres and facilities, however, Morton is not interested in acquiring the oil storage chambers.

As DOE controls only 4.3 hectares (10.6 acres) of surface area in six separate parcels of land at the site, the land use is primarily determined by the other industrial occupants on the dome. Surface facilities would be either razed, salvaged, transferred to another occupant for beneficial use, or transferred for caretaker status to the General Services Administration (GSA).

In general, all mechanical and electrical process systems and equipment relating to oil storage would be removed for salvage. This would include pumps, motors, meters and provers, valves, vent and flare systems, tanks, switch-gear, motor controls, and generators. Above and below grade piping, cable, and conduit associated with these systems within the fenced perimeter of the site, would be removed for reuse or disposal offsite at an approved facility. Process piping, cable, and conduit which enter building foundations or are beyond the fenced perimeter of the site would be drained, cleaned, plugged, or capped as appropriate and abandoned in place.

The Weeks Island site includes a halon fire protection system (required by Louisiana State Order SDS-8) containing 6800 kg (15,000 pounds) of halon in cylinders. Halon is an ozone depleter. The halon system protects the service shaft, manifold room, and header and can be activated either manually or automatically. If the site is decommissioned, the halon system would be dismantled. The cylinders of halon would be removed from the manifold and transported offsite for reuse.

The oily water collection and treatment system piping, tanks and other equipment, would be drained, cleaned, demolished and removed from the site for reuse or disposal at a DOE/SPR approved facility.

All aboveground and below ground electrical distribution systems required to maintain the decommissioned facility would remain and be transferred to the GSA.

Buildings associated with the shafts would be demolished and disposed of at a DOE/SPR approved facility. Warehoused spare equipment, parts and materials would be transferred to other DOE sites. The fire truck would be transferred to another DOE site. Buildings which would be decommissioned and transferred to GSA include the Administration, Control and Laboratory Buildings, Crude Oil and Firewater Pumphouses, Warehouse, and Guardhouse.

General site improvements, including paved roads, drives, parking lots, rainfall runoff collection systems and structures, fencing, fire protection and potable water supply, distribution systems, and sanitary sewer collection and treatment system, would be transferred to the GSA with selected exceptions. The water wells would be plugged and abandoned, and the shaft and fill hole site fencing would be removed.

The site area would be filled and graded as necessary to promote surface runoff to the existing drainage systems. Erosion control measures would be used where needed to reduce sediment transport from the decommissioned site areas.

### 2.3 Alternatives for Pipeline Decommissioning

The 36-inch concrete-coated crude oil pipeline buried between Weeks Island and St. James is currently totally vegetated along its 110 km (67 mile) length. Under one proposed alternative, the pipeline would be drained, cleaned, filled, and capped according to U.S. Army Corps of Engineers permitting requirements.

Another alternative would be to sell or transfer the pipeline to a commercial party, if interest was expressed. It is feasible that commercial interest would be expressed only in selected sections of the pipeline, so that portions would be decommissioned as detailed above, and portions would be transferred to commercial use.

## 2.4 No Action Alternative

The no action alternative is assessed to provide a baseline for comparison with the potential environmental effects of the proposed action.

After the crude oil inventory is pumped out of the Weeks Island storage chambers, the chambers would be left "empty," and then the shafts and fill and vent holes would be plugged, sealed, and abandoned according to Louisiana State Order 29B. In this alternative, the mine would not be filled with brine by controlled flooding, nor would brine be used to wash the salt walls and float out as much residual oil as possible. In this situation, the amount of crude oil remaining in the mine is roughly estimated to be in the range of 300,000 to 700,000 barrels (i.e., up to about 1 percent of the total initial inventory). This residual oil may be layered onto mine surfaces (e.g., oil coatings), trapped in ponds on uneven mine floors, sorbed onto crushed salt piles, or trapped in salt fractures. It is anticipated that groundwater intrusion into the empty storage chambers would continue, eventually filling the chambers, turning into brine, and trapping the residual oil in the salt dome chamber high areas.

## 2.5 Alternatives Considered but Not Assessed

DOE has considered several alternatives that, for the reasons detailed, are not evaluated further in this assessment.

DOE considered concurrent removal of oil and fill with brine. The advantage of this approach would be additional stability because the mine would never be empty. However, DOE determined that concurrent fill was impracticable. Concurrent fill would require construction of an additional pipeline, parallel to the existing 110 km (67 mile) pipeline, so that two fluids could be moved simultaneously; or producing brine from a solution mine in the Weeks Island dome. Concurrent fill had the potential for increased environmental impacts from construction of the new pipeline that would cross both wetlands and floodplains and developing a new brine source at Weeks Island would involve months of delay in removing the crude oil inventory. In addition, concurrent fill and drawdown capabilities were not designed into the facility and such engineering reconfiguration modifications cannot practicably be made with caverns full of oil.

The effects of flooding the mine with water from the ICW were modelled and it was concluded that water flooding, either naturally or by DOE under controlled circumstances, should not be used due to the unacceptable risk of structural failure due to erosion. The most feasible approach would be to flood as rapidly as possible by introducing water into the lower level through multiple injection points. The result would be localized dissolution of salt at the points of water introduction. Salt dissolution could create large cavities near the injection points and undercut or completely dissolve room support pillars and could result in localized collapse and disruption to surface facilities. Under all reasonable modelling scenarios, predicted salt dissolution of pillars is unacceptable. Therefore, DOE is not assessing further the alternative of filling the mine with water.

DOE could remove the pipeline and sell it for salvage. However, because the pipeline is concrete-coated, the salvage value is minimal and redisturbing the right of way (ROW) would undo about 15 years of natural revegetation; this alternative has not been assessed.

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# 3.0 AFFECTED ENVIRONMENT

## 3.1 Geology

This section is subdivided into discussions of surface/near-surface geology, and subsidence/sinkholes.

### 3.1.1 Surface and Near-Surface Geology

The Weeks Island salt dome borders Vermilion Bay, which is contiguous to the Gulf of Mexico. Weeks Island is one of five piercement salt domes producing surface expression located along the Gulf Coast in southern Louisiana and one of 45 to 50 known domes in coastal Louisiana. The Weeks Island dome has a diameter of approximately 3 km (2 miles), and is not covered by cap rock. The top of the salt is an irregular surface located at an approximate minimum elevation of 13 m (50 feet) below MSL. The source bed for the salt dome is the Louann Salt of Jurassic age (approximately 180 million years ago). The upward movement of the Weeks Island salt mass may have begun during the Oligocene period (26 million years ago), and continues at present, at a rate of approximately 2.5 millimeters (0.10 inches) per year.[2]

The elevated Weeks Island area is underlain by nearly flat-lying Pleistocene-to-recent age unconsolidated deltaic sediments, from the land surface to the top of the salt. The surficial soils are classified as the Memphis-Frost Association, with Frost soils found on the dome periphery and in depressions in terrace uplands, and Memphis soils found on the bulk of the salt dome. The Memphis-Frost Association varies from well-drained and very gently sloping to poorly-drained loamy soils in areas of low slope. A typical profile consists of a thin silt loam layer, underlain by about 0.6 m (2 feet) of silty clay loam, underlain by a silty loam to a depth of 2 m (7 feet).[3]

The most prominent topographic feature on the island is a ridge running northeast across the center of the island. This ridge, which is topped by clay layers, forms the highest elevation (50 m (171 feet)) on the island and is called the "Devil's backbone."

Table 3-1 presents a summary of the units found in the shallow stratigraphy overlying and immediately adjacent to the salt dome at Weeks Island.

### 3.1.2 Subsidence and Sinkholes

Scientists have recognized for many years that subsidence occurs throughout the Louisiana coastal region; in some areas, sinking occurs at a rate of approximately 1 m (3.3 feet) per century. Subsidence at Weeks Island is occurring over all existing mined areas. A preliminary study by Sandia National Laboratory identified a subsidence rate of 3.3 cm (0.11 feet) per year at Weeks Island.[4] More than one third of the United States is underlain by marine evaporites, all of which have varying degrees of solubility in permeating freshwater or unsaturated brine. Extraction of soluble materials causes many basins with great thicknesses of bedded salt to exhibit land-surface subsidence.[5] Groundwater flow in contact with salt causes extensive solution, cavity formation, collapse, and ground subsidence. Natural salt subsidence affects large areas over long time spans, but mineral extraction greatly accelerates the process and is usually in localized areas.[6]

**TABLE 3-1**
**Shallow Stratigraphy of Weeks Island**

| Unit | Notes |
|---|---|
| Cary Sand and Clay and Wisconsin Sand | Found only along the Devil's Backbone. |
| Two Creeks Clay | Stiff, brown, silty clay; ranges in thickness up to approximately 12 m (40 feet). Likely permeability very low ($10^{-6}$ cm/sec ($4x10^{-7}$ inch/sec) or less). |
| Alton Sand and Gravel | Sequence of alternating layers of rust-orange sandy gravel, and silty sand underlying the clays. Ranges in thickness from 25 to 70 m (90 to 240 feet). Silt or clay lenses (usually thin and discontinuous) occur at various depths. |
| Sangamon Clay | Discontinuous lenses of interglacial black, marine clay. Found only locally on top and along the flanks of the salt dome. |
| Illinoian Sands and Gravels | Only found flanking the dome. |
| Peoria Clay | Thick dark marine clay of Peorian age. |
| Kansas Sand | Provides the shallowest hydrocarbon production in the area. |
| Nebraskan Sand | Lowest Pleistocene bed. Thickest towards the northwest of the island. |

Source: Weeks Island Strategic Petroleum Reserve Geological Site Characterization Report, June 1987. Prepared by Acres International Corporation, Buffalo, NY.

Solution-subsidence sinkholes and collapse features associated with salt domes result from:

- Natural and man-induced dissolution of salt;
- Natural and man-induced removal of cap rock materials, such as sulfur; and
- Pumpage of oil, natural gas, and groundwater from supradomal strata.[7]

A study by the U.S. Geological Survey identified more than 850 sites of sinkhole development in the Eastern United States since 1950, with more than 6,500 associated sinkholes or related features at those sites.[8] Subsidence has been greatest at sites that have been associated with mining.

Thus, the current subsidence rate at the Weeks Island dome is consistent with regional trends. In addition, the existing sinkholes have, to date, had fewer consequences than other regional occurrences (e.g., distortion of surface features at Jefferson Island), perhaps due to nearly two decades of crude oil storage in otherwise empty caverns exerting outward pressure. It is fair to assume that, during the oil storage period, the stability of the mine full of oil was greater than that of an empty mine.

### 3.2 Groundwater

Table 3-1 describes the soil layers (i.e, the shallow stratigraphy) of Weeks Island. The Gonzales formation is located above the salt dome and includes the Alton sands and, at greater depths, the Wisconsin sands. Permeability, a measure of the ability of water to flow through soil, for the Alton and Wisconsin sand is approximately $3x10^{-2}$ cm/sec ($1x10^{-2}$ inch/sec). Gravel layers within the Alton formation have a similar permeability of 0.5 to $1.0x10^{-2}$ cm/sec (2 to $4x10^{-3}$ inch/sec).[9] Below the Alton are thin layers of the Sangamon clay located locally on top and along the flanks of the salt dome. The Sangamon clays present permeabilities near $1x10^{-6}$ cm/sec ($4x10^{-7}$ inch/sec) or 10,000 times less permeable than the sands and gravels. Beneath the Sangamon clay, and flanking the salt dome, are the Illinoian sands and gravels.

Groundwater level measurements on Weeks Island indicate that the water table is essentially at sea level. Groundwater is very saline or brine near salt domes due to dissolution of salt. Some intermittent clay lenses are associated with sporadic perched groundwater at 3 m (10 feet) below surface level, but these are of limited areal extent. The top 2 m (7 feet) of groundwater in the saturated sand is fresh to brackish, and salinity increases with depth to fully-saturated (brine) at approximately 4 m (12 feet) above the top of salt. With about 10 km (4 square miles) of total dome cross-sectional area, and an assumed 30 percent porosity, this indicates there is on the order of 70 million barrels of brine currently above the dome. Theories are that the Weeks Island salt dome rises about 33 cm (1 foot) per century, and salt dissolution keeps the top of salt constant. From this one can roughly estimate that approximately 600,000 to 2 million barrels of brine are produced naturally along the top of the dome per year, depending on a variety of factors. The upper storage chamber is located 120 m (400 feet) below the top of salt and there is no evidence of vertical groundwater flow down through the dome. Figure 3-1 presents a schematic diagram of the salt dome, the upper level of the storage chamber, and salinity variation in groundwater.

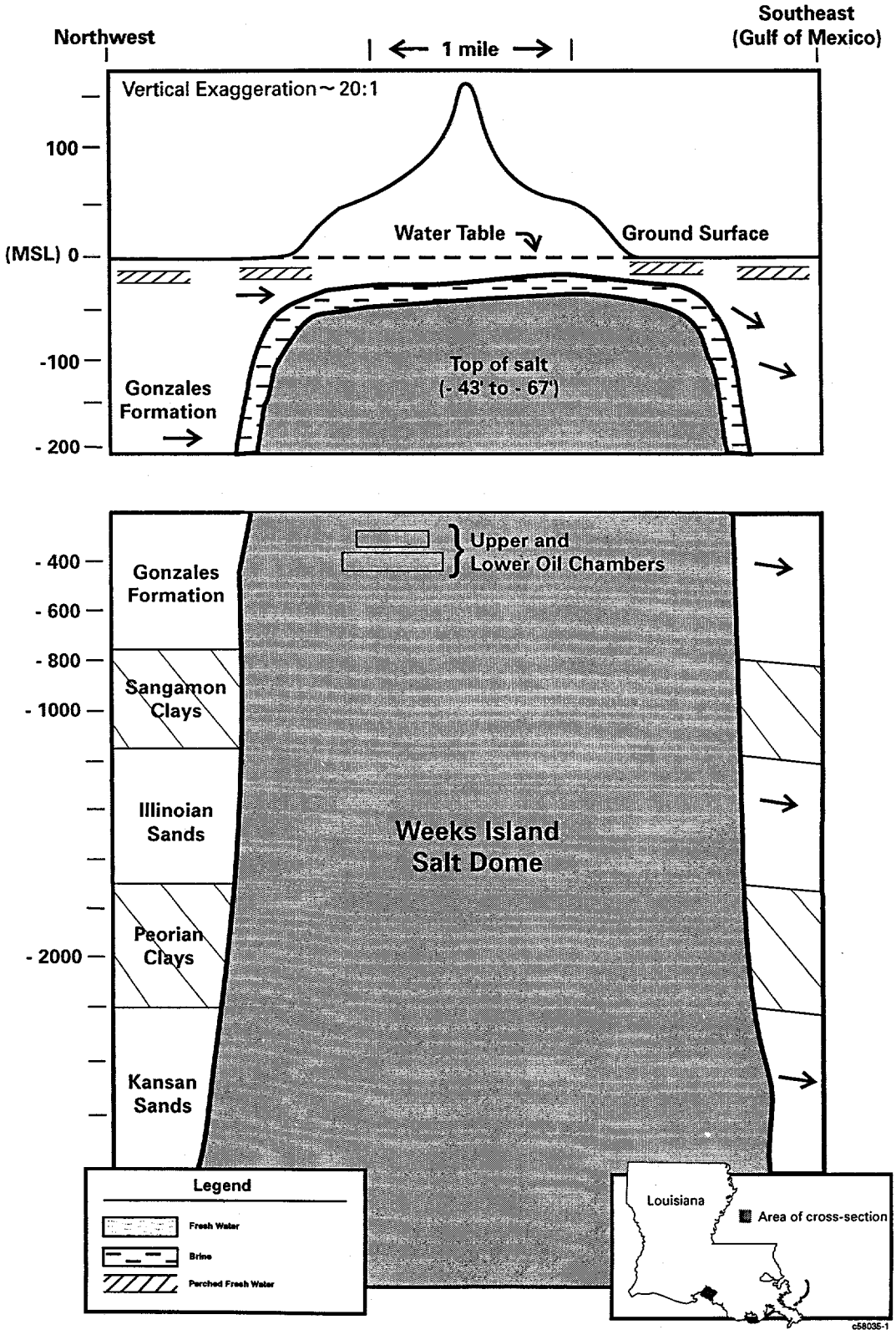
Elevated sulfate and chloride values can be found in a shallow plume 240 m (800 feet) in length and 210 m (700 feet) in width, downgradient from a former acid plant used by Morton. Groundwater impact from gasoline and diesel fuel has also been documented near the acid plant. Groundwater contamination by the herbicide tebuthiuron has been documented near a retention pond of a former plant in the area. Both facilities are located approximately 460 m (1,500 feet) from the property boundary of the DOE central facility. Currently, aquifer remediation programs are in place for all these plumes.[10]

The groundwater regime appears to be the result of infiltration of precipitation, as indicated by a rapid rise in static levels in wells after rainfall events. Groundwater flow direction follows the general topographic slope, and flows radially off the dome towards the surrounding bayous, the Intracoastal Waterway (ICW), and Weeks Bay.[11]

Groundwater contribution to surface waters in the Vermilion River basin is considered to be of such small magnitude from Weeks Island as to be discounted in water budget computations.[12]

Although there are no population centers within nine miles of Weeks Island, 21 water wells exist within three miles of the site. Of these, 14 are industrial wells, five are unused or monitoring wells, and two are actively used by DOE for nonpotable industrial purposes. In addition to the two DOE wells Morton has four operational wells on Weeks Island. Due to the swampy nature of the

**FIGURE 3-1**
**Generalized Hydrogeologic Cross Section of Weeks Island**



surroundings and the lack of a local resident population, demand for public water supply development around Weeks Island is unlikely.[13]

To summarize, the quality of water in aquifers ranges from mineralized (iron) freshwater, to moderately saline to brine, as depth increases. Due to the brackish, mineralized, and saline character of the groundwater, it is considered neither an important water resource (e.g., for potable and culinary uses) nor a major contributor to the Chicot Aquifer which is the main source of potable and culinary water for southern Louisiana. Because of its marginal quality and limited development potential, the groundwater existing on the Weeks Island dome can only be recognized as a poor overall economic or environmental resource.

**Pipeline Groundwater Characterization**

Based on U.S. Geological Survey (USGS) quadrangle maps, within 1.6 km (1 mile) of the Weeks Island to St. James pipeline there are two documented groundwater wells, located near Florence about 6 km (4 miles) from the site, and two flowing wells near Donaldsville, located about 11 km (7 miles) from the St. James terminal. According to the State of Louisiana, there are a number of additional wells along the pipeline ROWs. These wells have industrial uses but some are likely used for potable water.

### 3.3 Surface Waters

Weeks Island is located in the transition between the Chernier and the Deltaic Plains of south-central Louisiana, in the Marsh Island-Bayou Teche Drainage. Drainage of storm water and surface waters from the SPR site is to the east, north, and south into nearby Warehouse Bayou and surrounding wetlands. The surrounding area is composed of swamps, crossed by bayous or drainage channels which lead to the bays, such as Weeks Bay and Vermilion Bay, adjacent to the Gulf of Mexico. Flow within the bayous and the swamps is largely controlled by tidal fluctuations. Salinity within the bayous and swamps generally increases in a downstream or seaward direction.

Thirty-one surface water bodies are located within 8 km (5 miles) of the SPR site. The water bodies that are closest to the site and/or are regionally important include Plantation Lake, Sandy Bottom Pond, Warehouse Bayou, Weeks Bayou, Bayou Patout, Long Ride Barge Bayou, Stumpy Bayou, Bayou Pete, the ICW, Bayou Cypremort, Bayou Carlin, Bayou Garrett, Two Mouth Bayou, Shark Bayou, Sheepshead Bayou, the Vermilion River, Weeks Bay, and Vermilion Bay. Most of the surface water bodies near the Weeks Island SPR site are either fresh or brackish, and are tidally influenced. Groundwater contribution to surface waters in the Vermilion River basin are known to be of such small magnitude as to be discounted in water budget computations.[14]

None of the thirty-one surface water bodies located within 8 km (5 miles) of the SPR site have downstream public water intakes. Weeks Bay (3 km (2 miles)), the ICW (2 km (1.4 miles)), Vermilion Bay (6 km (4 miles)), and West Cote Blanche Bay (7 km (4.4 miles)) are used for recreational purposes, and the last one for oyster propagation (the numbers in parentheses indicate the approximate distance to the SPR site). Seventeen of the water bodies have no documented uses, but all the waterbodies are important nursery areas for sport and commercial fishing, and nine have service oil industry barge or small boat traffic. Along the Louisiana coast there is heavy oil movement via tankers, barges, and other vessels. The total waterborne oil

movement (tonnage loaded or landed) in the Louisiana coastal area from 1990 to 1993 was 1,132.4 million tons (or 7.5 billion barrels), as extrapolated from waterborne commerce data for 1990 to 1992.

To summarize, surface water bodies represent an important regional environmental and economic resource with several significant uses (e.g., transportation, fisheries, recreation).

Surface water bodies crossed by pipelines are detailed below in Section 3.5.3.

### 3.4 Land Use

Weeks Island is located in Iberia Parish, Louisiana, 14 km (9 miles) south of Lydia, approximately 23 km (14 miles) south of New Iberia, and 150 km (95 miles) southwest of New Orleans, on the eastern edge of Weeks Bay. In Iberia Parish, the primary land uses are agriculture (primarily sugarcane, soybeans, rice, native pecans, and hay) and forestry (of bottomlands forest type trees including tupelo, blackgum, sweetgum, oaks, and baldcypress.) The dome itself is virtually uninhabited and the surrounding area is sparsely populated. Weeks Island is predominantly covered with second growth deciduous forest, except for a few hundred acres (40 hectares) on the eastern portion of the dome that are used for sugarcane farming. No land on the Weeks Island dome, and more specifically within the limited land owned by DOE, is prime or unique farmland.

The DOE facility on the island contains approximately 4.3 surface hectares (10.6 square acres) among six parcels. Other operations on the dome include commercial operations by Morton and Shell Oil Company. Morton operates a mechanically mined, room-and-pillar salt mine that extends to a depth of 400 m (1,312 feet), in addition to two small, leached brine caverns (northeast of the SPR facility) operated for the production of table salt. Extensive surface facilities support the Morton operations (see Figure 1-2). Shell Oil Company produces oil and gas on the north overhang of the dome. Additional oil and gas fields are located off the dome at the northern and southern edges of the island about 3 km (2 miles) from the DOE storage site. Over 250 oil wells and 35 gas wells have been completed to date in the Weeks Island Field.

The Weeks Island facility is located within the Louisiana Coastal Zone. There are two identified coastal restoration projects in the Weeks Island area. The first is the Weeks Bay Shore Protection Project (TV-10). This project, which has not been initiated, will involve the construction of some retention levees on the shore and the addition of fill material to reclaim the marsh between Weeks Bay and the ICW. A second project, also listed but not commenced, is the Shark Island Project (TV-1) which is located on Vermilion Bay and will involve building a rock breakwater on the shoreline. Two additional projects, still in the conceptional stage and not yet listed, are PTV-21 (to restore wetlands loss in the forested area of Weeks Island) and XTV-26 (the diversion of water and the construction of a water control structure at the ICW to control freshwater in Two Mouth Bayou). There are no immediate plans to list these two projects in the near future. Another land use project in the bay is the permitted and funded development of a deepwater channel through Weeks Bay to the Port of New Iberia. Although this is not a Coastal Restoration Project, it has received State funds.

**Pipeline Land Use Characterization**

Along the pipeline ROW from Weeks Island to the St. James terminal there is a combination of salt marsh, freshwater marsh, swamp forest and agriculture. The main agricultural areas near Weeks Island are Florence, Freetown, and the Franklin vicinity. Prime or unique farmland is found along 30 percent (32 km (20 miles)) of the pipeline ROW. The pipeline comes within 1.6 km (1 mile) of several residential areas including Cypremort, Alice B, Ivanhoe, Florence, Franklin, Caffery, Irish Bend, Belle River, Pierre Part, Bruly St. Martin, Star, Kesseler, Klotzville, Carie, and Burton Lane. The pipeline also skirts oil and gas production facilities at Napoleonville. Waterbodies in the area are used extensively for recreation, sport and commercial and shell fisheries.

The land use along the pipeline from St. James to Bayou Choctaw is primarily for agriculture, although there are some sections of swamp, with wetlands concentrated at both ends of the pipeline and sporadically in between. Sugarcane is the predominant agricultural commodity, with cane processing plants located throughout the area. The majority (about 80 percent) of the land along this pipeline ROW (48 km (30 miles)) is designated as prime or unique farmland. The pipeline comes within one mile of several residential areas including Freetown (Assumption Parish), Belle Rose, Annadale, White Castle, Doreyville, Catherine, Glenmore, Blythwood, St. Louis and Plaquemine. Five crawfish farms are located along the pipeline right of way. Waterbodies in this area are also used for recreation, sport, and commercial fishing.[15]

## 3.5 Ecology

Weeks Island is located within the Deltaic Plain ecosystem in the outer coastal floodplain province.[16] The DOE site is located on the southwest slope of the island. The following sections discuss vegetation, wildlife, and rare, threatened, and endangered species at Weeks Island.

Although the DOE only controls 4.3 hectares (10.6 acres) of Weeks Island with minimal ecological resources, there are substantial terrestrial and aquatic natural resources around the facility. The following sections describe these resources for biological assessment purposes.

### 3.5.1 Terrestrial Ecology

Undeveloped upland areas on Weeks Island include hardwood forested areas and agricultural fields. In forested areas, sweetgum, water oak, bitternut hickory, and southern magnolia are the dominant tree species. Some of the water oaks on the island are 90 to 120 cm (3-4 feet) in diameter (at breast height). Edge trees include the Chinese tallow. The shrub layer contains sweet bay, yaupon, southern bayberry, magnolia, shining sumac, and palmetto. Ferns dominate the herbaceous layer in several areas. Vine species include trumpet vine and cypress vine. Agricultural fields include both planted and fallow fields. Sugarcane is the primary crop species, and legumes dominate in the fallow fields.

Seven rare plant species are reported to occur at, or within a 1.6 km (1 mile) radius of the site. Note that these plant species have not been designated as endangered or threatened by Louisiana or U.S. Fish and Wildlife Service (USFWS).

Bird species present on Weeks Island are killdeer, mourning dove, mockingbird, boat-tailed grackle, cardinal, common nighthawk, cattle egret, hawks, owls, woodpeckers, thrushes, vireos, and warblers. Mammals present include mink, nutria, river otter, raccoon, swamp rabbit, bobcat, squirrels, coyote, and white-tailed deer. Threatened or endangered species periodically seen at the site include the Louisiana black bear (*Ursus americanus luteolus*), a Federal and State threatened species.[17,18]

Louisiana black bears are habitat generalists that utilize a variety of cover types, however, they are primarily associated with forested wetlands. Black bear habitat requirements within forested wetlands include food (primarily nuts and berries), thick vegetation for escape cover, vegetated dispersal corridors, large trees for den sites, and isolated areas for refuge from human disturbance. Weeks Island provides suitable habitat for the Louisiana black bear. See Appendix B for details on the Louisiana black bears on Weeks Island.

### 3.5.2 Aquatic Ecology

The various swamps, marshes, bayous, lakes, and bays of the southern Louisiana delta area support diverse aquatic flora and fauna. None of these aquatic habitats are located within the DOE facility. However, in other areas with freshwater bodies, macrophytes are the dominant aquatic vegetation. Macrophytes provide a food source for insects, mammals, and birds, and a substrate for periphytes. Benthic (bottom-dwelling) and suspended algae are abundant and also provide an important food source.[19]

Freshwater wetlands support zooplankton populations of copepods, cladocerans, rotifers, ostracods, and amphipods. Benthic invertebrates include dipterans, oligochaetes, and amphipods. Clams, snails, and crayfish are the macroinvertebrates typically found in freshwater areas. At least 68 species of freshwater fish inhabit this region.[20] Some common species are largemouth bass, crappie, catfish, gar, buffalo, sunfish, gizzard shad, and suckers.[21] The freshwater environment also supports an abundance of waterfowl, particularly surface-feeding ducks.[22] Commercially important species found in freshwater environments include crayfish, catfish, buffalo, and drum. Some reptiles (turtles and bullfrogs) are also commercially important.[23]

Coastal Louisiana's swamps and marshes are important wildlife areas that are particularly sensitive to changes in salinity and water level. There are three categories of coastal marshes: salt marsh, brackish marsh, and intermediate marsh. Salt marshes have a relatively low floral diversity, high vegetative productivity, and diverse fauna. Typical herbs and grasses include saltwort, soft rush, leafy three-square, oystergrass, and salt marsh cordgrass. Fiddler crabs, mud crabs, clams, snails, and shrimp are common macroinvertebrates. The typical fish are killifish, cyprinids, and immature mullet and spot.[24]

In the intermediate and brackish marshes (the most common marsh type around Weeks Island), common flora include wire grass, saw grass, and wild millet. Common macroinvertebrates are snails, oysters, crabs, clams, and shrimp. Typical fish include killifish, catfish, and gar. The diverse assemblage of common amphibians and reptiles includes the Mobile cooter, southern leopard frog, broad-banded water snake, speckled king snake, and western cottonmouth.[25]

Five species of endangered or threatened sea turtles are known to inhabit the waters of the northern Gulf of Mexico, west of the Mississippi River: Green, hawksbill, Kemp's Ridley (Atlantic Ridley), leatherback, and loggerhead turtles. Five species of endangered whales are also

found in the Gulf: Fin, sei, humpback, right, and sperm whales. Table 3-2 provides the common and scientific names of these marine animals, along with their designation as threatened or endangered. In addition, a threatened anadromous fish species, the Gulf sturgeon (*Acipenser oxyrhynchus desotoi*) is found in the northern Gulf.

**TABLE 3-2**
**Threatened and Endangered Sea Turtles and Whales in the Gulf of Mexico**
**(West of the Mississippi River)**

| Common Name | Scientific Name | Designation |
|---|---|---|
| Green Turtle | *Chelonia mydas* | Threatened |
| Hawksbill Turtle | *Eretmochelys imbricata* | Endangered |
| Kemp's Ridley Turtle | *Lepidochelys kempi* | Endangered |
| Leatherback Turtle | *Dermochelys coriacea* | Endangered |
| Loggerhead Turtle | *Caretta caretta* | Threatened |
| Fin Whale | *Balaenoptera physalus* | Endangered |
| Sei Whale | *Balaenoptera borealis* | Endangered |
| Humpback Whale | *Megaptera novaeangliae* | Endangered |
| Right Whale | *Balaena glacialis* | Endangered |
| Sperm Whale | *Physeter macrocehpalus* | Endangered |

### 3.5.3 Pipeline Ecological Characterization

In this section, characterizations are presented for the Weeks Island to St. James pipeline and for the Bayou Choctaw to St. James pipeline ROW.

**Weeks Island to St. James Pipeline ROW**

The Weeks Island pipeline crosses a combination of salt marsh, freshwater wetlands, forests, and agricultural lands en route to St. James. From west to east this pipeline crosses various oilfield canals at Weeks Island, Bayou Stumpy, Bayou Choupique, the Charenton Drainage and Irrigation Canal, and Bayou Teche. The pipeline crosses extensive waterways and swamps within the Atchafalaya River Basin, including the main channel of the Atchafalaya River, Grand Lake, and the ICW. East of the Atchafalaya River Basin the pipeline crosses Belle River, Lake Verret, Pierre Bay, Bayou Lafourche, Baker Canal, Bayou Verret, and the St. James Canal. The waterbodies crossed by the pipeline provide recreation resources as well as sport, commercial, and shell fishing opportunities. The pipeline crosses the Attakapas Island Wildlife Management Area just east of Grand Lake. The pipeline also crosses agricultural areas near Weeks Island at Florence and Freetown and near Franklin.[26] Approximately 30 percent (32 km (20 miles)) of these agricultural areas are designated as prime or unique farmland.

At least a portion of the Weeks Island to St. James pipeline is located within 1.6 km (1 mile) of an environmentally sensitive area or a navigable body of water as defined by Title 49 CFR §194.103. Environmentally sensitive areas along this pipeline are typically large expanses of swamp and some minor waterways. Navigable waterways include the ICW, Bayou Teche, Atchafalaya River, Lake Verret, and Bayou Lafourche.[27]

The various swamps, marshes, bayous and lakes of the southern Louisiana delta area support diverse aquatic flora and fauna. Freshwater wetlands support zooplankton populations of copepods, cladocerans, rotifers, ostracods, and amphipods. Benthic invertebrates include dipterans, oligochaetes, and amphipods. Clams, snails, and crayfish are the mollusks typically found in freshwater areas. At least 68 freshwater fish inhabit this region including the largemouth bass, crappie, catfish, gar, buffalo, sunfish, gizzard shad, and suckers. Freshwater environments also support millions of waterfowl, particularly surface-feeding ducks.[28]

Terrestrial wildlife near the pipeline may include deer, bear, mink, nutria, river otter, raccoon, swamp rabbit, bobcat, squirrels, and coyote. Common birds in the area include hawks, owls, woodpeckers, thrushes, vireos, and warblers.[29]

The Weeks Island to St. James pipeline crosses identified habitat for threatened or endangered species. The Southern bald eagle is reported to nest within Iberia Parish, and nests may be present within or near the ROW, however the USFWS reported that it is not of concern in the Weeks Island vicinity. Several rare species of plant exist near the pipeline. These plants include the glade fern, climbing bittersweet, lance-leaved glade fern, southern shield wood-fern, snow melanthera, three-lobed coneflower, and the broad-leaved spiderwort.[30]

**Bayou Choctaw to St. James Pipeline ROW**

The Bayou Choctaw to St. James pipeline crosses a combination of freshwater marsh, swamp, bottomland forest, and agricultural lands. From west to east the pipeline crosses Wilbur Canal, Bayou Jacob, Bayou Plaquemine (which serves as the ICW in this area), Bayou Goula, Bayou Tigre, Bayou Sigur, Bayou Lafourche, Baker Canal, and St. James Canal. Many of these waterbodies provide recreation, support sport, commercial, and shell fisheries. Much of the area is agricultural, with concentrations of wetlands at either end of the pipeline and sporadically in between. The pipeline skirts the southern side of Plaquemine and passes through parts of Glenmore, White Castle, Belle Rose, and Freetown. Sugarcane is the predominant agricultural commodity in this area.[31] Approximately 80 percent (48 km (30 miles)) of the land along this pipeline route is designated as prime or unique farmland.

At least a portion of the Bayou Choctaw to St. James pipeline is located within 1.6 km (1 mile) of an environmentally sensitive area or a navigable body of water as defined by Title 49 CFR §194.103. Environmentally sensitive areas along this pipeline are typically swamp areas and minor waterways and headwaters. Navigable waterways include the ICW and Bayou Teche.[32]

### 3.6 Solid and Hazardous Waste

All SPR wastes are characterized and disposed of according to Federal and state hazardous waste regulations. The State of Louisiana has been delegated enforcement responsibility for regulations under the Resource Conservation and Recovery Act (RCRA).

During the operations at Weeks Island, wastes associated with underground hydrocarbon storage activities have been considered under the RCRA exclusion for drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas or geothermal energy, as regulated by the Louisiana Department of Natural Resources. Other wastes generated at Weeks Island (e.g., in conjunction with construction, operations, and maintenance activities) are considered for characterization under RCRA. Weeks Island has never operated as a treatment, storage, or disposal facility and usually maintains its small quantity generator status (based on generation of less than 100 kg (220 pounds) per month of hazardous waste). The site does not generate or store radioactive or mixed wastes.

Weeks Island has been designated by EPA as a CERCLA disposition of NFRAP (No Further Remedial Action Planned) based on completed site evaluations (determination by EPA Region VI on September 16, 1991).

## 3.7 Air Quality

### 3.7.1 Climate

The area around the Weeks Island site has a maritime climate largely influenced by the Gulf of Mexico. The average summer air temperature for the area is 29°C (85°F); the average winter air temperature is 12°C (54°F). July and August are the warmest months; January and February are the coldest months. The highest amount of rainfall occurs during the summer months in association with either local thunderstorms or an occasional tropical storm. Winter precipitation generally results from frontal activity and falls as slow, steady rainfall; it may occur at any time of the day and continue intermittently for several days.[33] The mean annual precipitation is approximately 140 cm (56 inches).[34] Frozen precipitation in the area is rare; over a 25-year period (1946-1971) the mean annual snowfall was 0.5 cm (0.2 inches).[35]

### 3.7.2 Air Quality Status

Based on 40 CFR part 81 ("Designation of Areas for Air Quality Planning Purposes"), Iberia Parish, Louisiana has been determined to be in attainment of the National Ambient Air Quality Standards (NAAQS).[36] There are six specified air pollutants regulated under NAAQS (carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone, lead, and total suspended particulates). For all of these air pollutants, Iberia Parish is in attainment or listed as better than the national standards. Although Iberia Parish is in attainment for ozone, small very localized problems may as yet be unidentified due to incomplete data. The Weeks Island facility does not monitor air quality; however, the Louisiana Department of Environmental Quality (LA DEQ) maintains a monitoring station in Morgan City, located approximately 60 km (35 miles) southeast of the Weeks Island site.

The Weeks Island facility has an air quality permit which authorizes about 6,000 kg (7 tons) of Volatile Organic Carbon (VOC) emissions per year from flare operations and fugitive VOC emissions from pipeline components. Flare activity is the burn-off of the gases released during fill of the oil in the cavern and standby operations. These gases are primarily from the volatilized crude oil (hydrocarbons). The Weeks Island facility has operated in accordance with all air quality permit and regulatory requirements.

The site also has a halon fire protection system which consists of 44 cylinders containing a total of 6800 kg (15,000 lbs.) of halon. Halon is an ozone depleter. These halon cylinders are self contained and are connected to a manifold. The cylinders are grouped at three separate elevations at the site. The halon system protects the service shaft, manifold room, and header. The system can be activated manually or automatically.

### 3.8 Socioeconomic Conditions

Weeks Island is located in the southern part of Iberia Parish on Vermilion Bay. Weeks Island itself is virtually uninhabited and the surrounding area is sparsely populated. Four other parishes, St. Mary, St. Martin, Vermilion, and Lafayette, surround the site and comprise the region where any direct socioeconomic effect of the Weeks Island SPR site decommissioning would likely be felt. The City of Lafayette, the largest city in the region, is about 60 km (35 miles) northwest of the site. New Iberia (24 km away) is also within the five-parish region. This section discusses the socioeconomic conditions in this five-parish region.

#### 3.8.1 Population and Economic Activities

The Weeks Island region experienced a modest overall 4.8 percent increase in population during the period 1980 to 1990. With the exception of St. Mary Parish, the population in each of the other parishes within the five-parish region experienced a net increase during the 1980s and early 1990s. None of the parishes are experiencing any serious out-migration at this time. In Lafayette and Iberia Parishes, the population has seen some increase in the recent years.

The regional economy in the Weeks Island area experienced wide fluctuations during the 1980s. The regional workforce rose from 167,150 in 1980 to 194,250 in 1984, declined to 168,600 in 1988, and rose again to 201,113 in 1992. The regional unemployment peaked at 19 percent in 1986 steadily declined to 6.1 percent in 1990, climbed to 9.4 percent in 1992, and fell again to 7.0 percent in 1994 (see Figure 3-2). The unemployment rate in Iberia Parish displayed a similar, but even more pronounced trend. Although there is no single dominant industry in Iberia Parish, the top four sectors, manufacturing, service, retail trade, and government employ about 67 percent of the workforce and account for 63 percent of earnings. These same sectors also account for the majority of economic activity in the region as a whole (Figure 3-3). Lafayette and Iberia Parishes had the highest earnings per worker, while St. Martin Parish had the lowest.

The Weeks Island SPR facility currently employs approximately 100 workers. Dyn McDermott, the management and operating contractor, employs 62 people. Wackenhut Services has 36 guard force employees at the site, all under the age of 50.

The Weeks Island area has recovered from the 1980s recession in the oil industry through growth in the retail, medical, and service fields.[37] Industry analysts believe that most of the streamlining by the major oil companies has already occurred and that this trend will taper off. Furthermore, according to projections by the Louisiana Econometric Model, over the 1995 to 1996 period, the oil and gas extraction sector will reverse its downward trend and add a few jobs.[38] Residential construction in Lafayette Parish, and to a lesser extent, Iberia Parish, has shown continuing signs of rebounding from the economic slump of the eighties.[39] The commercial construction market has increased markedly through retail shopping centers in Lafayette Parish. Office building construction and other commercial developments are beginning to rebound as well.

**FIGURE 3-2**
**Unemployment Rate in the Weeks Island Region, 1980-1994**

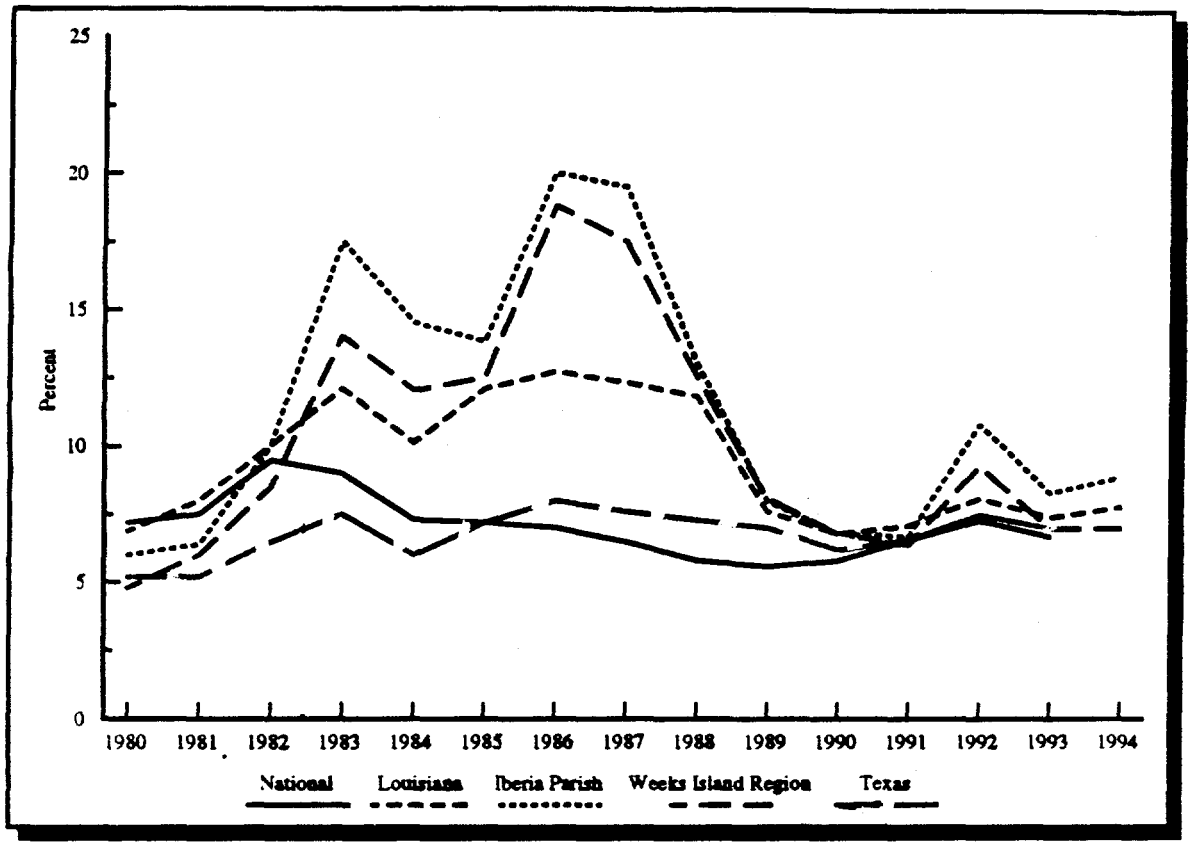
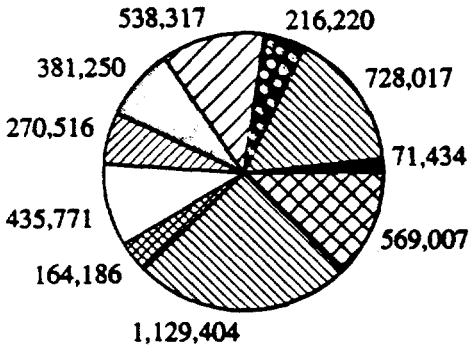


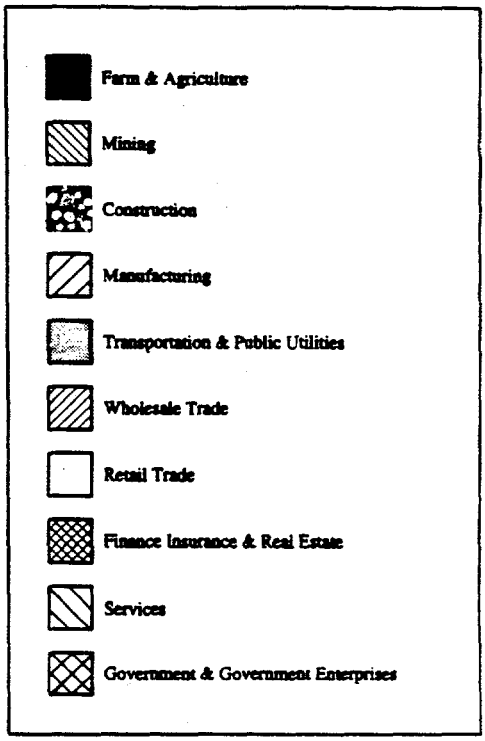
FIGURE 3-3
Weeks Island Region Industry Earnings and Workforce, 1992

Earnings by Industry:
(Thousands of Dollars)

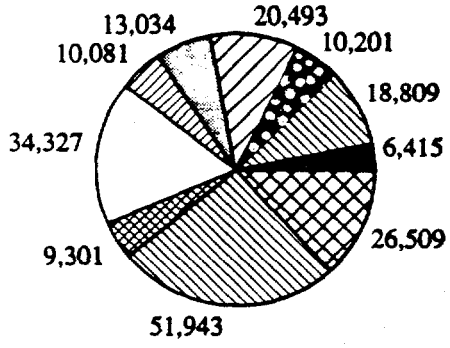



Source: Personal Income by Major Source and Earnings by Industry. Dept. of Commerce. Bureau of Economic Analysis.

# Weeks Island Region




Workers by Industry:




Source: Personal Income by Major Source and Earnings by Industry. Dept. of Commerce. Bureau of Economic Analysis.

The Federal government spent over $840 million in the Weeks Island region in 1990 or about $2,183 per capita. Almost one-fifth of that spending, $150.6 million amounting to over $2,205 per capita, was in Iberia Parish. Local government expenditures in 1987 were $504 million with $35 million spent by governments within Iberia Parish. Total annual industry earnings in Iberia Parish were approximately $685 million or $22,300 per worker in 1992. Industry earnings for the region were $4.5 billion or $22,400 per worker. The Weeks Island facility's present annual payroll including salary and associated benefits is approximately $6.8 million. This figure represents 1.0 percent of the Iberia Parish economy and 0.15 percent of the total regional economy.

### 3.8.2 Emergency Response Capabilities and Health Care

#### SPR Response Planning for Weeks Island and Pipelines

The Weeks Island facility has a site Facility Response Plan that provides a detailed overview of the resources available to respond to emergency oil discharges. The document identifies and describes the qualified individuals for the facility, activation of the emergency response team, activation of the discharge response contractors, and communications with emergency responders and state and Federal officials. Additionally, it contains accident scenarios with appropriate accident mitigation, consequence assessment, spill cleanup and waste handling and disposal, as well as environmental restoration and recovery. The SPR also has an approved (EPA Region VI, U.S. Coast Guard District 8, U.S. Department of Transportation Research and Special Projects Administration [RSPA]) Facility Response Plan for offsite pipelines and provides emergency response training to site personnel. The document delineates pipeline locations and operational characteristics and provides the same type of detailed response resources as listed above. Furthermore, DOE has developed a Comprehensive Contingency Plan for the sequential decommissioning process to minimize the impacts of any unexpected events or problems should they occur.

#### Regional Health Care and Emergency Response Capabilities

Iberia Parish has 78 physicians, or one physician for every 876 residents. In its two hospitals, Iberia Parish has 243 beds or one for every 281 residents. The closest hospital to Weeks Island is located about 25 km (15 miles) from the site in New Iberia.

Emergency services would be available for the Weeks Island site from both Iberia and St. Mary Parishes. Police services for Iberia Parish are provided by the Iberia Parish Sheriff's Department and the New Iberia Police Department. Officers in Iberia Parish have received hazardous materials training and first responder operational level training. Police protection for St. Mary Parish is provided by the St. Mary Parish Sheriff's Department and the Baldwin Police Department.

Seven volunteer fire departments and one full-time fire department constitute Iberia Parish's firefighting capabilities. St. Mary Parish has a total of twelve fire departments. Fire suppression and emergency medical training are required of all firefighters and at least one person at each fire department has had hazardous materials (hazmat) training. The nearest fire station to the Weeks Island site has an approximate response time of ten to 15 minutes.

There are seven independent ambulance and rescue units available for Weeks Island from Acadian Ambulance Service in Lafayette. In addition, there are two units provided by the fire department in Iberia Parish. Each one of the units can provide advanced (or paramedic) life support with the nearest unit about 20 minutes away from the Weeks Island site. Iberia General Hospital, Dautrive Hospital, and the nearest medical evacuation helicopter support are within 25 km (15 miles) of Weeks Island. A trauma center in the city of Lafayette is approximately 50 km (30 miles) away.

### 3.8.3 Demography for Environmental Justice Concerns

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," was signed on February 11, 1994. This Order requires Federal agencies to develop environmental justice strategies for carrying out the requirements of the Executive Order.

DOE examined 1990 census information from the six U.S. Census Block Groups within a 8 km (5 mile) radius of the Weeks Island Facility. Block Groups are a smaller more precise subset of U.S. Census Tracts. DOE gathered information on the racial makeup and income levels for individuals in each block group. Because not all of each block group is within the 8 km (5 mile) radius around the Weeks Island facility, the number of individuals within the radius was calculated by estimating the percentage of each block group which fell within the radius. The number of minority and low income individuals in these partial block groups is analyzed below.

Within a 8 km (5 mile) radius around Weeks Island there are 1,058 individuals. The distribution of these individuals by block group is shown in Figure 3-4. Of these individuals, 184 (17 percent) individuals are of minority background and 875 (83 percent) are of non hispanic white background (e.g., caucasian). The only block group with a more than 50 percent racial minority population is Block Group 221010411003. Of the 134 individuals in this block group within 8 km (5 miles) of the Weeks Island facility, 85 (64 percent) are non hispanic black, 10 (7 percent) are non hispanic asian, and 39 (29 percent) are non hispanic white individuals.

Of the 1,058 individuals within the 8 km (5 mile) radius of the Weeks Island facility, poverty level information was available on 1,044 individuals. Of these people, 185 (18 percent) were below the poverty level (with 46 (4 percent) at 50 percent of the poverty level). Of the 859 individuals (82 percent) above the poverty level, 153 (15 percent) had incomes up to twice the poverty level and 706 (67 percent) had incomes of more than twice poverty level. In Block Group 221010411003, of the 133 individuals for which poverty information was available, 94 (71 percent) were below the poverty level.

## 3.9 Worker Health and Safety

Weeks Island is the location of several different commercial mining and storage operations. Morton originally sold the SPR property site to DOE and owns the property that surrounds the DOE land. Morton shares the salt dome with DOE, owns the Markel Mine which is attached to the DOE storage chambers, and is currently engaged in salt mining operations on the dome. Morton operations are not connected to the DOE subsurface facilities. Specifically, Morton operates a mechanically mined, room-and-pillar salt mine that extends to a depth of 400 m (1,312 feet), in addition to two small, leached brine caverns (northeast of the SPR storage

**FIGURE 3-4**
**Population Within 5 Miles of Site by Census Block Group**

facility) operated for the production of table salt. Morton employs more than 250 people at Weeks Island.

The Weeks Island SPR workforce has had only minor injuries resulting in lost workdays at a rate below industry standards over its operating lifetime. There was, however, one construction fatality during preparation of the chamber for storage.

The SPR "Environmental Safety and Health Manual" provides a baseline to govern compliance under the SPR integrated Environmental Safety and Health (ES&H) program. This program supports DOE's commitment to environmental and worker health and safety, and covers present and future activities at SPR sites, from initial design to decommissioning. The manual includes functional areas on emergency preparedness, fire protection, industrial safety and hygiene, radiation protection, occupational medical service, and transportation safety. The manual documents procedures for complying with all applicable OSHA requirements.

### 3.10 Natural, Scenic, Archaeological, Cultural, and Historical Resources

Weeks Island has no identified state or Federal natural or scenic resources. The 4.3 hectares (10.6 acres) of DOE property offers little potential for these resources.

The State of Louisiana identified one recorded archeological site that is near the Weeks Island facility. Archaeologists have found scattered artifacts from the prehistoric period at Plantation Lake which is located on the west central portion of Weeks Island. According to the State of Louisiana Department of Culture, Recreation, and Tourism, the National Register eligibility of this site is undetermined.

There are no other known archaeological sites, historical sites, or Native American tribal lands near the DOE property at Weeks Island or along the pipeline ROW.

### 3.11 Ambient Noise

Ambient sound levels present in the surrounding area during daily operations at the current SPR site are comparable to a suburban area (i.e., 55 decibels). When the oil pumps are in operation, sound levels are more likely comparable to a noisy urban area (i.e., 63 to 68 decibels).

## 4.0 ENVIRONMENTAL IMPACTS

The Department of Energy does not anticipate any short-term, long-term, or cumulative environmental impacts to occur from the proposed decommissioning actions of transporting brine via a pipeline, filling the storage chambers with brine, extracting several hundred thousand barrels of residual oil, and transferring ownership of the surface facilities and pipeline for similar industrial uses or abandonment. DOE anticipates that pipelines will maintain integrity and that the brine and 10,000 to 30,000 barrels of remaining residual oil will remain safely trapped within the chambers surrounded by several hundred feet of solid salt which is several hundred feet beneath the ground surface. It is not forecasted that normal geologic events will affect the encapsulation of the brine/oil to a degree allowing brine or oil to be release into the subterranean environment in quantities that would reach and impact the human environment or natural resource values.

DOE contends that not filling the chambers with saturated brine in a controlled manner which allows for the managed extraction of about 98 percent of the residual oil (i.e., the no action alternative) would leave the chambers much more vulnerable to uncontrolled groundwater inflow, subsequent erosion of the salt structural integrity, and a higher risk of larger quantities of oil escaping from the chambers resulting in higher risk of some of that oil migrating to a location affecting the human environment.

NEPA requires Federal actions to be assessed for the potential impacts to the environment. In the following sections of this assessment, DOE used a risk analysis approach in order to speculate the range of possible events that could result in a release of brine or oil in a sufficient quantity to impact groundwater, surface waters, aquatic and terrestrial resource values, public and worker health and safety, and other environmental concerns.

Risk is a function of the probability of an event occurring and the consequences that might happen if the event did occur. In environmental risk analysis, consequences are evaluated against the environmental importance of the location of the event such as groundwater quality and uses, surface waters, farmland, and important biological habitats. Consequences are also evaluated against speculated financial costs incurred from an assessment of potential natural resource damage and necessary clean up costs. High environmental risk events are those with a reasonable probability of occurring in a location of environmental importance, and which have severe environmental consequences and/or pose a threat to public/worker health and safety.

These speculations are assessed with professional judgement and knowledge of current environmental circumstances and socially acceptable risks associated with everyday commercial activities in a petroleum region.

### 4.1 Assessment of Event Scenarios

The SPR Risk Coding Matrix (a tool used for budgeting and planning throughout the SPR program and included as Appendix C) has been modified for NEPA purposes and used to categorize probability and consequences for each release event leading to potential environmental impacts. Probability and consequences are the two components of environmental risk analysis.

For the identified release events, a group of approximately 20 experts[a] with geotechnical experience and detailed knowledge of the Weeks Island facility have identified consequence and probability categories. Once probability and consequence are defined, an event can be placed into a risk category: high, medium, low, or very low. Generally, impacts defined as "significant" in NEPA terminology could result from high risk events with a high probability of substantially degrading the Gulf Coast environment; natural resource damage assessment exceeding 100 million dollars; a spill of oil or brine exceeding 2,400 barrels with a high potential for long-term injury to sensitive fish and wildlife habitats, sensitive biologies, or human-use activities; or public or worker endangerment without adequate warning time. Medium and low risk events can be regarded as having high, medium, or low localized impacts; while very low risk occurrences correspond to negligible impacts.

Because the environment criterion is so important to the assessment, some points are worth highlighting. The spill volume thresholds are based on the National Spill Contingency Plan for oil spill response. However, the DOE environment criterion has been applied to spills of oil and brine. For purposes of impact assessment, location is also a critical factor, therefore the spill volume is considered as well as the potential for damage. Potential for damage refers to adverse effects to sensitive fish and wildlife habitats, sensitive biological resources, or human-use activities such as groundwater use for drinking. Thus, spills of a threshold volume, but with no potential for damage, would be evaluated as having fewer consequences, and therefore, lower impacts.

Probability is the likelihood of occurrence. "Highly likely" is a very probable event within the next year; "likely" is an event with one chance of occurring within the next ten years; "possible" events have one chance of occurring in one hundred years; and "unlikely" are events likely to occur less than once in one hundred years. For purposes of this EA, another category of "highly unlikely" has been defined for events occurring less than once in one thousand years.

### 4.1.1 No Action Alternative

At completion of oil inventory relocation, up to 700,000 barrels of oil could remain in the mine -- coating surfaces, sorbed in piles of loose salt, trapped in fractures, and collected in irregularities. Under the no action decommissioning alternative, the shafts, vent and fill holes would be plugged and sealed, and salt creep would proceed until, over geologic time, the mine is closed. If there were no leak pathway to the surrounding geologic formation, this oil would ultimately be sealed within the salt body.

Groundwater, however, is currently leaking into the mine at about 175 gallons per hour. At this rate, the chambers would fill with water or brine in about 2,000 years. It is probable that this rate would accelerate. Although the groundwater at the top of the salt dome is brine, it is not totally saturated and has the capacity to dissolve salt and enlarge the pathway of the leak. In addition, it may be impossible to seal off fractures in the salt, the existing sinkholes, or any additional water pathways into the mine that may develop.

As the mine flooded, the oil would be stripped from surfaces and would float above the brine. Should it reach a leak pathway, the lighter oil could seep upward through the denser,

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[a] The number of experts ranged from 18 to 21, depending on the specific event being assessed. Some individuals did not complete surveys for all events. Because of the subjective nature of the assessment, statistical confidence limits for the results cannot be stated.

descending brine and be released into the adjacent groundwater aquifers. There, however, could be a substantial lag of up to 2,000 years before this occurred.

In the interim, the conditions leading to instability of the mine could be exacerbated. Uncontrolled filling of the storage chamber with undersaturated brine could erode and partially dissolve the salt pillars thereby accelerating their fracturing, further weakening the mechanical stability of the chambers, possibly resulting in localized collapse, worsening surface subsidence, and producing additional leaks into the mine.

Thus, there are three concerns of the no action alternative that were evaluated by the risk assessment procedure: the risk of the release of oil to the groundwater aquifers adjacent to the salt dome; the risk that oil released to these aquifers could be of quantities that ultimately reach and contaminate surface waters; and the risk that destabilization of the chambers and resulting surface subsidence could impact Morton's operations.

**Event 1a: Release of Oil to Adjacent Groundwater**

As described above, part of the unrecovered oil could escape from the chambers after they flooded naturally. The oil would be released into the saline groundwater aquifers at or near the top of the salt dome. The release could occur slowly over a very long period of time. Any oil plume would move slowly through the highly porous, unconsolidated sediments of the Gonzales formation in the direction of groundwater flow, toward the Gulf of Mexico.

The panel of experts believed the probability of this event occurring would be between one chance in 100 and one chance in ten, or the category of "possible." The assessed consequence category is "severe," based on the potential liability of pumping and cleaning groundwater of the potential volume of oil. Although there may be no valid need to pump and clean groundwater of such marginal quality and use, this is considered a high risk event with possible major environmental consequences because of the large volume of trapped oil and possible Safe Drinking Water Act violations.

**Event 2a: Release of Oil to Surface Waters**

If crude oil escaped from the salt dome into the Gonzales formation, it would likely migrate in the direction of groundwater flow (i.e., sedimentary bed dip) under the Gulf of Mexico until its volume was sorbed onto the porous sediments. There is, however, a risk the oil could rise through fractures, faults or other pathways and seep into surface water such as Vermilion Bay, West Cote Blanche Bay, or the Gulf of Mexico, at a rate sufficient to cause a sheen on surface water or to impact the biota.

A critical factor affecting the potential impact of residual oil on coastal and inland waters is the fate of oil in these settings. For example, oil is particularly persistent in low-energy, wetland habitats.[40] The ICW in the vicinity of Weeks Island is within an estuarine region dominated by inflow from the Atchafalaya River in the east. The region includes all of Weeks Bay, the northern extent of Vermilion Bay, and the waters of the ICW. The ICW is hydraulically connected to many water bodies in this region. Vermilion and Weeks Bays are linked to the ICW by a series of peripheral canals, bayous, and lakes. The water bodies and extensive marshlands in this region exchange water freely along much of the ICW resulting in a fairly homogeneous water quality dominated by inflow from the Atchafalaya River.

The consequences of such an occurrence could be severe, based on speculated clean up costs and resource damage assessment. The probability of occurrence for this event, however, is judged to be unlikely (i.e., less than a one percent chance). Therefore, the overall risk is low. A number of natural oil seeps are known along the Louisiana and Texas continental shelf. As with such natural seeps, this event would be less likely than a normal shipping spill occurrence, especially those that exceed the 240-barrel threshold defined for a "major" oil spill. Due to the unlikely probability, this event would have medium environmental risk with possible Clean Water Act violations.

To provide some perspective, it is possible to compare the amount of SPR oil that could eventually reach surface water to the amount of oil spilled during normal waterborne oil movement that takes place along the Louisiana coast. From 1990 to 1993, there were 12 oil spills from vessel traffic along the Louisiana coast and ten from offshore facilities (these spills were each greater than 240 barrels). These spill data are displayed in Table 4-1. The risk of surface water spills from commercial activities is more likely than subterranean releases from SPR caverns migrating to surface waters resulting in major public concern and/or substantial threat to public health or welfare or the environment.

**TABLE 4-1**
**Louisiana Coastal Oil Spills, 1990-1993**

| SOURCE OF SPILL | NUMBER OF SPILLS ABOVE 240 BARRELS |
|---|---|
| Tankers | 1 |
| Barges | 9 |
| Other Vessels | 2 |
| Offshore Facilities | 10 |
| TOTAL: | 22 |
| **WATERBORNE OIL MOVEMENT** | 1,130 million tons or 7.5 billion barrels |

*Sources: The Emergency Response Notification System and the Oil Spill Intelligence Report.*

**Event 3a: Surface Subsidence Impacting Morton Operations**

In the no action (empty mine) alternative, the absence of oil to support the cavern walls would cause tensile stresses in the pillars and the middle section of the roof. Even though the stability would not be substantially impacted in the short-term, the known leak would probably continue to grow. Continued and uncontrolled groundwater inflow into the empty storage chambers would result in leaching of salt along the leak path, which would in turn increase the leak and affect the stability of the empty mine. This could result in partial or total structural failure of the mine, displacement of residual oil, and possible disruption of nearby Morton operations. The causes leading to this event, as well as its probability and consequences, are

severe economic consequences to Morton, with a "possible" probability, and thus, the event is considered high localized risk.

In summary, the no action alternative would possibly have high environmental impacts to Morton operations and medium environmental impacts on estuarine and marine surface waters resulting from some groundwater contamination migrating to surface waters.

### 4.1.2 Brine-filled Storage Chambers Alternative

Following oil drawdown, oil stripping activities, plugging and abandonment activities and filling chambers with brine at the Weeks Island site, a comparatively small amount of crude oil would remain in the brine-filled storage chambers. The minimum amount of residual oil is estimated to range between 10,000 barrels and 30,000 barrels.

As part of the proposed action, Morton's Markel Mine would be flooded with brine, assuming Morton's full participation and cooperation. A flooded Markel mine would provide the best preventive against accelerated subsidence, but might preclude the economic extraction of salt reserves on the 800 Level (between 1,000 Level and the Markel mine), which comprise approximately 10.0 million tons of recoverable salt.[41]

**Event 1b: Residual Crude Oil Seepage to Groundwater**

The residual oil would remain isolated in the brine-filled chambers unless an event occurred that led to a release. There would be no risk if the minimal amount of oil (i.e., 10,000 to 30,000 barrels) is adequately contained. If, however, residual oil eventually seeped out of the storage chamber at a noticeable rate (e.g., sufficient to be observable by sheen, taste, or odor), then it could contaminate the groundwater environment.

Both the consequences and probability of this event are assessed in lower risk categories than for the comparable event in the no action alternative (i.e., event 1a) -- indicating that filling the empty storage chambers with brine lowers the probability of release and recovering residual oil reduces the amount of residual oil available for release; thus, reducing the consequences. The assessed probability of occurrence is unlikely (1 in 1,000) and the consequences to groundwater of marginal quality would be minimal. Because of the complexity and the indeterminate nature of the interconnections between the Weeks Island groundwater and the surrounding Chicot Aquifer, it is difficult to predict the potential groundwater impacts if there would be an oil release. However, because the groundwater is of generally poor quality and both topographically and hydraulically detached from the Chicot, the potential environmental impact is assessed as low.

**Event 2b: Residual Crude Oil Release to Surface Water**

As in Event 1b, it is anticipated that the residual crude oil would remain isolated and would not enter the adjacent surface waters of Vermilion Bay. If, however, oil eventually seeped out of the abandoned chamber into the surrounding aquifer, then into the surface water at a noticeable rate (e.g., sufficient to cause a sheen or to impact aquatic ecology), it could contaminate the environment.

The probability is highly unlikely (1 in 10,000) for this event. This event would have more serious consequences, when compared to the Event 1b (groundwater contamination by residual

crude), but lower probability. The assessment reflects the higher economic value of nearby surface waters (e.g., for fishing) as compared to the saline aquifer, but also the more complex release pathway (i.e., through groundwater several hundred vertical feet to surface water when direct communication is not known to occur). The potential consequences to aquatic ecology are detailed in event 2a above and the event would have moderate environmental impacts overall.

**Event 3b: Brine Spills to Sensitive Environments during Pipeline Transport**

Under the preferred alternative, the Weeks Island mine would be backfilled with brine (see page 9 for a discussion of brine sources). There is risk of environmental impacts due to a brine spill during filling, either from offsite pipeline leakage or onsite leakage during transfer. Potential spills, both large and small, could occur anywhere along the pipeline lengths involved in transporting the brine to the Weeks Island site. There are 110 km (67 miles) of pipeline between Weeks Island and St. James, and an additional 60 km (37 miles) of pipeline between Bayou Choctaw and St. James. A pipeline leak in the Atchafalaya floodway would be of special concern. The pipelines, as currently permitted, may transport both crude oil and brine. The pipelines are inspected for serviceability and brine would be treated to minimize corrosion/erosion damage to assure pipeline integrity for SPR mission purposes.

For this assessment, the probability of a brine spill and the consequences are approached in two ways. First, probability is examined based on the number of spills from other SPR operating sites. Spills resulting from transport of brine offsite were assumed to be representative (e.g., along a run of pipeline leading to an offshore diffuser). Minor spills were not included. Table 4-2 presents the number of representative brine spills occurring from 1987 through 1992. The type of brine spills cited are those occurring during large volume transfers; the spill volumes are also given in the table. The table shows that the annual average number of these spills (two spills) and percent brine spilled of the total volume transported (0.062%) are both small values. Large volume spills, defined as those over 70,000 bbls, have occurred only three times in the approximately 17 year operating history of all SPR sites. The largest of these spills, at 825,000 bbls, occurred in 1989.

The second approach for assessing probability was via a survey of 18 experts within the SPR system.[42] When asked to determine the likelihood of a brine spill that would affect sensitive environments during the proposed action, this average result falls into the DOE frequency category of "highly unlikely (1:10,000)." This appears consistent with the operating history, especially when one considers that with experience in brine transport, the SPR has instituted precautions against spills. In addition, prior to brine movement to Weeks Island, the pipelines will be inspected and reinforced if needed.

The expert survey also addressed the level of consequence if such a spill were to occur. The average assessment was that the event would have consequences in the "critical" category due to the dollar value of $870,000 for clean-up costs and associated liability. However, the overall assessed environmental risk was considered low.

To better understand the consequences of a large brine spill, the largest SPR brine spill, which occurred near Bryan Mound in 1989, is a reasonable prototype. The area affected by the spill was a marsh meadow wetland described as a "vegetation complex occurring on clayey, saline

**TABLE 4-2**
**Historical Brine Spills from Pipeline Systems at Existing SPR Sites**

| Year | Total # of Brine Spills During Large Volume Transfers | Volume of Brine Spilled (bbls) | Total Volume of Brine Handled in Pipeline System (MMB) | % Brine Spilled of Total Volume Transported |
|---|---|---|---|---|
| 1987 | 2 | 90 | 212 | 0.00004 |
| 1988 | 2 | 14 | > 6.3 | 0.0002 |
| 1989 | 2 | 825,005 | 591 | 0.14 |
| 1990 | 4 | 74,076 | 439 | 0.017 |
| 1991 | 1 | 7 | 179.8 | 0.000004 |
| 1992 | 1 | 133 | 11.11 | 0.001 |
| 1993 | 1 | 370 | 32.7 | 0.001 |
| 1994 | 1 | 90 | 14.5 | 0.006 |
| Average | 2 | 112,473 | 186 | 0.062 |

Source: SPR Annual Environmental Monitoring Reports.

soils with standing water up to 0.2 meters (8 inches) deep."[43,44] Injured vegetation was reportedly confined to a 3.4 hectare (8.35 acres) area surrounding the pipeline break. Overall, less than 1.5 hectares (4 acres) of the initially affected area required continued attention and they were estimated to recover fully without intervention within a few years. Thus, the spill had no serious long-term adverse consequences.

If a spill into swamplands were to occur along the pipelines during transport of brine to Weeks Island, it would likely have similar consequences. Environmental impacts would be localized and short-term and would be moderated by frequent heavy rainfall and natural flushing supplemented by revegetation if needed (although any cypress trees suffering damage would require more time to recover). If such a spill occurred on agricultural land, DOE would be liable to landowners for crop losses. In the more unlikely event that an aquifer relied on for drinking water were contaminated by brine, DOE would implement appropriate groundwater remediation.

An alternative to transporting brine to Weeks Island from Bayou Choctaw would be to produce brine at Weeks Island. This cannot be done on the DOE property because of the storage caverns. Because locally produced brine would be transported across a pipeline of minimal length, the risk of spills would be considerably reduced. Solution mining is very stable because it is vertical and would not exacerbate subsidence, thus there is very low environmental risk associated with this option should a viable commercial brine source become available.

**Event 4b: Brine Discharge from a Brine-Filled Storage Chamber**

Following decommissioning, the creep closure of the storage chamber would continue. Creep closure would slowly increase the pressure of the brine within the mine, forcing it through the perforated fill casing, or along the known leak path and/or unknown leak paths into the sediments above the dome. Creep closure has been estimated to be 12 gallons per hour or 2,500 barrels per year following decommissioning. This would be a nearly constant process over the foreseeable future (i.e., until the mine volume has been lost). To understand the impact of the slow release of such a quantity of brine, this must be compared to the quantity of brine which currently exists above the dome and/or is being produced by natural hydrogeologic processes. As detailed in Section 3.2 and Figure 3-1, a brine layer currently 4 meters (12 feet) thick lies on top of the salt. With about 10 $km^2$ (4 square miles) of total dome cross-sectional area, and an assumed 30 percent porosity, this indicates that there is on the order of 70 million barrels of brine currently above the dome. The addition of 2,500 barrels per year of brine represents an annual increase of about 0.0036 percent, which is probably of no consequence.

Another way to view the discharge is to compare the 2,500 barrels with the natural dissolution that is going on along the top of the Weeks Island dome. Estimates are that the dome rises about 30 cm (1 foot) per century. Physically, salt dissolution occurs keeping the top of salt nearly constant. From this one can estimate that approximately 600,000 to 2 million barrels of brine are produced naturally along the top of the dome per year. The addition of 2,500 barrels annually from the mine would represent an increase of about 0.13 to 0.42 percent. Therefore, only negligible impacts are anticipated to groundwater or surface water from brine releases from the storage chambers.

**Event 5b: Surface Subsidence Impacting Morton Operations**

Analyses of the predicted subsidence following decommissioning show that filling the oil storage chambers with brine would result in a reduced long-term subsidence rate (i.e., a few percent of the current rate). A decommissioned mine filled with brine would provide better confinement and mine stability than an oil-filled mine because brine is denser than oil. A study indicates that a brine-filled mine would have a subsidence rate at the surface of about eight percent of the present rate.[45] There would be no impact anticipated on Morton's adjacent mining operation. Morton surface facilities, however, are located geographically within the zone of subsidence of their own underground mine. The subsidence due to Morton mining would be greater than from the storage chambers following brine fill.

There is, however, risk of surface subsidence due to instability of the mine during the period between drawdown and completion of brine fill. This could lead to surface facility damage with potential underground bulkhead damage leading to damage to Morton's operations. This event is defined as unlikely in probability (i.e., 1 in 1,000) but severe in economic consequences; thus, the overall risk is low. The impacts could include loss of Morton surface facilities. Injury to personnel would not be expected because subsidence is usually a gradual occurrence.

**Event 6b: Brine Release into Morton Mine Affecting Worker Safety**

DOE's preferred alternative would be to fill all underground travelways, including the Markel Mine. The doors in the existing bulkheads isolating the Markel Mine from the SPR travelways would not be closed or sealed. As planned, the brine-filled SPR chambers and

travelways and the Markel Mine would remain relatively stable and isolated. There should be no leakage from the Markel Mine into the Morton Mine workings and no impact on Morton workings or personnel safety of underground workers. The physical separation of the closest Morton shaft to the incline on the Markel side of the Markel isolation bulkheads is about 16 meters (37 feet).

Brine, however, could presumably leak from the Markel Mine into the current Morton mine workings (or into any future workings on the 800 foot level). Assuming no additional bulkheads or shaft lining are included during decommissioning, potential risk of brine leakage with subsequent safety hazards to Morton personnel have been estimated. The probability of occurrence is unlikely (1 in 1,000) and the consequences would be severe from a cost perspective, with the overall event risk characterized as medium. The impacts could include injury to personnel, although adequate evacuation time is predicted because leaks would be noticeable.

### 4.1.3 Events Related to the Partial Fill Alternative

For the partial fill alternative, events 1b to 5b, as detailed above would be essentially the same; the only distinguishing event is the risk of underground hazards to Morton personnel would be reduced further because neither connecting drifts or the Markel Mine would be filled.

**Event 6c: Brine Release into Morton Mine Affecting Worker Safety**

For this event, it is assumed that the Markel Mine would not be flooded and that the Markel Mine bulkheads would be closed and sealed prior to the SPR travelways being flooded. The empty Markel Mine would provide a barrier between the SPR brine-filled travelways and the Morton Mine, and there should be no impact on Morton workings or personnel safety. Under this alternative, DOE would be required to build an isolation bulkhead in the ventilation bypass travelway; additional maintenance would likely be required by DOE in the production and hoist shafts. In addition, there would be an increased potential for a new sinkhole to form over the Markel Mine, possibly resulting in brine flooding.

As with event 6b, the probability of occurrence is unlikely (1 in 1,000) and the consequences would be severe, with the overall event risk characterized as medium. The economic costs of event 6c are estimated to be slightly lower, however, given the statistical sample size it is not possible to assign confidence ranges to the difference between the two events. Thus, the full mine and partial fill alternatives cannot be distinguished in terms of consequences for worker health and safety; both could include injury to personnel.

## 4.2 Other Potential Impact Areas

In the following discussions, impacts that occur from general site decommissioning activities (e.g., loss of jobs, removal of surface facilities and transfer to new ownership) are evaluated.

### 4.2.1 Land Use

Because DOE controls only 4.3 hectares (10.6 acres) on Weeks Island, none of the alternatives offer foreseeable environmental impacts to land use. If the buildings were razed and the land returned to its natural state, this would result in a change in land use from industrial to

undeveloped, but no significant beneficial environmental impacts would result. If the existing facilities were transferred via sale, lease, or donation, there would be no resulting change in land use.

Under one of the proposed alternatives, brine would be transported from Bayou Choctaw via St. James using existing pipelines. All activity would occur in previously disturbed areas and, therefore, the proposed action would not result in a change in land use. However, another alternative would be to generate the brine at the Weeks Island salt dome on Morton property; in this case some additional clearing might be necessary because temporary water and brine pipelines of up to 1.6 km (1 mile) in length would have to be constructed. Because the pipelines would be needed only during the brine fill period of about 13 months, pipeline construction would not result in permanent change in land use. The additional cost, schedule delay, and potential for environmental impacts of the pipeline construction and removal makes this alternative less preferred by DOE.

The proposed action for subsurface and surface facilities at Weeks Island would not directly affect the Louisiana Coastal Zone, because the decommissioning of the subsurface and surface facilities would not: alter surface water quality or quantity in the coastal watershed or coastal zone; result in dredge fill, development, construction or waste discharge into coastal waters; or impact air quality in the coastal zone. Even under the scenario where the site was sold or leased to another commercial entity, the resulting industrial activity would not likely change the level of activity in the coastal zone. In addition, it is very unlikely that any alternative would affect the two listed or the two proposed Coastal Restoration Projects in the area. Thus, no environmental impacts on land use would be expected from the proposed action.

### 4.2.2 Ecology

Biological resource assessment has determined that decommissioning Weeks Island under any alternative would not likely result in long-term adverse impact, or a "taking" in the context of the Endangered Species Act, of habitat of the threatened Louisiana black bear (Appendix B), because the 4.3 hectares (10.6 surface acres) would continue to be either in some form of administrative or semi-industrial usage or allowed to revegetate after structures are razed. The latter situation would provide a minimal increase in potential wildlife habitat, specifically the black bear. The event scenarios detailed earlier in this chapter deal with largely underground occurrences, and would have negligible impacts on the black bears or other ecological resources on Weeks Island.

### 4.2.3 Solid and Hazardous Waste

Under all the alternatives, all liquid or solid hazardous substances at the site would continue to be properly disposed in conformance with Federal and state laws and regulations. All hazardous substances would be either reused, recycled, or sent to waste facilities for proper disposal. For example, the auxiliary systems containing halon and propane would be dismantled and these substances reused or recycled.[46]

If the site is razed or transferred, any nonhazardous debris from demolition would likely be transported to a nearby landfill for disposal. The amount of debris from the demolition of surface facilities would not be likely to cause any substantial impact on the landfill space.

Similarly any hazardous debris would be properly disposed and would likely have little impact on hazardous waste disposal facilities.

Any oil contaminated piping or equipment would be disposed of properly. Because it is technically impractical to remove the residual crude oil (the estimated 10,000 barrels remaining after oil recovery) some crude oil would remain in the cavern with the brine. Waste associated with development or production of crude oil is exempt from RCRA regulations, but is subject to Louisiana State Order 29M. Representatives of LA DEQ have confirmed that the proposed action has no RCRA consequences.[47]

### 4.2.4 Air Quality

Under any alternative, the decommissioning of the Weeks Island facility would have negligible impact on air quality. Most air emissions would be in accordance with current air quality permit levels that allow emissions of about 6,000 kg (6 tons) of VOCs/year. Nitrogen oxide (NOx) emissions generated by the burning of VOC emissions will not exceed 100 tons during decommissioning. Under the proposed alternative, once the cavern was filled with brine and the oil recovery operation complete, emission levels would drop to near zero. Thus, the decommissioning would result in a negligible positive long-term impact to air quality. In addition, although, any conversion of the aboveground facilities might result in some emission of suspended particulates and carbon monoxide from demolition and conversion construction activities, because the area is in attainment, these emissions would have a negligible impact.

The fire protection system at the Weeks Island site contains over 6,800 kg (15,000 lbs) of halon. Halon is an ozone depleter with an Ozone Depletion Potential (ODP) of 10. If the site is decommissioned, the halon system would be dismantled. The halon-filled cylinders would be removed from the manifold and transported to a Halon Bank for recycling and reuse. In the remote possibility of an accident, halon could be released from a tank. However, the release of the halon itself would be highly unlikely to cause any substantial impact to workers. In addition, any release of halon to the environment would have no substantial effect on localized air quality.

Based on 40 CFR part 81 ("Designation of Areas for Air Quality Planning Purposes"), as listed in the April 1995 edition of BNA's Environment Reporter, Iberia Parish, Louisiana has been determined to be in attainment of the NAAQS. Thus, conformity analysis (required in some cases by 40 CFR part 51, subpart W) is not necessary for the decommissioning of the Weeks Island site.[b]

### 4.2.5 Socioeconomic Impacts

The socioeconomic impacts of decommissioning the Weeks Island facility would not be regionally substantial. Under the proposed decommissioning action, the largest impact would be from the loss of approximately 100 full-time jobs after the third year of the decommissioning effort. The loss in salaries and associated payroll expenditures from these jobs is estimated to be $6.8 million annually. This figure represents only 1.0 percent of the economy of Iberia Parish or 0.15 percent of the total regional economy. In addition, the loss of 100 jobs would represent a

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[b] In nonattainment areas, all Federal departments, agencies, or their agents must demonstrate that any activity they support, approve, provide financial assistance for, license, or permit conforms to the appropriate State Implementation Plan.

0.05 percent reduction in the total regional workforce of 200,000 individuals. A final way of illustrating the negligible impact given to size of the overall economy is to note that the 6.8 million dollars represent only 0.81 percent of the total Federal dollars spent in the region. Fluctuations in the migration of workers and their families during the first three years of decommissioning would have only a small effect on local housing, education, health care, and transportation systems.

The total demographic impacts of decommissioning Weeks Island would be relatively small. Decommissioning would require preliminary site modifications, oil pipeline/tie-in, and oil movement in the first and second years of the proposed operation. Mine plugging and abandonment efforts would occur during the second and third years of the decommissioning operation, while the remaining three years of the plan would involve minimal security and mine monitoring activity. Site modifications at Weeks Island could require as many as 17 new workers during the first year of decommissioning. These workers would be needed for short periods of time, however, so over the course of the first year, the manhours required for site modifications are the equivalent of only two full-time positions.

The demographic effect of actual decommissioning would be minimal. During the first and second years of the project, oil would be withdrawn in a normal operations mode using existing mine booster and pipeline pumps with simultaneous inert gas fill of the mine. The current Weeks Island staff is needed for the drawdown procedure, so all employees could likely retain their positions during this time. The one-to-two-year period provides workers an opportunity to search for new jobs while still employed, and some employees would be reassigned during that period. Some of those offered reassignment would be relocated outside the Weeks Island region, but others may choose to stay. The current Weeks Island staff resides throughout the region, with the largest concentration (53) living in New Iberia (see Table 4-3).

During the second and third years of the decommissioning project, approximately 178 temporary jobs would be created. Mine plugging and abandonment efforts would require approximately 125 workers during the second and third years of the operation. Again, much of the work would be completed in relatively short periods of time, so the total manhours required translates into approximately 51 full-time jobs over the course of one year. In addition to plugging and abandonment efforts, surface facility decommissioning would require as many as 53 new workers (16 full-time equivalent jobs). Given the short-term nature of the individual jobs, it is unlikely that more than a few workers would relocate permanently to the Weeks Island region. Most of these positions could be filled through the existing workforce and by transient workers from outside the area.

After the second year of the decommissioning project, oil movement would be complete. At that time, the permanent Weeks Island staff of approximately 100 employees would no longer be needed for maintenance and operation activities, so most of the jobs would be phased out. After the third year of decommissioning, the security needs for the site would drop from the current staff to approximately three individuals.

**Economic Impacts**

The main direct economic impact of decommissioning the Weeks Island site would include a short-term economic gain from the additional income generated from new jobs created during the first two to three years of site decommissioning, increased demand for local supplies and

**TABLE 4-3**
**Distribution of Residences of SPR employees at the Weeks Island Site**

| City or Town | Number of Employees |
|---|---|
| Abbeville | 4 |
| Baldwin | 2 |
| Broussard | 2 |
| Charenton | 1 |
| Clute | 1 |
| Deridder | 1 |
| Erath | 4 |
| Franklin | 3 |
| Hackberry | 1 |
| Jeanrette | 7 |
| Lafayette | 8 |
| Loreauville | 1 |
| Lydia | 4 |
| Maurice | 1 |
| Metarie | 1 |
| Morgan City | 2 |
| New Iberia | 53 |
| Praireville | 2 |
| St. Martinville | 1 |
| Sulphur | 2 |
| Youngsville | 4 |
| Total | 105 |

materials used to decommission the facility, and increased expenditures in the local economy by project workers. These direct impacts would likely have multiplier effects on the regional economy, particularly in the local trade and services sectors.

There is some potential for larger positive impacts on the region's economy depending on the degree to which the project procures goods and services from within the area. It is estimated that the cost of the Weeks Island decommissioning would result in a slight impact on the regional economy.

There could be a longer-term slight negative economic impact from the loss of the existing jobs at the site after the second year of the decommissioning project. Given that over half the staff resides in New Iberia, which is the largest city in Iberia Parish and a regional economic center, and the remainder of the staff are dispersed across 12 different cities and towns and that the loss of jobs would only result in a 0.15 percent loss of income regionally, the economic impact on the region would be negligible.

Using prevailing wage rates in the construction industry and projected manpower requirements, it is estimated that $2 million in additional income would be generated in the peak year of the project. The impact of this income would be increased somewhat by the multiplier effects of local spending. Nevertheless, the additional income directly generated by the project would be small relative to the regional economy.

**Evaluation of Potential Environmental Justice Impacts**

As discussed above the decommissioning of the Weeks Island facility will have no impact on human health and safety, natural resources, or the environment of any community (minority, low-income, or otherwise) surrounding the facility. Additionally, under any alternative there would be no impacts to any communities along the pipeline right of way. The individuals who work at the Weeks Island facility represent a minor component of the local economy and live in scattered locations. Therefore, because any loss of jobs would be spread out, there would be a negligible economic impact on any local community and none on minority or low-income populations. In addition, if DOE procures brine from an independent contractor, there is potential for job creation in a local area (e.g., near salt domes listed in Section 2.1); these areas may or may not be environmental justice communities.

Within an 8 km (5 mile) radius surrounding Weeks Island, 17 percent of the population is of minority background and 18 percent are at poverty level or below. Only one census block within 8 km (5 miles) of the Weeks Island site has a over 50 percent of its individuals in the racial minority and below poverty level. This Block Group has 95 (71%) of its individuals in the racial minority and 94 (71%) below the poverty level. In addition, a segment of the pipeline runs through this block group.

Because none of the alternatives would impact the community as a whole, there would be no impacts to the minority and low-income community. Under any of the proposed alternatives, there would be no disproportionately high or adverse effects on minority or low income populations.

### 4.2.6 Natural, Scenic, Archaeological, Cultural, and Historical Resources

Under the alternative to obtain brine from Bayou Choctaw, all activity would occur onsite within existing plant facilities; therefore, the proposed action would not directly impact the environmental resources as there are no identified state or Federal resources at these sites. This alternative would not cause any adverse impacts to natural and scenic resources.

If brine is generated from a new well at Weeks Island (on Morton property), temporary water and brine pipelines of up to 1.6 km (1 mile) in length would be constructed. These pipelines would possibly cross wetlands through newly created ROWs. Because the pipelines would be needed only during the brine fill period of about 13 months and likely would be removed after completion of brine fill, pipeline construction would not result in permanent disturbance of environmental resources.

None of the proposed alternatives would cause adverse impacts to cultural, historical, or archaeological sites, or Native American land.

### 4.2.7 Ambient Noise

If surface facilities are removed and salvaged or demolished, noise would remain at levels appropriate to an industrial area. Short-term increased noise levels would be similar to other industrial uses, creating negligible additional noise. This would include noise from removing aboveground equipment, above and below grade piping, cable, and conduit; demolishing and removing the oily-water collection and treatment system piping, tanks and accessories; and demolishing buildings associated with the shafts. Long-term noise would be likely to remain consistent with that of an industrial area.

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## 5.0 SUMMARY OF ENVIRONMENTAL IMPACTS AND CONCLUSIONS

In Table 5-1, the potential environmental impacts are summarized by impact area. The impacts identified throughout Chapter 4 are condensed in the table, and columns indicate the hypothetical assessed impacts for the no action alternative and the proposed action. For most impacts, the partial fill and full mine alternatives are identical, and where different, are distinguished in the proposed action impact column.

The scenario descriptions in the summary table were developed by a group of experts who hypothesized the range on incidents resulting in some potential impact that could occur during decommissioning. These scenarios range in likelihood of occurrence from possible (1 in 10) to highly unlikely (1 in 10,000) and also have severities ranging from critical to severe. The specific descriptions of the events, their probabilities and severities are contained in Section 4.1. The resulting potential impacts are summarized in the following table. DOE, however, does not anticipate any environmental impacts from decommissioning Weeks Island.

TABLE 5-1
SUMMARY OF ENVIRONMENTAL IMPACTS

| Potential Impact Area | Environmental Concern | Impacts for No Action Alternative | Impact for Proposed Action (when impacts differ, distinguished for full mine and partial fill alternatives) |
|---|---|---|---|
| Geology | Collapse of oil storage chamber from erosive groundwater inflow (see also groundwater, surface water, and worker health and safety for consequences) | Risk is higher than proposed action because empty chamber is more likely (possible probability of 1 in 100) to collapse than brine-filled chamber (see events 1a and 3a) | Most likely outcome is continued current rate of surface subsidence; brine-filled chamber decreases probability to unlikely (1 in 1,000) of increased subsidence rate and chamber collapse (see event 5b) |
| | Loss of economic value of salt accessible via Markel Mine | No impact; no brine fill occurs | Full mine alternative: 10 million tons salt lost economic value; negligible regional economic impact<br><br>Partial mine fill alternative: no impact because salt still accessible via unflooded Markel Mine |
| Groundwater | Release of residual oil into saline aquifer above salt dome | Residual oil released when uncontrolled groundwater inflow to chamber leads to surface subsidence with subsequent saline aquifer contamination; however, saline aquifer is not relied on for drinking water or other human uses and is not known to be linked with surface water, so the medium/high impact would have low practical environmental consequences but could constitute high liabilities (see event 1a) | With brine-filled chamber, collapse of chamber through subsidence is not a prerequisite for residual oil release; residual oil release could occur through existing leak paths but would be unlikely (1 in 1,000) given limited volume of remaining residual oil; in addition, saline aquifer is not relied on for drinking water or other uses and is not considered linked with surface water, environmental consequences assessed as low (see event 1b) |

TABLE 5-1
SUMMARY OF ENVIRONMENTAL IMPACTS (continued)

| Potential Impact Area | Environmental Concern | Impacts for No Action Alternative | Impact for Proposed Action (when impacts differ, distinguished for full mine and partial fill alternatives) |
|---|---|---|---|
| | Release of brine into saline aquifer above salt dome | In case of chamber collapse, uncontrolled groundwater flow into the chamber would accelerate salt erosion and increase brine flow to saline aquifer, however, minimal adverse environmental impacts would result because saline groundwater has low economic or environmental value (see event 1a) | Groundwater connection between chamber and aquifer is already established; controlled saturated brine release (2,500 bbls) into natural brine (millions of barrels) would have little impact on groundwater quality (see event 4b) |
| | Groundwater contamination from brine spill during pipeline transport | No impact; brine transport does not occur | Spill unlikely to be of sufficient duration or volume to reach and affect aquifers, and therefore, no expected impacts to drinking water wells along pipeline ROW (see event 3b) |
| Surface water | Release of residual oil into saline aquifer above salt dome and subsequent release to surface water | Residual oil released to groundwater after surface subsidence has unlikely probability (1 in 1,000); subsequent migration to surface water would be required prior to impacts and is even more unlikely; therefore, overall impacts to surface water are considered low (see event 2a) | Probability of residual crude oil reaching surface water is highly unlikely (1 in 10,000), given limited pathway from groundwater and unlikely (1 in 1,000) probability of residual oil even reaching groundwater; volume of residual crude is small compared to oil transported in Louisiana waters without major environmental impacts; therefore, low impact to surface waters are anticipated (see event 2b) |

TABLE 5-1
SUMMARY OF ENVIRONMENTAL IMPACTS (continued)

| Potential Impact Area | Environmental Concern | Impacts for No Action Alternative | Impact for Proposed Action (when impacts differ, distinguished for full mine and partial fill alternatives) |
|---|---|---|---|
| | Release of brine into saline aquifer above salt dome and subsequent release to surface water | Groundwater flow from saline aquifer to fresher surface water unlikely to occur because of fluid density differences; aquifer does not discharge directly to surface water; no perceptible change in surface water salinity; negligible surface water impacts | Groundwater flow from saline aquifer to surface water unlikely to occur; aquifer does not discharge directly to surface water; no perceptible change in surface water salinity; negligible surface water impacts |
| | Surface water contamination from brine spill during pipeline transport (see also ecological impacts) | No impact; brine transport does not occur | Brine spill to surface water likely to be rapidly diluted by surface water flow and heavy precipitation; under low flow circumstances, potential for moderate impact of localized salinity increase in surface water (see event 3b) |
| Land use | Transfer of surface facilities to other industrial use | No impact; DOE retains surface parcels | Negligible impact; use of land by new owner (e.g., Morton) likely to be consistent with current industrial use |
| | Return of surface parcels to natural environment | No impact; DOE retains surface parcels | Negligible positive impact; slightly enhanced area (i.e., at most 4.3 hectares (10.6 acres)) for habitats in six separate parcels scattered throughout industrial area |
| | Potential for impacts to agricultural lands from spill during pipeline transport of brine | No impact; brine transport does not occur | Potential high short-term localized impacts to agricultural lands, including portions of prime and unique farmlands along the pipeline |
| | Disturbance to ongoing coastal restoration projects | No impact | No identified impacts; no perceptible change in surface water quality |

TABLE 5-1
SUMMARY OF ENVIRONMENTAL IMPACTS (continued)

| Potential Impact Area | Environmental Concern | Impacts for No Action Alternative | Impact for Proposed Action (when impacts differ, distinguished for full mine and partial fill alternatives) |
|---|---|---|---|
| Ecological impacts | Effects on aquatic ecology from residual oil released to surface water | Low impact anticipated due to remaining volume of residual oil; if a leakage path would be established, potential effects on aquatic organisms could be severe (see event 3a) | Low impact; release of residual oil to groundwater unlikely (1 in 1,000) and migration to surface water highly unlikely (1 in 10,000); however, potential effects of oil on aquatic organisms could be moderate (see event 3b) |
| | Effects on aquatic ecology from brine released from chamber to surface water | Negligible because no significant brine flow to surface water because of different densities | Negligible because no significant brine flow to surface water because of different densities |
| | Impacts from brine spill during pipeline transport | No impact; brine transport does not occur | Low impact; based on assessment of spills during operating history, natural areas recover quickly (e.g., several growing seasons) with natural dilution processes; possible significant short-term (e.g., vegetation loss, impacts to non-mobile aquatic organisms) localized impacts |
| | Potential impacts on Louisiana black bear | No impact; activities at Weeks Island unchanged; no "taking" of bears as defined under Section 7 of the Endangered Species Act | No impact; activities at Weeks Island unchanged; no "taking" of bears as defined under Section 7 of the Endangered Species Act |
| Solid/hazardous Waste | Disposal of construction debris from razed buildings and remaining inventory of hazardous materials | No impact; DOE facilities remain in place | No impact; debris disposed of in proper facilities and any hazardous waste disposed of in permitted facilities |

**TABLE 5-1**
**SUMMARY OF ENVIRONMENTAL IMPACTS (continued)**

| Potential Impact Area | Environmental Concern | Impacts for No Action Alternative | Impact for Proposed Action (when impacts differ, distinguished for full mine and partial fill alternatives) |
|---|---|---|---|
| Air Quality | Release of VOCs from oil chamber during brine fill | No impact; VOCs remain in empty chambers | Negligible impact; VOC and NOx emissions treated by flare and remain within acceptable limitations enforced by LA DEQ; no effect on regional air quality |
| | Release of particulates and CO during demolition | No impact; demolition does not occur | Negligible impact; no effect on regional air quality |
| | Release during dismantle of halon system | No impact; dismantle does not occur | Negligible impact; halon is transported intact in cylinders and reused |
| Socioeconomic | Increased funding to local contractors during decommissioning activities | Minimal positive impact; total cost estimated at $40 million plus or minus 5 percent | Minimal positive impact; total cost estimated at $53 million plus or minus 5 percent |
| | Decrease in jobs from facility | No impact; jobs retained | Negligible regional impact given size of local economy |
| | Potential for disproportionate impacts to minority and low income populations (i.e., environmental justice community under E.O. 12898) | No identified impacts | No identified impacts |
| | Affect on public health and safety from a brine spill from the pipeline | No identified impacts | No identified impacts |

TABLE 5-1
SUMMARY OF ENVIRONMENTAL IMPACTS (continued)

| Potential Impact Area | Environmental Concern | Impacts for No Action Alternative | Impact for Proposed Action (when impacts differ, distinguished for full mine and partial fill alternatives) |
|---|---|---|---|
| Worker Health and Safety | Impacts to Morton workers from surface subsidence and/or rupture on underground bulkheads | Medium risk from surface subsidence which is characterized as possible (1 in 100) for the empty mine alternative; unlikely to cause serious injury or death to workers; adequate warning time anticipated | Full mine alternative: Underground flooding of Morton mine unlikely to occur (1 in 1,000) due to rupture of salt wall between Markel and Morton workings; if leaks occur, impacts on workers could include serious injury or death although adequate warning time anticipated<br><br>Partial mine fill alternative: Underground flooding of Morton mine unlikely to occur (1 in 1,000) due to subsidence from Markel Mine (unfilled) and/or groundwater inflow to Markel; if structural integrity of Markel fails, impacts on workers could include serious injury or death, but adequate warning time is anticipated |
| Natural, Scenic, Archeological, Cultural, Historical Resources | No identified concerns | No identified impacts | No identified impacts |
| Ambient Noise | No identified concerns; continued noise levels consistent with commercial/industrial land use | No identified impacts | No identified impacts |

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## ENDNOTES


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20. *Ibid.*

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    U.S. Department of Energy, *Strategic Petroleum Reserve, Final Environmental Impact Statement, Capline Group Salt Domes, (Iberia, Napoleonville, Weeks Island Expansion, Bayou Choctaw Expansion, and Chacahoula), Iberia, Iberville, and Lafourche Parishes, Louisiana,* Volumes I-IV, July 1978, Document Number DOE/EIS-0024.

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# APPENDIX A

# AGENCY CONSULTATION AND PUBLIC PARTICIPATION

## APPENDIX A
## AGENCY CONSULTATION AND PUBLIC PARTICIPATION

As part of the NEPA process, the Department of Energy (DOE) has encouraged public participation in the planning phase of the decommissioning of the SPR Weeks Island facility. Two public meetings have been held. The first public meeting took place on March 2, 1995 and was held to explore possible future uses for the Weeks Island facility. The second public meeting took place on June 8, 1995 and was held to receive public comments on the alternatives for decommissioning the Weeks Island facility and their potential environmental impacts. In addition, speakers at the public meetings and other parties who had expressed interest were contacted by telephone and invited to comment on the State Review Draft of this EA. The public has also been kept informed of the decommissioning process through numerous newspaper articles which have appeared in local and regional newspapers. A list of these articles appears at the end of this Appendix (see Attachment 1). DOE has also made quarterly presentations to the SPR Environmental Advisory Committee.

### Notice of Public Meetings

Prior to each meeting, a notice appeared in the Federal Register (FR) announcing the meeting. On Wednesday, February 15, 1995, "Strategic Petroleum Reserve Weeks Island Alternative Uses, Notice of Public Meeting" appeared at 60 FR 8647 announcing the March 2nd meeting. On Monday, May 22, 1995, a notice appeared, "Intent to Prepare an Environmental Assessment of the Decommissioning of the Strategic Petroleum Reserve Weeks Island Facility, Iberia Parish, Louisiana" at 60 FR 27091, announcing the June 8th meeting.

In addition, prior to each meeting, public notices inviting members of the public to attend the meeting appeared in local newspapers. Table A-1 lists the newspapers and dates for these public notices. Public service announcements with the same information ran on two television stations (KATC and KLFY) and one radio station (KANE) for about one week prior to the meetings. In addition, before each meeting, an announcement of the meeting and an invitation to participate was mailed to a list of approximately 200 interested persons. The list included Federal, state, and local agencies, environmental organizations, industry, press, and other interested individuals. The mailing before the June 8th meeting included a factsheet describing the project.

**TABLE A-1**
**DATES OF PUBLIC NOTICES THAT APPEARED IN LOCAL NEWSPAPERS**

| Newspapers | Dates the Public Notice of March 2nd Appeared | Dates the Public Notice of June 8th Appeared |
|---|---|---|
| The Daily Iberian<br>New Iberia, LA | February 24, 1995<br>March 1, 1995 | May 28, 1995 |
| The Advertiser<br>Lafayette, LA | February 24, 1995<br>March 1, 1995 | May 28, 1995<br>May 30, 1995 |
| The Advocate<br>Baton Rouge, LA | February 24, 1995<br>March 1, 1995 | May 30, 1995 |

Both public meetings gave interested individuals an opportunity to comment. During both meetings, the DOE presented a brief overview of the history and purpose of the SPR. DOE also reviewed the history and layout of the Weeks Island facility and described the events (e.g., the development of two sinkholes) that led to DOE's decision to decommission the facility.

**March 2nd Public Meeting**

The March 2nd Public Meeting focused discussion on possible future uses for the SPR Weeks Island facility. During that meeting, seven individuals presented comments or asked questions. One of these individuals represented the Center for Coastal Energy and Environmental Resources (part of the Office of Economic Development at Louisiana State University (LSU)) and one represented an environmental organization. In addition, one national laboratory, one university, and one private citizen submitted written comments. Although the public meeting was devoted to exploring uses for the Weeks Island facility, a good portion of the March 2nd meeting involved comments concerning the facility, current and future environmental impacts due to sinkholes and potential oil seepage, health effects, the decision to abandon, and plans for abandonment. A number of suggested uses for the Weeks Island facility were presented at the meeting and in the written comments. These suggestions were to use the site:

- for private development;
- as a geoscience/environmental research center (i.e., the Salt Dome Utilization Laboratory proposed by LSU) for the study of salt dome properties and their processes. (The proposal was that funding would be from a consortium of public and private interests);
- as a test facility for post closure sealing of WIPP (Waste Isolation Pilot Project);
- as a mining research facility, either governmental or private;
- as a corrosion research facility (existing infrastructure has hardware that could be used for experimental corrosion studies);
- as a coastal islands wildlife preserve (protecting the habitat and using the aboveground facilities as an administrative center).

DOE considered these suggestions in developing the proposed action and alternatives.

**June 8th Public Meeting**

The June 8th public meeting focused on potential environmental impacts from the Weeks Island decommissioning. During the public comment period, eight individuals presented comments. One individual represented an environmental organization. In addition, two other organizations (Iberia Industrial Development Foundation and Morton International Salt Company) submitted written comments.

The public meeting was devoted to receiving public comment on the alternatives for decommissioning of the Weeks Island facility and their potential environmental impacts. A number of comments about the Weeks Island facility were presented at the meeting and in writing. These included comments about:

- potential oil or brine contamination of resources including soil, surface waters, groundwater, wetlands, agricultural lands (e.g., sugarcane fields), terrestrial ecology (e.g., the black bear), aquatic ecology (e.g., fisheries and oyster beds), and recreational resources;

- impacts to ongoing coastal restoration projects;

- the desire for more groundwater mapping;

- the source, density, transportation, and storage of brine; including questions asking if brine was the proper material (two other materials were mentioned), and if brine migration can be avoided; there were also concerns about cavern closure and sinkhole formation during the 32 month period between emptying and filling the mine;

- the present sinkholes and the development of future sinkholes;

- the monitoring scheme at Weeks Island after decommissioning is completed; and general concerns about the long term situation at Weeks Island;

- the effect on Morton Salt and the ultimate stability of the dome;

- the abandonment in place of the Weeks Island pipeline;

- some of the small towns in the vicinity of Weeks Island (Freetown, Glencoe, Louisa, and Four Corners); these concerns included questions about environmental justice, contamination of drinking water, economic and employment issues, and, in case of a catastrophic emergency, safety and evacuation issues;

- that people attending the March meeting should be considered interested parties; in addition a desire for broader outreach, information, and coordination with the public as well as allowing public input before future actions; also allowing the public to review the EA concurrent with the state; and

- the cost of moving the oil and methods of contracting that DOE has employed.

DOE considered these comments in preparing the State Review draft of the Environmental Assessment.

**Incorporation of Comments from Public Meetings**

In preparing this EA, DOE has taken into consideration all public comments received, both written and oral. DOE has also consulted a number of individuals in Federal and state agencies during the development of this EA. These agencies include the Louisiana Department of Natural Resources, the Louisiana Department of Environmental Quality (Hazardous Waste Enforcement, Groundwater, and Water Permits sections), and the U.S. Fish and Wildlife Service of the U.S. Department of the Interior. A list of these agency personnel contacted appears in Table A-2.

**TABLE A-2**
**LIST OF AGENCY PERSONNEL CONSULTED**

| Contact Name/ Agency | DOE/Contractor Contact | Date | Topics Addressed |
|---|---|---|---|
| Joe Ball<br>Louisiana Department of Natural Resources | Tom Westbrook | 2/16/95 | -- State Order 29M |
| | | 5/3/95 | -- State Order 29M |
| Pierre Catron<br>Louisiana Department of Natural Resources | Eileen Hollander | 6/26/95 | -- RCRA applicability |
| Wayne Desselle<br>Hazardous Waste Enforcement Section | Eileen Hollander | 6/26/95 | -- RCRA applicability |
| Bill Schramm<br>Groundwater Section<br>Louisiana Department of Environmental Quality | Tom Westbrook<br>David Brine | 5/5/95 | -- State Order 29M |
| | | 7/3/95 | -- Groundwater |
| Dan Smith<br>Water Permits Section<br>Louisiana Department of Environmental Quality | Tom Westbrook | 6/1/95 | -- State Order 29M<br>-- Water Discharge<br>-- Public Meeting |
| Martha Zastrow<br>Water Permits Section<br>Louisiana Department of Environmental Quality | Tom Westbrook<br>David Brine | 6/19/95 | -- Groundwater |
| Wendy Lovelace<br>Geological Survey<br>U.S. Dept. of Interior | Alex Turchi | 6/30/95 | -- Location of registered wells within one mile of the site/pipeline |
| Russell Watson<br>Acting Field Supervisor<br>Fish and Wildlife Service<br>U.S. Dept. of Interior | Durinda Robinson | 6/21/95 | -- The Louisiana Black Bear<br>-- Contingency response plans for oil/brine spills |
| Louisiana Groundwater Advisory Group | DOE and Dyn McDermott staff | 8/22/95 | -- Weeks Island Decommissioning |

**Comments on State Review Draft of the Environmental Assessment**

Speakers at the public meetings and other individuals who had expressed interest were contacted by telephone in late August 1995, and invited to comment on the EA. Seventeen copies of the Draft EA were distributed in September 1995 to those individuals and groups who wished to comment. In addition, a formal request for review was submitted to the Office of the Governor of the State of Louisiana, and an informal review copy was circulated to LDNR. In all 13 letters of comment were received on the Draft: two from Louisiana State agencies; one from a Federal agency; three from community organizations; two from local private companies; one from an individual; and four from members of the SPR Environmental Advisory Committee. Comments from these letters fell into several different categories. Included were comments concerning: the EA and the extent of public participation; the proposed action; geology; groundwater; pipelines; and environmental justice.

EA and Extent of Public Participation

COMMENT 1: In terms of the EA and the extent of public participation, one commenter stated that there should be a more thorough study with more public input and that DOE is not informing or including local residents in the decommissioning process.

RESPONSE: The EA has examined all potential impacts from the proposed decommissioning. In addition, it has included ample opportunity for public involvement including public notice (newspapers, radio, TV, mailings), and opportunity for public comment (two public meetings and public circulation of the draft EA). For details on these opportunities for public involvement see the earlier sections of this appendix.

COMMENT 2: Another commenter stated that DOE's discussion of risk analysis and the SPR Risk Coding Matrix is confusing and underestimates the severity of possible consequences.

RESPONSE: The SPR Risk Coding Matrix and the associated discussion provide the best explanation of a very complex subject. This effort has fully disclosed all of the available information. The results discussed are the independent conclusions of 18 to 21 experts using the Delphi Method which DOE considers the best possible tool for this analysis.

Proposed Action

COMMENT 3: One commenter proposed that DOE should create a new well to produce brine at the Weeks Island site.

RESPONSE: Brine cannot be produced at the DOE Weeks Island site because the storage caverns underlie the DOE property. The option of producing brine at Weeks Island is still being considered as a viable option by DOE. The production of brine at Weeks Island is proposed as an alternative brine source in Section 2.1 of the EA and its feasibility is dependent on a brine source, supplier, scheduling, and economic constraints.

COMMENT 4: Another commenter suggested that DOE should stagger draining and filling operations at the facility in order to reduce structural/geological instability at the site.

RESPONSE: The relocation of the crude oil is not within the scope of this EA (See Section 1 of the EA). However, the current engineering design of the Weeks Island storage

facility does not meet the requirements for concurrent (or staggered) removal of oil and replacement with brine. The concurrent (or staggered) removal alternative would require extensive delays in oil relocation and modification to an engineering system designed only to move crude oil in one direction. The concurrent alternative would also force the operation of the storage chambers at levels above 100 psig. This has been identified by a Hazard and Operability Analysis as creating an unacceptable risk.

COMMENT 5: A number of comments were received concerning the fill hole. One commenter requested that DOE not perforate the second fill hole at the bottom of the water table until DOE determines that Morton's water wells would not be contaminated and that DOE should not seal this fill hole at the top. Another commenter expressed concern that if relief perforations plug up, then the pressure of brine in the SPR storage chambers could rise to an elevated level.

RESPONSE: Brine from the perforated well would be clean because it enters the fill hole casing from the lower portion of the storage chambers. DOE also maintains that this type of plug has been used on oil storage chambers before without any adverse effects. In addition, DOE intends to implement a long term monitoring program at the Weeks Island site. Consideration will be given to inclusion of a pressure gauge which would be used to measure brine pressure in the storage chamber.

COMMENT 6: One commenter suggested that DOE shafts may only be plugged if Morton agrees that the Markel may be flooded and that connecting the Markel Mine to Morton's existing operations is not an option.

RESPONSE: Flooding the Markel Mine is only a viable solution if DOE has Morton's consent. Morton has the option of connecting the Markel Mine to its existing facilities within the confines of their own property. Flooding the travelways above the storage chambers with brine would not compromise worker safety, therefore, it is still considered an option for decommissioning.

COMMENT 7: Several commenters submitted comments on contingency plans. Some commenters stated that DOE should develop contingency plans to deal with a release of oil or brine at the Weeks Island site. Another felt that the SPR Program has not adequately considered possible site decommissioning mitigation plans related to accelerated ground subsidence, additional leakage into the storage chambers, and the release of oil into the environment. One commenter requested that DOE consider and plan for every "what if" scenario, in order to protect Morton Salt and its employees. Other commenters felt that DOE should provide information regarding emergency response (including availability of rural emergency vehicles and response plans for Louisa, Freetown, and Glencoe) and that the public should be kept well informed of any danger at periodic times during the decommissioning of the SPR.

RESPONSE: DOE has contingency plans and emergency response procedures in place. In addition, DOE has developed contingency plans for all specific events that could be associated with drawdown, decommissioning, and post-decommissioning. As part of this effort, DOE has developed a "Comprehensive Contingency Plan" for the sequential drawdown process to significantly minimize any problems should they occur. DOE acknowledges that this planning effort was not specifically mentioned in the State Review Draft EA. DOE has included information about the planning effort in Section 3.8.2 of the Final EA.

In terms of Morton, DOE has attempted to identify all possible scenarios that could affect Morton Salt operations. DOE is maintaining close contact with Morton. If any new issues are identified, DOE would contact Morton as they occur. Regarding emergencies, DOE has not identified any potential for emergencies in the identified rural areas (e.g., Louisa, Freetown, Glencoe) as a result of the proposed action. However, Section 3.8.2 of the EA discusses the emergency response and health care capabilities of the area. DOE would continue its practice to keep the public informed should any danger arise. DOE does not anticipate any public danger during the decommissioning of its Weeks Island site.

COMMENT 8: Several commenters requested that DOE require environmental monitoring of the site and the pipeline rights of way throughout the transfer, and monitor the site continuously thereafter. The commenters request that DOE be proactive and liable for long term monitoring and appropriate corrective action associated with the facility. One commenter suggests that DOE should consider simplistic long term surveillance to provide an indication that the impacts to the affected aquifer are on the order of those predicted in the EA.

RESPONSE: DOE currently monitors the site and pipeline right of way and would continue to do so throughout crude oil relocation and subsequent brine fill. DOE intends to do additional monitoring to verify the containment of oil and groundwater characteristics. (See Section 2.1)

Geology

COMMENT 9: Several comments were received concerning the geology of the site. One of these comments suggested that the EA should include a more extensive subsidence and stress measurement analysis of the Weeks Island facility and that DOE must perform additional studies to characterize the technical aspects of sinkhole development and monitor the site for additional sinkholes.

RESPONSE: The Weeks Island facility has been subject to extensive modeling efforts over the past 15 years and has one of the most intensive subsidence arrays over any of the Gulf Coast salt dome mines. DOE does not dispute that more study may be beneficial, but maintains that this study would be necessary only if the Weeks Island decommissioning were not occurring. DOE has recognized events that might occur in its Contingency Response Plan, including information on the expansion of existing sinkholes and the possibility of new sinkholes, and no increased safety benefits would be expected from further study. Furthermore, DOE intends to closely monitor existing sinkholes and conduct surveillance to identify any potential new sinkholes.

COMMENT 10: Several comments were also received concerning salt fracture patterns. One commenter suggested that the existence of a "fracture network" in the overburden may explain some surficial features. Another comment states that the EA is biased because the risk assessment disallowed consideration of rock salt fracture patterns.

RESPONSE: There is no documented evidence of such a "fracture network." DOE acknowledges this hypothesis as a possibility, but does not anticipate any increased risk resulting from these hypothetical fractures. The possibility of multiple salt fractures linking to potential leakage pathways, with undesired operational and environmental consequences, was considered in the risk assessment process and Comprehensive Contingency Plan.

COMMENT 11: One commenter suggested that the hydrologic monitoring program at the Weeks Island facility is inadequate.

RESPONSE: Limited monitoring occurred long before sinkhole formation, but was intensified in early 1994. Presently, a detailed hydrologic monitoring system is operating at the sinkhole. This system would be maintained during drawdown and closure of the facility, including final backfilling with brine.

COMMENT 12: Another commenter asked DOE to describe how they would insure the integrity of the SPR caverns and mine shafts after the decommissioning for as long as necessary into the future.

RESPONSE: The proposed action is the best alternative for maintaining the integrity of the Weeks Island facility. The pressure of the brine on the walls and ceilings of the storage chambers would provide stability against structural stresses. In addition, because the brine is more dense than water, filling the chamber with brine would shut off or slow down groundwater intrusion. This would prevent further salt dissolution, growth of the crevasse, and structural failure of the storage chambers. It is also noted that these caverns existed prior to DOE use of the facility for oil storage.

COMMENT 13: Another commenter stated that the risk of a catastrophic occurrence upon oil removal is greater than the draft EA acknowledges. This commenter suggested that DOE must conclusively demonstrate that injecting undersaturated brine would not cause safety problems.

RESPONSE: A self imposed average of 85 percent saturated brine would keep localized dissolutement to a minimum. Models have indicated that no adverse impact would likely occur to Morton facilities as a result of injecting brine with a saturation level between 85 and 100 percent.

Groundwater and Surface Water

COMMENT 14: Several commenters submitted comments pertaining to groundwater and surface water issues. One commenter stated that DOE's preferred alternative is likely to enhance instability in two ways: additional pressure while the cavern is filling, and continuous uncontrolled dissolution and deposition of salt within the cavern after refilling. The commenter noted that a release of 73 million barrels of brine and some amount of oil would result in substantial injury to coastal ecosystems.

RESPONSE: Relocating crude oil from the caverns does not fall within the scope of this EA. As discussed in Section 4.1.1 of the EA, under the no action alternative up to 700,000 barrels of oil could remain in the cavern after oil relocation, groundwater would continue to flood the chamber, and the conditions leading to instability of the cavern could be exacerbated. This situation would be more unstable than any conditions taking place during controlled brine fill. As outlined in Section 2.0, the cavern would be filled with saturated brine which cannot dissolve salt to any degree of significance. There is no indication that a release of 73 million barrels of brine would ever occur. The Environmental Impacts Section discusses the impacts associated with a possible release of a limited amount of residual oil and/or brine.

COMMENT 15: Two comments addressed groundwater leakage. One commenter asked DOE to describe what would be done to prevent or slow down ground-water leakage after the decommissioning is complete, while another was concerned that the draft EA is overly optimistic about the ability of available technology to warn of, and remediate, increased inflows of water.

RESPONSE: The proposed action of filling the storage chambers with brine would stop or significantly slow down the groundwater leakage. Because brine is more dense than water and oil, it would shut off the flow of groundwater into the chambers. This would prevent further salt dissolution, growth of the crevasse, and structural failure of the storage chambers.

Pipelines

COMMENT 16: Several comments address potential impacts from the pipelines. One commenter thought that a better explanation is needed for environmental concerns about pipelines carrying brine to the Weeks Island site. Another commenter was concerned that the potential for adverse environmental impacts to surface waters and dependent natural resources has been understated throughout the document. This commenter noted that every year DOE experiences a spill of significant proportions from their pipeline system during transfers.

RESPONSE: DOE added the language suggested by the first commenter to the EA in a section of Chapter 4, Event 3b. In response to the second comment DOE notes that the brine spill history of the SPR is outlined in Table 4-2 of the EA which shows that, although brine spills have occurred every year at existing SPR sites, these spills have been small compared to the volume of the brine transported. During the 18 years of SPR operation, neither brine nor oil spills have resulted in significant environmental impacts.

COMMENT 17: Several commenters asked that DOE include in the EA information as to how often the pipeline is inspected, and as to whether DOE would drain, clean, cap, and fill the pipeline with non-corrosive fresh water according to the COE requirements.

RESPONSE: Periodic inspections of off-facility pipelines are conducted to observe conditions on and adjacent to the pipeline right of way. Aerial or land patrols are conducted weekly during fluid movement and every 2-3 weeks when fluid is not being moved. Physical inspection of water crossings are conducted at least every 5 years to ensure that the pipeline does not become exposed due to washout. Water crossing inspections may include use of divers and probes.

As described in Section 2.3, there are several options for pipeline disposal. Pipelines could be sold in whole or part, or abandoned. If sections are abandoned, they would be abandoned in compliance with U.S. Army Corps of Engineers (COE) requirements and coordinated with Coastal Zone Management. These include requirements that the pipeline be drained, cleaned, filled with non-corrosive fresh water, and capped.

Environmental Justice

COMMENT 18: Several comments were received on environmental justice concerns. One commenter stated that the EA does not include a procedure to address the Environmental Justice concerns and impacts caused by current and planned site activities.

RESPONSE: Section 3.8.3 of the EA outlines the demography for Environmental Justice concerns in the area. Included in this section is information on the racial makeup and income

levels for the individuals surrounding the Weeks Island facility. Section 4.2.5 evaluates the potential Environmental Justice impacts from the proposed action. This section also includes a analysis of any potential socioeconomic impacts from the proposed action.

COMMENT 19: One comment stated that informational meetings have not been held to provide information to and receive input from the environmental justice communities nor is there evidence of such planning in the draft. Another comment addressed a concern that environmental justice communities have not received information on the NEPA process and, therefore, they have been unable to provide input and address concerns to the DOE.

RESPONSE: As noted in the EA there would be no disproportionately high or adverse affects on minority or low income populations from the proposed action. As a result, DOE has not identified a need to develop additional procedures to specifically address the Environmental Justice community. However, DOE has provided ample opportunity for public involvement in the EA/NEPA process. This opportunity for public involvement has included public notice (newspapers, radio, TV, mailings), and opportunity for public comment (two public meetings and public circulation of the State Review Draft EA). For details on these opportunities for public involvement see the earlier sections of this appendix.

**Attachment 1**
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# APPENDIX B

## LOUISIANA BLACK BEAR (*URSUS AMERICANUS LUTEOLUS*)

## APPENDIX B
## LOUISIANA BLACK BEAR (*URSUS AMERICANUS LUTEOLUS*)

The following background information on the Louisiana black bear is provided in support of the conclusion that the proposed action would not have adverse effects on the species. USFWS concurs with DOE's conclusion.[1]

### Population

The Louisiana black bear is a Federally designated threatened subspecies. Black bear populations have suffered serious declines as a result of habitat destruction and fragmentation, and illegal shooting. Population density of the Louisiana black bear can range up to more than 1-2 bears per 50 hectares on isolated forest fragments in north Louisiana to 1-4 bears per 1,000 hectares in other areas of occupied habitat. The estimated bear population in the Tensas River Basin in northeast Louisiana is 80 to 120 animals. At present, no statewide population estimate exists. Since 1988, approximately 140 different black bears have been captured and radio-collared as part of ongoing research projects studying the Louisiana black bear.[2] Presently, over 60 bears have been radio-collared and monitored.[3]

### Geographic Range and Habitat

The Louisiana black bear historically inhabited eastern Texas, Louisiana, and southern Mississippi, but more than 80 percent of its suitable habitat has been destroyed by human activities, particularly by conversion to agricultural land.[4] As a result of habitat fragmentation, black bear are currently limited to the bottomland hardwood forest habitats in the Tensas River Basin in northeast Louisiana, and the upper Atchafalaya River Basin, primarily south of Highway 90 in St. Mary and Iberia Parishes.[5]

The lower Atchafalaya appears to have the largest population density and the upper Atchafalaya the lowest.[6] Black bears utilize areas of high habitat diversity and require large area of isolated, undisturbed forest.[7] They forage in both the timbered areas of the forest and the succulent vegetation of forest openings.[8]

Areas of thick cover serve as "escape cover" – an important component of bear habitat that allows bears to avoid contact or visual encounters with humans in an increasingly fragmented environment.[9,10] Dense cover that limits visibility, slows human foot travel, and creates noise when traversed, provides security for bedding, denning, or fleeing bears.[11] The switchcane/palmetto/shrub understories as well as the vegetative regrowth of briars, vines, and saplings provide escape cover and daybed resting sites.

The black bear is highly mobile and can cover large distances during daily foraging activities.[12] Trails and small roads do not disrupt bear movements or habitat use in the Tensas River Basin.[13] Home range size varies considerably and depends partly on habitat quality.[14] The area needed to maintain a minimum viable population of black bears seems to be approximately 60,000 hectares (150,000 acres), but larger areas provide increased viability. Males have been known to range over 25,000 hectares (approximately 100 square miles), while females occupy much smaller home ranges, often less than 2,000 hectares (5,000 acres).[15]

**Food Habits**

The black bear, an omnivore, feeds primarily on vegetation.[16] Understory plants in forested areas found in the bear's diet include blackberries, pokeweed, elderberry, devil's walking stick, French mulberry, red mulberry, grapes, dogwoods, and paw paw.[17] Bears also eat beetles, grubs, and other invertebrates found in decomposing logs.

Bears are opportunistic feeders and will eat almost anything that is available.[18] Although natural foods comprise a majority of a bear's diet, bears will readily take advantage of food options provided by humans. When available, bears may feed on agricultural crops such as corn, wheat, oats, and sugarcane, occasionally damage beehives in search of honey, and will readily become habituated to human garbage or pet foods when the opportunity exists.[19]

In the late fall and early winter, prior to denning, bears feed on oak acorns, beechnuts, and pecans (hard mast crops) in order to build fat reserves.[20] During this time, the bears move extensively and forage continuously.[21] Hard mast food is a critical food source during this time of the year.[22] Increased acorn yields can result in reduced deathrate and an increased birthrate.[23]

**Breeding**

Female black bears become sexually mature at 3 to 5 years and have one to four cubs every other year.[24] Breeding takes place during the summer months and cubs are born in winter dens.[25] After the eggs are fertilized, implantation is delayed until the bear enters its winter den. Eight weeks later, the eight to twelve ounce cubs are born.[26] The young cubs grow rapidly, and emerge from the den with their mother about two months after birth.[27] The young remain with their mother for the first year, den with her the following winter, and search for their own territory in their second summer.[28]

## ENDNOTES – APPENDIX B


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4. Weaver, K.M., D.K. Tabberer, L.U. Moore, Jr., G.A. Chandler, J.C. Posey, and M.R. Pelton, "Bottomland Hardwood Forest Management for Black Bears in Louisiana," *Proceedings of the Annual Conference Southeastern Association of Fish and Wildlife Agencies*, Volume 44, 1990, pp. 342-350.

5. Personal Correspondence, Letter from Paul L. Davidson, Coordinator, Black Bear Conservation Committee, The Nature Conservancy of Louisiana, P.O. Box 4125, Baton Rouge, Louisiana, 70821, (504) 338-1040, October 4, 1995.

6. *Ibid.*

7. *Federal Register*, "Endangered and Threatened Wildlife and Plants; Threatened Status for the Louisiana Black Bear and Related Rules," Volume 57, pp. 588-595, January 7, 1992.

8. Weaver, K.M., D.K. Tabberer, L.U. Moore, Jr., G.A. Chandler, J.C. Posey, and M.R. Pelton, "Bottomland Hardwood Forest Management for Black Bears in Louisiana," *Proceedings of the Annual Conference Southeastern Association of Fish and Wildlife Agencies*, Volume 44, 1990, pp. 342-350.

9. *Ibid.*

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13. Weaver, K.M., D.K. Tabberer, L.U. Moore, Jr., G.A. Chandler, J.C. Posey, and M.R. Pelton, "Bottomland Hardwood Forest Management for Black Bears in Louisiana," *Proceedings of the Annual Conference Southeastern Association of Fish and Wildlife Agencies*, Volume 44, 1990, pp. 342-350.

14. Personal Communication, *Conversation with Richard Pace*, USFWS, LSU Cooperative Fish and Wildlife Research Unit, Baton Rouge, LA 70803, (504) 388-5747, February 11, 1993.

15. Personal Correspondence, Letter from Paul L. Davidson, Coordinator, Black Bear Conservation Committee, The Nature Conservancy of Louisiana, P.O. Box 4125, Baton Rouge, Louisiana, 70821, (504) 338-1040, October 4, 1995.

16. Pelton, M., "The Black Bear," *Audubon Wildlife Report 1987*, National Audubon Society, 1987.

17. Weaver, K.M., D.K. Tabberer, L.U. Moore, Jr., G.A. Chandler, J.C. Posey, and M.R. Pelton, "Bottomland Hardwood Forest Management for Black Bears in Louisiana," *Proceedings of the Annual Conference Southeastern Association of Fish and Wildlife Agencies*, Volume 44, 1990, pp. 342-350.

18. Black Bear Conservation Committee, *Black Bear Management Handbook for Louisiana, Mississippi and east Texas*, October 1992, p. 6.

19. Personal Correspondence, Letter from Paul L. Davidson, Coordinator, Black Bear Conservation Committee, The Nature Conservancy of Louisiana, P.O. Box 4125, Baton Rouge, Louisiana, 70821, (504) 338-1040, October 4, 1995.

20. Weaver, K.M., D.K. Tabberer, L.U. Moore, Jr., G.A. Chandler, J.C. Posey, and M.R. Pelton, "Bottomland Hardwood Forest Management for Black Bears in Louisiana," *Proceedings of the Annual Conference Southeastern Association of Fish and Wildlife Agencies*, Volume 44, 1990, pp. 342-350.

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24. Black Bear Conservation Committee, "Living With the Louisiana Black Bear," Undated brochure.

25. Black Bear Conservation Committee, *Black Bear Management Handbook for Louisiana, Mississippi and east Texas*, October 1992, p. 7.

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28. Black Bear Conservation Committee, "Living With the Louisiana Black Bear," Undated brochure.

# APPENDIX C

# RISK CODING MATRIX

## A. SEVERITY CATEGORIES:

Each severity category includes the consequences to personnel, the public, SPR investment loss, the environment, regulatory compliance, and the SPR mission. The hazard is placed in the highest category for which it meets one or more criteria (i.e., a potential death is "catastrophic" even if all other consequences are negligible.

| SEVERITY | Catastrophic | Critical | Marginal | Negligible |
|---|---|---|---|---|
| CONSEQUENCES | I | II | III | IV |
| Personnel | Death or fatal work-related illness. | Permanent disability, severe work-related illness or injury, or 5 or more lost workday cases from one occurrence. | Lost time injury or illness not resulting in disability or loss of quality of life. | Injury which results in no lost time and is treatable by first aid at the facility. |
| Public | Death, severe personal injury, or illness of one or more members of the public. | Any personal injury or illness to members of the public. | Any significant impact to members of the public not included in categories I and II, such as a major quality of life loss or perceived illness. | Little or no impact to members of the public. |
| Environment | A spill of oil, brine, or other hazardous substance in excess of 2,389 bbls[1], which has the potential for injury[2] to sensitive fish and wildlife habitats, sensitive biologics, or human-use activities.[3] | A 238-2,389 bbl spill of oil, brine, or other hazardous substance which has the potential for injury to sensitive fish and wildlife habitats, sensitive biologics, or human-use activities. | A reportable spill of less than 239 bbls of oil, brine, or other hazardous substance which has the potential for localized injury to sensitive fish and wildlife habitats, sensitive biologics, or human-use activities. | A nonreportable spill of oil, brine, or other hazardous substance which has low potential for injury to sensitive fish and wildlife habitats, sensitive biologics, or human-use activities. |
| Investment Loss | Singe occurrence loss greater than $2.5 million or an annual loss of $500,000 or more.[4] | A single occurrence loss of $100,000 - $2.5 million or an annual loss of $50,000 - $500,000. | A single occurrence loss of $10,000 - $100,000, or an annual loss of $5,000 - $50,000. | A single occurrence loss of less than $10,000 or an annual loss of less than $5,000. |
| Compliance | Major noncompliance with Federal, State, or local laws; enforcement actions; or compliance agreements significant to ES&H and involving significant potential fines or penalties.[5] | Major noncompliance with Executive Orders; DOE Orders; or Secretary of Energy Directives (Notice or Guidance Memoranda) significant to ES&H but not involving significant potential fines or penalties. | A marginal noncompliance with Federal, State, or local laws; Enforcement Actions; Compliance Agreements; Executive Orders; DOE Orders; or Secretary of Energy Directives significant to ES&H. | Significant deviation from good management practices with no potential civil or criminal penalties. |

1 Oil spill sizes are those defined for coastal (region) in the National Spill Contingency Plan.

2 (Environmental) injury is defined in 59 FR 126, July 1, 1994, i.e., a measurable adverse change, either long- or short-term, in the chemical or physical quality or the viability of a natural resource resulting either directly or indirectly from exposure to a discharge of oil, or exposure to a product of reactions resulting from a discharge of oil.

3 "Sensitive environments" as defined in 59 FR 126, July 1, 1994, includes areas such as wetlands, National and State parks, critical habitats for endangered/threatened species, wilderness and natural resource areas, marine sanctuaries and estuarine reserves, conservation area, preserves, wildlife areas, wildlife refuges, wild and scenic rivers, recreational areas, national forests, Federal and State lands that are research national areas, heritage program areas, land trust areas, and historical and archeological sites and parks. These areas may also include unique habitats such as: aquaculture surface water intakes, bird nesting areas, critical biological resource areas, designated migratory routes, and designated seasonal habitats.

4 Investment loss categories are adapted from those used in the ES&H Management Plan and dollar amounts are consistent with DOE accident investigation categories. Investment loss includes the sum of the dollar value of property damage or loss, equipment damage or loss, noncompliance fines and penalties, and spill clean-up costs.

5 Compliance definitions are those used in the DOE ES&H Management Plan.

| SEVERITY | Catastrophic | Critical | Marginal | Negligible |
|---|---|---|---|---|
| CONSEQUENCES | I | II | III | IV |
| SPR Mission | Equipment damage that results in site downtime[6] of 30 days or greater. | Equipment damage that results in downtime of greater than 10 but less than 30 days. | Equipment damage that results in downtime of one to ten days. | Equipment damage that results in less than one day of downtime. |

**B. FREQUENCY CATEGORIES:** "Occurrence Frequency" is assessed in terms of hazard probability, or the likelihood that an identified hazard will result in a mishap, based on an assessment of such factors as location, tasks performed, environment, and exposure. Exposure may be assessed in terms of cycles, hours of operation, or years. The SPR risk matrix is based upon the number of expected occurrences in a given number of years. Nonlinear risk impacts are assessed on an average yearly rate based on a normal equipment or scenario life cycle. Note that the frequency revision was intended to accomplish the following goals:

- Highlight immediate risks;
- Not de-emphasize high severity/low probability occurrences; and
- Be easily translatable to the Environmental Safety and Health Management Plan and the Dyn McDermott Project Authorization Board priority process.

| HIGHLY LIKELY (H) | LIKELY (L) | POSSIBLE (P) | UNLIKELY (U) |
|---|---|---|---|
| A hazard whose potential impact is very probable (100%) within the next year or one occurrence in a year. | A hazard whose potential impact is probable (10% - 100%) within the next year, or one whose impact has at least one chance of occurring within the next ten years. | A hazard whose potential impact is possible (1% - 10%), or has one chance of occurrence in a hundred years (this category can be compared to the 100-year flood exposures used in design). | A hazard whose potential impact is likely to occur less than once in a 100 years (<1%). |

**C. RISK CODING MATRIX:** The matrix shown below is a graphic representation of the definitions when integrated to a single risk code. Hazard control priorities of high, medium, low, and very low are indicated for each risk category.

| | FREQUENCY | | | |
|---|---|---|---|---|
| SEVERITY | *Highly Likely* | *Likely* | *Possible* | *Unlikely* |
| *Catastrophic* | IH | IL | IP | IU |
| *Critical* | IIH | IIL | IIP | IIU |
| *Marginal* | IIIH | IIIL | IIIP | IIIU |
| *Negligible* | IVH | IVL | IVP | IVU |

| | |
|---|---|
| | High Risk Hazards |
| | Medium Risk Hazards |
| | Low Risk Hazards |
| | Very Low Risk Hazards |