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Final Environmental Impact Statement

(Final Statement to FEA-DES 77-9)

STRATEGIC PETROLEUM RESERVE

Capline Group Salt Domes

Iberia, Napoleonville, Weeks Island Expansion
Bayou Choctaw Expansion, Chacahoula,

Iberia, Iberville, and Lafourche Parishes, Louisiana

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Responsible Official:

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Acting Assistant Secretary for Environment

U.S. DEPARTMENT OF ENERGY
Washington, DC 20545

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Volume III

Appendix C Environmental Impacts of the Proposed and Alternative Actions

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APPENDIX C

ENVIRONMENTAL IMPACTS OF THE PROPOSED AND ALTERNATIVE ACTIONS

APPENDIX C

ENVIRONMENTAL IMPACTS OF THE PROPOSED AND ALTERNATIVE ACTIONS

C.1 INTRODUCTION

Expected and potential impacts (both positive and negative) from construction and operation of the Capline Group of SPR crude oil storage sites are described in detail in this appendix. The most significant adverse effects that may occur are common to all candidate sites. These effects are related to the potential for oil spills, the release of hydrocarbon vapors during oil transfer operations, construction effects on wetland productivity and habitat value, brine disposal and the temporary influx of large numbers of construction workers to the region.

The risks associated with the handling and storage of both crude oil and brine are treated in Section C.2 to apply to the Capline Group in any of the site combinations. Environmental impacts of oil terminal facility construction and operation are described in Section C.3. Environmental impacts related to the proposed development of the Capline Group (early storage phase sites plus Napoleonville dome) are described in Section C.4. Sections C.5 through C.7 describe the impacts associated with the alternative site groupings.

C.2 SPR OIL AND BRINE SPILLS FOR THE CANDIDATE STORAGE SITES

As the risks of accidental release of oil and brine during project development and operation may have impacts on many aspects of the environment, the quantities of these fluids expected to be released to the environment are summarized in Section C.2 for each site. Detailed descriptions of oil and brine spill risks, including methodology of calculation, dispersal in the environment, and cleanup and prevention technology are provided in Appendix E. Evaluation of the associated environmental risks expected to accompany development of the terminal systems and each site is provided in the site-specific descriptions of impact in Sections C.3 through C.7.

Oil spills expected to accompany development of SPR storage facilities would result from marine transport between the Gulf of Mexico and the docks at St. James and Sunshine, from terminal operation at the storage sites and at the terminal tank farms. The risk of cavern collapse is considered unlikely. An analysis of the cavern design from an aspect of stability appears in Appendix F. Estimates of spill frequency and total spill volume are provided in Tables C.2-1 through C.2-8 (taken from Appendix E) during cavern fill and cavern withdrawal operations, respectively, for the early storage development and SPR expansion at each group of candidate sites, and for each terminal system combination (see Section 2.3.1).

The greatest volume of oil spill is expected to occur during cavern fill (for each site) because of the VLCC tanker lightering operation in the Gulf. (During withdrawal, oil is expected to transported directly to other ports by 45,000 to 50,000 dead weight ton (MDWT) tankers.) The greatest potential for large oil spills would occur with tanker transport between the Gulf and the terminals (60,000 barrels maximum credible spill; 1,111 barrels average spill); however, there are estimated to be 14 tanker casualty spills (of any size) during five full fill/withdrawal cycles for 383 MMB Capline Group storage site combination (Tables C.2-7 and C.2-8).

TABLE C.2-1a Expected crude oil spill during cavern fill operations - proposed system - DOE/Koch terminal combination.

	Average Spill Size	Bayou Choctaw (Early Storage)		Weeks Island (Early Storage)		Napoleonville		Total Program Spill Risk		Maximum Credible Spill Size
		No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	Barrels
Gulf of Mexico										
Transfers	16.2	17.4	282	16.5	267	27.8	450	61.7	999	1,000
Vessel Casualty	1111	0.010	11.1	0.0095	10.6	0.016	17.8	0.036	39.5	60,000
Mississippi River										
Vessel Casualty	428	0.510	218	0.484	207	0.815	349	1.81	774	60,000
Koch Transfers	27	---	---	---	---	4.57	123	4.57	123	500
DOE Transfers	27	3.48	94	3.30	89	0.99	27	7.77	210	500
Pipelines										
Pumping	1100	0.029	31.6	0.042	46,5	0.024	25.8	0.095	103.9	5,000
Terminals										
Koch	1100	---	---	---	---	0.0615	67.7	0.062	67.7	5,000
DOE	1100	0.047	51.7	0.0445	49.0	0.0135	14.9	0.105	115.6	5,000
Storage Site	500	0.047	23.5	0.0445	22.3	0.075	37.5	0.167	83.3	3,000
Total										
Single Fill		21.52	711.9	20.43	691.4	34.37	1112.7	76.32	2,516	
Total										
5 Fills		107.6	3560	102.1	3457	171.9	5564	381.6	12,581	

TABLE C.2-1b Expected crude oil spills during emergency oil withdrawal operations and total system spill expectation - proposed system - DOE/Koch terminal combination.

	Average Spill Size	Bayou Choctaw (Early Storage)		Weeks Island (Early Storage)		Napoleonville		Total Program Spill Risk		Maximum Credible Spill Size
		No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	Barrels
Gulf of Mexico										
Vessel Casualty	1111	0.0036	4.0	0.0036	4.0	0.001	1.2	0.0082	9.2	60,000
Mississippi River										
Vessel Casualty	428	0.324	139	0.324	139	0.097	41.4	0.745	319.4	60,000
Koch Transfers	80.6	-	-	1.49	120	-	-	1.49	120	500
DOE Transfers	80.6	1.49	120	-	-	0.44	36	1.93	156	500
Bull Bay										
Barge Casualty	428	0.003	1.3	-	-	-	-	0.003	1.3	20,000
Transfers	3.6	4.17	15	-	-	-	-	4.17	15	500
Pipelines										
Pumping	1100	0.008	8.8	0.014	15.6	0.004	4.6	0.026	29.0	5,000
Terminals										
Koch	1100	-	-	0.030	33	-	-	0.030	33.0	5,000
DOE	1100	0.030	33	-	-	0.009	9.9	0.039	42.9	5,000
Storage Site	500	0.047	23.5	0.045	22.3	0.075	37.5	0.167	83.3	3,000
Total										
Single Withdrawal		6.08	344.6	1.91	333.9	0.63	130.6	8.61	809.1	
Total										
5 Withdrawals		30.4	1723	9.5	1670	3.2	653	43.1	4,046	
Project Total										
5 Cycles		138.0	5283	111.6	5127	175.1	6217	424.7	16,627	

TABLE C.2-2a Expected crude oil spill during cavern fill operations - proposed system - DOE/Nordix terminal combination.

	Average Spill Size	Bayou Choctaw (Early Storage)		Weeks Island (Early Storage)		Napoleonville		Total Program Spill Risk		Maximum Credible Spill Size
		No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	Barrels
Gulf of Mexico										
Transfers	16.2	17.4	282	16.5	267	27.8	450	61.7	999	1,000
Vessel Casualty	1111	0.010	11.1	0.0095	10.6	0.016	17.8	0.036	39.5	60,000
Mississippi River										
Vessel Casualty	428	0.657	281	0.484	207	0.995	426	2.136	914	60,000
Nordix Transfers	27	3.48	94	---	---	3.38	91	6.86	185	500
DOE Transfers	27	---	---	3.30	89	2.18	59	5.48	148	500
Pipelines										
Pumping	1100	0.013	14.6	0.42	46.5	0.53	58.1	0.108	119	5,000
Terminals										
Nordix	1100	0.047	51.7	---	---	0.0455	50.1	0.093	102	5,000
DOE	1100	---	---	0.0455	49.0	0.0295	32.5	0.074	81.5	5,000
Storage Site	500	0.047	23.5	0.0445	22.3	0.075	37.5	0.167	83.3	3,000
Total										
Single Fill		21.65	757.9	20.43	691.4	34.57	1222	76.65	2,671	
Total										
5 Fills		108.3	3790	102.1	3457	172.9	6110	383.3	13,357	

TABLE C.2-2b Expected crude oil spill during emergency oil withdrawal operations and total system spill expectation - proposed system - DOE/Nordix terminal combination.

	Average Spill Size	Bayou Choctaw (Early Storage)		Weeks Island (Early Storage)		Napoleonville		Total Program Spill Risk		Maximum Credible Spill Size
		No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	Barrels
Gulf of Mexico										
Vessel Casualty	1111	0.0036	4.0	0.0036	4.0	0.001	1.2	0.0082	9.2	60,000
Mississippi River										
Vessel Casualty	428	0.418	179	0.324	139	0.097	41.4	0.839	359.4	60,000
Nordix Transfers	80.6	1.49	120	--	--	--	--	1.49	120	500
DOE Transfers	80.6	--	--	1.49	120	0.44	36	1.93	156	500
Bull Bay										
Barge Casualty	428	0.003	1.3	--	--	--	--	0.003	1.3	20,000
Transfers	3.6	4.17	15	--	--	--	--	4.17	15	500
Pipelines										
Pumping	1100	0.009	10.4	0.014	14.9	0.005	5.4	0.028	30.7	5,000
Terminals										
Nordix	1100	0.030	33.0	--	--	--	--	0.030	33.0	5,000
DOE	1100	--	--	0.030	33	0.009	9.9	0.039	42.9	5,000
Storage Site	500	0.047	23.5	0.045	22.3	0.075	37.5	0.167	83.3	3,000
Total										
Single Withdrawal		6.17	386.2	1.91	333.2	0.63	131.4	8.71	850.8	
Total										
5 Withdrawals		30.9	1931	9.5	1666	3.2	657	43.6	4254	
Project Total										
5 Cycles		139.2	5721	111.6	5123	176.1	6767	426.9	17,611	

TABLE C.2-3a Expected crude oil spills during cavern fill operations - alternative site grouping #1 - DOE/Koch terminal combination.

	Average Spill Size	Bayou Choctaw (Early Storage)		Weeks Island (Early Storage)		Weeks Island Expansion		Total Program Spill Risk		Maximum Credible Spill Size
		No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	Barrels
Gulf of Mexico										
Transfers	16.2	17.4	282	16.5	267	16.8	273	50.7	822	1,000
Vessel Casualty	1111	0.010	11.1	0.0095	10.6	0.0097	10.8	0.029	32.5	60,000
Mississippi River										
Vessel Casualty	428	0.510	218	0.484	207	0.494	211	1.488	636	60,000
Koch Transfers	27	3.48	94	-	-	0.48	13	3.96	107	500
DOE Transfers	27	-	-	3.30	89	2.89	78	6.19	167	500
Pipelines										
Pumping	1100	0.031	34.0	0.023	25.7	0.024	26.2	0.078	85.9	5,000
Terminals										
Koch	1100	0.047	51.7	-	-	0.0065	7.2	0.054	58.9	5,000
DOE	1100	-	-	0.0045	49.0	0.039	42.9	0.084	91.4	5,000
Storage Site	500	0.047	23.5	0.0445	22.3	0.0455	22.8	0.137	68.6	3,000
Total										
Single Fill		21.52	714.3	20.41	670.6	20.79	684.9	62.72	2,070	
Total										
5 Fills		107.6	3572	102.1	3353	104.0	3425	313.6	10,349	

TABLE C.2-3b Expected crude oil spills during emergency oil withdrawal operations and total system spill expectation - alternative site grouping #1 - DOE/Koch terminal combination.

	Average Spill Size	Bayou Choctaw (Early Storage)		Weeks Island (Early Storage)		Weeks Island Expansion		Total Program Spill Risk		Maximum Credible Spill Size
		No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	Barrels
Gulf of Mexico										
Vessel Casualty	1111	0.0036	4.0	0.0021	2.4	0.0022	2.4	0.008	8.8	60,000
Mississippi River										
Vessel Casualty	428	0.324	139	0.191	81.8	0.196	83.9	0.711	304.7	60,000
Koch Transfers	80.6	1.49	120	--	--	--	--	1.49	120	500
DOE Transfers	80.6	--	--	0.88	71.2	0.90	72.8	1.78	144	500
Bull Bay										
Barge Casualty	428	0.003	1.3	--	--	--	--	0.003	1.3	20,000
Transfers	3.6	4.17	15	--	--	--	--	4.17	15	500
Pipelines										
Pumping	1100	0.009	9.5	0.008	8.9	0.009	9.1	0.025	27.5	5,000
Terminals										
Koch	1100	0.030	33	--	--	--	--	0.30	33	5,000
DOE	1100	--	--	0.018	19.6	0.018	20	0.036	39.6	5,000
Storage Site	500	0.047	23.5	0.045	22.3	0.046	50.1	0.138	95.9	3,000
Total										
Single Withdrawal		6.07	345.3	1.14	206.2	1.17	238.3	8.39	789.8	
Total										
5 Withdrawals		30.4	1726	5.7	1031	5.8	1191	42.0	3949	
Project Total										
5 Cycles		138.0	5298	107.8	4384	109.8	4616	355.6	14,298	

TABLE C.2-4a Expected crude oil spills during cavern fill operations - alternative site grouping #1 - DOE/Nordix terminal combination.

	Average Spill Size	Bayou Choctaw (Early Storage)		Weeks Island (Early Storage)		Weeks Island Expansion		Total Program Spill Risk		Maximum Credible Spill Size
		No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	Barrels
Gulf of Mexico										
Transfers	16.2	17.4	282	16.5	267	16.8	273	50.7	822	1,000
Vessel Casualty	1111	0.010	11.1	0.0095	10.6	0.0097	10.8	0.029	32.5	60,000
Mississippi River										
Vessel Casualty	428	0.657	281	0.484	207	0.580	248	1.721	736	60,000
Nordix Transfers	27	3.48	94	-	-	2.03	55	5.51	149	500
DOE Transfers	27	-	-	3.30	89	1.33	36	4.63	125	500
Pipelines										
Pumping	1100	0.018	20.2	0.031	33.6	0.031	34.5	0.080	88.3	5,000
Terminals										
Nordix	1100	0.047	51.7	-	-	0.0275	30.3	0.075	82.0	5,000
DOE	100	-	-	0.0445	49.0	0.0180	19.8	0.063	68.8	5,000
Storage Site	500	0.047	23.5	0.0445	22.3	0.0455	22.8	0.137	68.6	3,000
Total										
Single Fill		21.66	763.5	20.41	678.5	20.86	730.2	62.95	2,172	
Total										
5 Fills		108.3	3817	102.1	3393	104.3	3651	314.8	10,861	

TABLE C.2-4b Expected crude oil spills during emergency oil withdrawal operations and total system spill expectation - alternative site grouping #1 - DOE/Nordix terminal combination.

	Average Spill Size	Bayou Choctaw (Early Storage)		Weeks Island (Early Storage)		Weeks Island Expansion		Total Program Spill Risk		Maximum Credible Spill Size
		No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	Barrels
Gulf of Mexico										
Vessel Casualty	1111	0.0036	4.0	0.0021	2.4	0.0022	2.4	0.008	8.8	60,000
Mississippi River										
Vessel Casualty	428	0.418	179	0.191	81.8	0.196	83.9	0.805	344.7	60,000
Nordix Transfers	80.6	1.49	120	---	---	---	---	1.49	120	500
DOE Transfers	80.6	---	---	0.88	71.2	0.90	72.8	1.78	144	500
Bull Bay										
Barge Casualty	428	0.003	1.3	---	---	---	---	0.003	1.3	20,000
Transfers	3.6	4.17	15	---	---	---	---	4.17	15	500
Pipelines										
Pumping	1100	0.009	10.4	0.008	9.3	0.009	9.5	0.026	29.2	5,000
Terminals										
Nordix	1100	0.030	33.0	---	---	---	---	0.030	33	5,000
DOE	1100	---	---	0.018	19.6	0.018	20.0	0.036	39.6	5,000
Storage Site	500	0.047	23.5	0.045	22.3	0.046	50.1	0.138	95.9	3,000
Total										
Single Wighdrawal		6.17	386.2	1.14	206.6	1.19	238.7	8.49	831.5	
Total										
5 Withdrawals		30.9	1931	5.7	1033	5.9	1194	42.5	4,158	
Project Total										
5 Cycles		139.2	5748	107.8	4426	110.2	4845	357.2	15,019	

TABLE C.2-5a Expected crude oil spills during cavern fill operations - alternative grouping #2 - DOE/Koch terminal combination.

	Average Spill Size	Bayou Choctaw (Early Storage)		Weeks Island (Early Storage)		Bayou Choctaw Expansion		Iberia		Total Program Spill Risk		Maximum Credible Spill Size
		No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	Barrels
Gulf of Mexico												
Transfers	16.2	17.4	282	16.5	267	10.4	168	9.2	150	53.5	867	1,000
Vessel Casualty	1111	0.010	11.1	0.0095	10.6	0.0060	6.6	0.0053	5.9	0.031	34.1	60,000
Mississippi River												
Vessel Casualty	428	0.510	218	0.484	207	0.303	130	0.272	117	1.569	672	60,000
Koch Transfers	27	---	---	2.11	57	---	---	1.87	50	3.98	107	500
DOE Transfers	27	3.48	94	1.19	32	2.07	56	---	---	6.74	182	500
Pipelines												
Pumping	1100	0.029	31.6	0.049	53.5	0.002	2.0	0.008	9.0	0.088	96.1	5,000
Terminals												
Koch	1100	---	---	0.029	31.9	---	---	0.025	27.5	0.054	59.4	5,000
DOE	1100	0.047	51.7	0.016	17.6	0.028	30.8	---	---	0.091	100.1	5,000
Storage Site	500	0.047	23.5	0.0445	22.3	0.028	14.0	0.025	12.5	0.145	72.3	3,000
Total												
Single Fill		21.52	711.9	20.43	698.8	12.84	407.4	11.41	371.9	66.20	2,190	
Total												
5 Fills		107.6	3560	102.1	3494	64.2	2037	57.1	1859	331.0	10,950	

TABLE C.2-5b Expected crude oil spills during emergency oil withdrawal operations and total system spill expectations - alternative site grouping #2 - DOE/Koch terminal combination.

	Average Spill Size	Bayou Choctaw (Early Storage)		Weeks Island (Early Storage)		Bayou Choctaw Expansion		Iberia		Total Program Spill Risk		Maximum Credible Spill Size
		No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	Barrels
Gulf of Mexico												
Vessel Casualty	1111	0.0022	2.5	0.0036	4.0	0.0014	1.6	---	---	0.007	8.1	60,000
Mississippi River												
Vessel Casualty	428	0.198	84.9	0.324	139	0.126	53.9	---	---	0.648	277.8	60,000
Koch Transfers	80.6	0.91	73.6	---	---	0.58	47.0	---	---	1.49	120.6	500
DOE Transfers	80.6	---	---	1.49	120	---	---	---	---	1.49	120	500
Bull Bay												
Barge Casualty	428	0.003	1.3	---	---	---	---	---	---	0.003	1.3	20,000
Transfers	3.6	4.17	15	---	---	---	---	---	---	4.17	15	500
Pipelines												
Pumping	1100	0.005	5.9	0.014	14.9	0.003	3.5	0.003	3.4	0.025	27.7	5,000
Terminals												
Koch	1100	0.018	20.2	---	---	0.012	12.9	---	---	0.030	33.1	5,000
DOE	1100	---	---	0.030	33.0	---	---	---	---	0.030	33.0	5,000
Storage Site	500	0.047	23.5	0.045	22.3	0.028	14.0	0.025	12.5	0.145	72.3	3,000
Total												
Single Withdrawal		5.35	226.9	1.91	333.2	0.75	132.9	0.03	15.9	8.04	708.9	
Total												
5 Withdrawals		26.7	1135	9.5	1666	3.8	665	0.2	79	40.2	3,545	
Project Total												
5 Cycles		134.3	4695	111.6	5160	68.0	2702	57.3	1938	371.2	14,495	

TABLE C.2-6a Expected crude oil spills during cavern fill operations - alternative grouping #2 - DOE/Nordix terminal combination.

	Average Spill Size	Bayou Choctaw (Early Storage)		Weeks Island (Early Storage)		Bayou Choctaw Expansion		Iberia		Total Program Spill Risk		Maximum Credible Spill Size
		No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	Barrels
Gulf of Mexico												
Transfers	16.2	17.4	282	16.5	267	10.4	168	9.2	150	53.5	867	1,000
Vessel Casualty	1111	0.010	11.1	0.0095	10.6	0.0060	6.6	0.0053	5.9	0.031	34.1	60,000
Mississippi River												
Vessel Casualty	428	0.657	281	0.502	215	0.391	167	0.272	117	1.822	780	60,000
Nordix Transfers	27	3.48	94	0.41	11	2.07	56	--	--	5.96	161	500
DOE Transfers	27	--	--	2.89	78	--	--	1.87	50	4.75	128	500
Pipelines												
Pumping	1100	0.013	14.6	0.050	55.4	0.013	14.2	0.008	9.0	0.084	93.2	5,000
Terminals												
Nordix	1100	0.047	51.7	0.006	6.1	0.028	30.8	--	--	0.081	88.6	5,000
DOE	1100	--	--	0.039	42.9	--	--	0.025	27.5	0.064	70.4	5,000
Storage Site	500	0.047	23.5	0.0445	22.3	0.028	14.0	0.025	12.5	0.145	72.3	3,000
Total												
Single Fill		21.65	757.9	20.45	708.2	12.94	456.6	11.41	371.9	66.44	2294.6	
Total												
5 Fills		108.2	3790	102.3	3541	64.7	2283	57.1	1859	332.2	11,473	

TABLE C.2-6b Expected crude oil spills during emergency oil withdrawal operations and total system spill expectations - alternative site grouping #2 - DOE/Nordix terminal combination.

	Average Spill Size	Bayou Choctaw (Early Storage)		Weeks Island (Early Storage)		Bayou Choctaw Expansion		Iberia		Total Program Spill Risk		Maximum Credible Spill Size
		No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	Barrels
Gulf of Mexico												
Vessel Casualty	1111	0.0022	2.5	0.0036	4.0	0.0014	1.6	---	---	0.007	8.1	60,000
Mississippi River												
Vessel Casualty	428	0.256	110	0.324	139	0.162	69.4	---	---	0.742	318.4	60,000
Nordix Transfers	80.6	0.91	73.6	---	---	0.58	47.0	---	---	1.49	120.6	500
DOE Transfers	80.6	---	---	1.49	120	---	---	---	---	1.49	120	500
Bull Bay												
Barge Casualty	428	0.003	1.3	---	---	---	---	---	---	0.003	1.3	20,000
Transfers	3.6	4.17	15	---	---	---	---	---	---	4.17	15	500
Pipelines												
Pumping	1100	0.006	6.5	0.014	15.6	0.004	3.9	0.003	3.4	0.027	29.4	5,000
Terminals												
Nordix	1100	0.018	20.2	---	---	0.012	12.9	---	---	0.030	33.1	5,000
DOE	1100	---	---	0.030	33.0	---	---	---	---	0.030	33.0	5,000
Storage Site	500	0.047	23.5	0.045	22.3	0.028	14.0	0.025	12.5	0.145	72.3	3,000
Total												
Single Withdrawal		5.41	252.6	1.91	33.9	0.79	148.8	0.03	15.9	8.13	751.2	
Total												
5 Withdrawals		27.1	1263	9.5	1670	3.9	744	0.2	79	40.7	3,756	
Project Total												
5 Cycles		135.3	5053	111.8	5211	68.6	3027	57.3	1938	372.9	15,229	

TABLE C.2-7a Expected crude oil spills during cavern fill operations - alternative grouping #3 - DOE/Koch terminal combination.

	Average Spill Size	Bayou Choctaw (Early Storage)		Weeks Island (Early Storage)		Chacahoula		Total Program Spill Risk		Maximum Credible Spill Size
		No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	Barrels
Gulf of Mexico										
Transfers	16.2	17.4	282	16.5	267	37.1	600	71.0	1,149.0	1,000
Vessel Casualty	1111	0.010	11.1	0.0095	10.6	0.0213	23.7	0.041	45.3	60,000
Mississippi River										
Vessel Casualty	428	0.510	218	0.484	207	1.087	465	2.081	890	60,000
Koch Transfers	27	3.48	94	-	-	1.78	48	5.26	142	500
DOE Transfers	27	-	-	3.30	89	5.63	152	8.93	241	500
Pipelines										
Pumping	1100	0.029	31.6	0.042	46.5	0.024	26.7	0.095	104.8	5,000
Terminals										
Koch	1100	0.047	51.7	-	-	0.024	26.4	0.071	78.1	5,000
DOE	1100	-	-	0.045	49.0	0.076	83.6	0.121	132.6	5,000
Storage Site	500	0.047	23.5	0.0445	22.3	0.100	50.0	0.192	95.8	3,000
Total										
Single Fill		21.52	711.9	20.42	691.3	45.84	1475.4	87.79	2,878.6	
Total										
5 Fills		107.6	3559	102.1	3457	229.2	7377	438.9	14,393	

[a] 383 MMB total capacity distributed as follows: 200 MMB expansion capacity at Chacahoula dome
94 MMB early storage capacity at Bayou Choctaw
89 MMB early storage capacity at Weeks Island

TABLE C.2-7b Expected crude oil spills during emergency oil withdrawal operations and total system spill expectations - alternative site grouping #3 - DOE/Koch terminal combination.

	Average Spill Size	Bayou Choctaw (Early Storage)		Weeks Island (Early Storage)		Chacahoula		Total Program Spill Risk		Maximum Credible Spill Size
		No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	Barrels
Gulf of Mexico										
Vessel Casualty	1111	0.0036	4.0	0.0036	4.0	0.0022	2.4	0.009	10.4	60,000
Mississippi River										
Vessel Casualty	428	0.324	139	0.324	139	0.194	82.9	0.842	360.9	60,000
Koch Transfers	80.6	1.49	120	-	-	-	-	1.49	120	500
DOE Transfers	80.6	-	-	1.49	120	0.89	72	2.38	192	500
Bull Bay										
Barge Casualty	428	0.003	1.3	-	-	-	-	0.003	1.3	20,000
Transfers	3.6	4.17	15	-	-	-	-	4.17	15	500
Pipelines										
Pumping	1100	0.009	9.5	0.014	14.9	0.007	7.5	0.030	31.9	5,000
Terminals										
Koch	1100	0.030	33	-	-	-	-	0.030	33	5,000
DOE	1100	-	-	0.030	33	0.018	19.8	0.048	52.8	5,000
Storage Site	500	0.047	23.5	0.045	22.3	0.100	50.0	0.192	95.8	3,000
Total										
Single Withdrawal		6.08	345.3	1.91	333.2	1.21	234.6	9.20	913.1	
Total										
5 Withdrawals		30.4	1727	9.5	1666	6.1	1173	46.0	4,566	
Project Total										
5 Cycles		138.0	5286	111.6	5123	235.2	8550	484.9	18,959	

TABLE C.2-8a Expected crude oil spills during cavern fill operations - alternative site grouping #3 - DOE/Nordix terminal combination.

	Average Spill Size	Bayou Choctaw (Early Storage)		Weeks Island (Early Storage)		Chacahoula		Total Program Spill Risk		Maximum Credible Spill Size
		No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	Barrels
Gulf of Mexico										
Transfers	16.2	17.4	282	16.5	267	37.1	600	71.0	1,149.0	1,000
Vessel Casualty	1111	0.010	11.0	0.0095	10.6	0.0213	23.7	0.041	45.3	60,000
Mississippi River										
Vessel Casualty	428	0.657	281	0.484	207	1.273	545	2.414	1,033	60,000
Nordix Transfers	27	3.48	94	-	-	4.40	119	7.88	213	500
DOE Transfers	27	-	-	3.30	89	3.01	81	6.31	170	500
Pipelines										
Pumping	1100	0.013	14.6	0.042	46.5	0.049	53.4	0.104	114.5	5,000
Terminals										
Nordix	1100	0.047	51.7	-	-	0.059	65.5	0.106	117.2	5,000
DOE	1100	-	-	0.045	49.0	0.041	44.6	0.086	93.6	5,000
Storage Site	500	0.047	23.5	0.0445	22.3	0.100	50.0	0.192	95.8	3,000
Total										
Single Fill		21.65	757.9	20.42	691.3	46.05	1582.2	88.13	3,031.4	
Total										
5 Fills		108.3	3,789	102.1	3457	230.2	7911	440.6	15,157	

[a] 383 MMB total capacity distributed as follows: 200 MMB expansion capacity at Chacahoula dome
94 MMB early storage capacity at Bayou Choctaw
89 MMB early storage capacity at Weeks Island

TABLE C.2-8b Expected crude oil spills during emergency oil withdrawal operations and total system spill expectations - alternative site grouping #3 - DOE/Nordix. terminal combination.

	Average Spill Size	Bayou Choctaw (Early Storage)		Weeks Island (Early Storage)		Chacahoula		Total Program Spill Risk		Maximum Credible Spill Size
		No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	No. Spills	Barrels	Barrels
Gulf of Mexico										
Vessel Casualty	1111	0.0036	4.0	0.0036	4.0	0.0022	2.4	0.009	10.4	60,000
Mississippi River										
Vessel Casualty	428	0.418	179	0.324	139	0.259	111	1.001	429	60,000
Nordix Transfers	80.6	1.49	120	-	-	0.89	72	2.38	192	500
DOE Transfers	80.6	-	-	1.49	120	-	-	1.49	120	500
Bull Bay										
Barge Casualty	428	0.003	1.3	-	-	-	-	0.003	1.3	20,000
Transfers	3.6	4.17	15	-	-	-	-	4.17	15	500
Pipelines										
Pumping	1100	0.009	10.4	0.014	15.6	0.010	10.6	0.033	36.6	5,000
Terminals										
Nordix	1100	0.030	33	-	-	0.018	19.8	0.048	52.8	5,000
DOE	1100	-	-	0.030	33	-	-	0.030	33	5,000
Storage Site	500	0.047	23.5	0.045	22.3	0.100	50.0	0.192	95.8	3,000
Total										
Single Withdrawal		6.17	386.2	1.91	333.9	1.28	265.8	9.36	985.9	
Total										
5 Withdrawals		30.9	1931	9.5	1670	6.4	1329	46.8	4,930	
Project Total										
5 Cycles		139.2	5720	111.6	5127	236.6	9240	487.4	20,087	

Because exposures are similar, the expected frequency and volume of oil spills is basically a function of storage capacity. Thus a 383 MMB storage capacity at a combination of sites would produce roughly 1.4 times as much oil spillage as a 284 MMB storage site (383/284=1.35).

A summary of brine and salt water spill risk expectations for the candidate SPR sites is provided in Table C.2-9 for leaching, oil fill, oil withdrawal and standby storage. Brine spill exposures occur from pipelines during leaching, oil withdrawal, and standby storage. Brine spill exposure is greatest during cavern fill; fresh water spill exposure is greatest during standby storage because of the assumed continuous exposure.

In describing site-specific impacts to water quality, ecology, and other aspects of the environment, in Sections C.3 through C.7 reference will be made to the spill expectations given in Tables C.2-1 through C.2-9.

TABLE C.2-9 Expected brine spill during leaching and fill operations.[a,b]

	Leaching	Cavern Fill	Program Total 5 cycles + leach	Average Spill Size (BBL)
I. Proposed System				
Napoleonville				
- No. Spills	.016	.009	.061	
- Barrels	48.8	27.6	186.8	3000
Bayou Choctaw				
- No. Spills	-	.003	.015	
- Barrels	-	7.7	38.5	3000
TOTAL				
- No. Spills	.016	.012	.076	
- Barrels	48.8	35.3	225.3	-
II. Alternative Group I				
Weeks Island Expansion				
- No. Spills	.009	.003	.024	
- Barrels	45.3	17.2	131.3	5000
Bayou Choctaw				
- No. Spills	-	.003	.015	
- Barrels	-	7.7	38.5	3000
TOTAL				
- No. Spills	.009	.006	.039	
- Barrels	45.3	24.9	169.8	-
III. Alternative Group 2				
Bayou Choctaw Expansion				
- No. Spills	.005	.002	.015	
- Barrels	16.2	4.7	39.7	3000
Iberia Dome				
- No. Spills	.008	.002	.018	
- Barrels	23.1	5.3	49.6	3000
Bayou Choctaw				
- No. Spills	-	.003	.015	
- Barrels	-	7.7	38.5	3000
TOTAL				
- No. Spills	.013	.007	.048	
- Barrels	39.3	17.7	127.8	-
IV. Alternative Group 3				
Chacahoula				
- No. Spills	.072	.047	.307	
- Barrels	360.5	236.9	1545	5000
Bayou Choctaw				
- No. Spills	-	.003	.015	
- Barrels	-	7.7	38.5	3000
TOTAL				
- No. Spills	.072	.050	.322	
- Barrels	360.5	244.6	1583.5	-

[a]Maximum credible spill 30,000 BBL

[b]Weeks Island early storage is non-contributing

C.3 CAPLINE GROUP SPR OIL DISTRIBUTION TERMINAL SYSTEMS

C.3.1 Introduction

Crude oil to be stored in the Capline Group SPR sites would be shipped in Very Large Crude Carriers (VLCCs) to the Gulf of Mexico. There, the crude would be loaded onto conventional tankers (up to 80,000 DWT) and transported up the Mississippi River to terminal systems, which, in turn, would be connected to the storage sites.

It is anticipated that two terminal systems on the Mississippi River would be used in combination to offload the crude oil from conventional tankers. These terminal systems comprise docks, oil surge tanks, connecting pipelines and valves, meters, and pumps. The number of docks, capacity of the tanks, and pipeline sizes would largely be determined by the throughput requirements of the Capline Group SPR system.

DOE has made the decision to build an early storage phase terminal system on the west bank of the Mississippi River immediately south of the CAPLINE Terminal at St. James, Louisiana. Construction and use of this terminal to serve Bayou Choctaw, Weeks Island, and Cote Blanche early storage sites was addressed in the May 1977 supplement to the Bayou Choctaw EIS (FES 76-5), and in the August 1977 supplement to the Cote Blanche and Weeks Island EISs (FES 76/77-7 and 8). The terminal will include two tanker docks and eight 200,000-barrel storage tanks. However, to meet the increased oil handling requirements of the Capline Group expansion, the DOE terminal would be expanded and additional terminal facilities may be needed at either of two nearby commercial terminals. These two terminals are the Koch, Inc., terminal at St. James, Louisiana, and the Nordix, Inc., terminal at Sunshine, Louisiana. Expansion of either of these two commercial terminals as a result of SPR activity would depend on program needs and the ability to reach an agreement with the terminal owners. The construction and use of these facilities as part of the SPR Program is assessed in this EIS so that a "worst-case" analysis of the potential impacts is presented.

The new Koch facilities which could be constructed for SPR use have not been assessed in previous environmental statements. Due to the proximity of the new Koch facility to the DOE terminal system, much of the description provided for that system would be applicable to the Koch terminal system. The major facility components of the Koch terminal system include: construction of a new dock on the east bank of the Mississippi River near St. James, Louisiana; construction of three 500,000-barrel oil surge tanks at the Koch terminal on the west bank of the Mississippi; and construction of a pipeline under the river, connecting the dock and oil surge tanks. The construction and operation of these components would be undertaken by the Koch Oil Company for the DOE.

The new Nordix terminal system components which could be constructed for SPR use have not been assessed in previous environmental statements. The major facility components of the Nordix terminal system include: construction of a new dock on the east bank of the Mississippi River, near Sunshine, Louisiana; construction of ten 150,000-barrel oil surge tanks on the east bank of the river; and construction of a pipeline under the river, connecting the terminal and the Bayou Choctaw-St. James Early storage phase pipeline. The construction and operation of these components would be undertaken by Nordix, Inc. for the DOE.

It is anticipated that only one of the two commercial terminal systems would be needed in addition to the DOE terminal for efficient operation of the Capline SPR Group. Therefore, for analysis purposes, two possible terminal systems which could satisfy the requirements of the SPR program were assessed. These combinations, and the major components of each, are shown. The circled portions are those components which are new to the Capline Group SPR program and which will be addressed in Section C.3.2. The appropriate EIS supplements referenced above should be consulted for the construction impacts of the other components. A summary of construction impacts for all facilities is included in Table C.3-2. The cumulative impact of operating the terminal systems for transporting the entire SPR storage volume is described in Section C.3.3.

MAJOR COMPONENTS OF THE CAPLINE
GROUP SPR OIL DISTRIBUTION TERMINAL SYSTEMS

Terminal System	Docks	Oil Surge Tanks	Pipelines
DOE	1-Described in Weeks Island FES Supplement	4-200,000 bbl Described in Weeks Island FES Supplement	None
	1-Described in Bayou Choctaw FES	4-200,000 bbl Described in Bayou Choctaw FES Supplement	
		4-200,000 bbl	
Koch	1-New @ Koch on east bank 1-Part-time use of existing @ Koch on west bank	3-500,000 bbl on west bank	3.2 mi. from dock on east bank to oil surge tank on west bank
DOE	1-Described in Weeks Island Early Storage FES	4-200,000 bbl Described in Weeks Island FES	None
	1-Described in Bayou Choctaw Early Storage FES Supplement	4-200,000 bbl Described in Bayou Choctaw FES Supplement	
		4-200,000 bbl	
Nordix	1-New @ Nordix 1-Part-time use of existing @ Nordix on east bank	10-150,000 bbl	7.0 mi. from Nordix to Bayou Choctaw-St. James Pipeline or an alternative 10.0 mile pipeline to the same areas

The first combination is the DOE/Koch terminal system. The new Koch system components to be described herein, include one dock to be constructed and operated by the Koch Oil Company for the DOE, three 500,000 barrel oil surge tanks, and a connecting pipeline. The DOE terminal system, comprising two docks and eight 200,000-barrel oil surge tanks, has been described and assessed and needs no further discussion.

However, four additional 200,000-barrel oil surge tanks constructed and operated at the DOE terminal system will be described.

The second combination is the DOE/Nordix terminal system. The new Nordix system components to be described herein include one dock, to be constructed and operated by the Nordix, Inc. for the DOE; ten 150,000-barrel oil surge tanks; and a proposed 7.0-mile or alternative 10-mile pipeline. The DOE terminal system, comprising two docks and eight 200,000-barrel oil surge tanks, has been previously described and assessed and needs no further discussion. An additional four 200,000-barrel oil surge tanks are new to the DOE terminal system.

The following sections detail the expected and potential environmental impacts associated with the use of each of the two terminal systems combinations. The impacts of the new facilities are addressed as site preparation and construction phase impacts (those occurring over the short-term), and operational impacts (those occurring after construction and during the life of the project).

C.3.2 Impacts From Site Preparation and Construction

The effects of constructing the components of terminal systems not previously assessed are described under the appropriate impact categories below. The new construction for these terminal systems is outlined in the above table. For the Koch terminal system, new components include: one new dock on the east bank of the Mississippi River, three 500,000 barrel oil surge tanks, and a connecting pipeline. For the Nordix terminal system, these components are: one new dock and ten 150,000-barrel oil surge tanks on the east bank of the Mississippi River, and a pipeline connecting the terminal and the Bayou Choctaw-St. James early storage phase pipeline. At the DOE terminal system, four 200,000-barrel oil surge tanks would constitute the new components. Construction of the other terminal components shown in the table has been assessed in the two EIS supplements discussed above.

C.3.2.1 Land Features

New construction for the Koch terminal system would require the regrading of approximately 27 acres at the Koch terminal on the west bank of the Mississippi River for the three 500,000-barrel oil surge tanks. Dock construction on the east bank of the Mississippi River, along with the laying of the river portion of the pipeline, would require the dredging of 745,000 cubic yards (cy). Laying of a 3.2-mile pipeline connecting those two components would require approximately 35 acres, and involve 25 acres of construction on cleared lands and 10 acres of construction in the Mississippi River.

New construction for the Nordix terminal system would require the regrading of approximately 37 acres at the Nordix terminal on the east bank of the Mississippi River, at Sunshine, Louisiana, for the construction of 10-150,000 bbl oil surge tanks. Dock construction in the Mississippi River would require the dredging of 95,000 cy. Laying of a 7-mile pipeline, from the terminal across the Mississippi River to connect with the Bayou Choctaw-St. James pipeline, would require approximately 92 acres, including 16 acres of construction in the river, and 76 acres of construction on dry land. Laying of the river portion of the pipeline would require dredging of 650,000 cy. An alternative 10-mile pipeline to connect the terminal with the Bayou Choctaw-St. James pipeline would require approximately 49 acres through which some of the pipelines would follow an existing right-of-way. This alternative would make use of an existing 12-inch pipeline across the Mississippi River, thereby eliminating the need for pipeline dredging in the river.

Construction of four 200,000 barrel oil surge tanks for the DOE terminal system would require the regrading of 36 acres and approximately 112,000 cy of fill.

C.3.2.2 Water Resources

Construction of the Koch terminal system, by the Koch Oil Company, would require 15,000 cy of excavation and 745,000 cy of dredging, and involve 57 acres of direct land disturbance. Sediment represents the major source of water pollution from most construction activities, especially those requiring extensive grading. Sediment includes solid and organic materials detached from the ground surface by erosion and carried with the drainage system principally by runoff. The introduction of sediment into various natural bodies of water and the associated turbidity and deposition of solids result in numerous adverse physical, chemical, and biological effects. Suspended sediment ultimately reduces the storage capacity of waterways, increases flooding hazards, fouls and destroys aquatic habitats, diminishes recreational and property values, and enhances the transport of other harmful pollutants such as human and animal sanitary wastes, pesticides, and petrochemicals. Construction of the 3.2-mile pipeline connecting the dock and the oil surge tanks would occur both on dry land and in the Mississippi River. Sedimentation resulting from this construction activity would be transported in the Mississippi, into the local drainage canal systems, and into local surface waters, such as Bayou des Acadiens, Bayou Paul, Bayou Butte, and Bayou Goula. Sediment loadings into the Mississippi would add a negligible quantity to a river already transporting a large amount of suspended sediments. Construction occurring to the west of the river levee on the west bank would cause sediment to be introduced into the local drainage canal system. However, a minimal amount of earth movement would occur in that area. (Construction of the dry land portion of the pipeline and the three 500,000-barrel oil surge tanks requires 15,000 cy of excavation.) The use of standard engineering practices, such as interceptor ditches, dikes, and sedimentation ponds, would minimize water quality degradation.

Impacts on water quality would result from dredging of 745,000 cy from the dock site and from laying the pipeline. Most of these impacts on water quality would be locally significant but of short-term duration. These impacts would include increases in turbidity and the release of toxic substances from bottom sediments.

Construction of the Nordix terminal system would require 53,000 cy of excavation and 745,000 cy of dredging, and involve 123 acres of direct land disturbance. As stated, sediment represents the major source of water pollution from most construction activities. Construction of the 7.0-mile pipeline, from the terminal to the Bayou Choctaw-

St. James pipeline, would occur both on dry land and in the Mississippi River. Sedimentation resulting from this construction activity would be transported in the Mississippi River, into local drainage canal systems, and into local surface waters, such as Bayou Paul and Bayou Butte. Water quality impacts resulting from construction of the Nordix terminal system components would be similar to those described above. The construction of the pipeline, however, would require the excavation of 53,000 cy for the dry land portion, thereby increasing the amount of sediment loadings into local surface waters. The use of standard engineering practices, such as interceptor ditches, dikes, and sedimentation ponds, would minimize water quality degradation.

Impacts on water quality resulting from dredging in the river for dock construction and pipeline laying would be similar to those described above. These impacts would be locally significant but of short duration.

The alternative 10-mile pipeline from Nordix would only be constructed on land since the river crossing already exists. Even though pipeline dredging as a source of sedimentation would be eliminated, sedimentation as a result of approximately 27,400 cy of excavation for pipeline construction on land would still affect local drainage canals, surface waters, and the Mississippi River. Impacts on water quality for this alternative would be similar but to a lesser degree than that stated above because of the decreased sedimentation.

C.3.2.3 Air Quality

The quality of air in the vicinity of the terminal facilities to be constructed in the Sunshine and/or St. James area would be slightly affected during site preparation and construction. The sources of emissions would generally be short-term and over a small area. The principal pollutant of concern would be hydrocarbon emissions since the data presented in Appendix B indicate that hydrocarbon (and oxidant) concentrations in southern Louisiana frequently exceed the National Ambient Air Quality Standard (NAAQS).

Construction emissions and impacts are described below for the additional DOE and Koch terminal facilities that may be built at St. James and for the Nordix terminal facilities at Sunshine. Impacts from site preparation and construction for early storage construction at St. James would be similar.

Sources of Emissions

The quality of air during construction would be affected primarily by the following pollution sources:

- General Construction Vehicles
- Paint Solvent on Storage and Surge Tanks
- Fugitive Dust

During construction of the terminal facilities there would be clearing operations, road construction, and land fill. A number of machines and heavy vehicles would be used. The diesel and gasoline engines would emit hydrocarbons, SO_2, CO, NO_x, and particulates. Accurate prediction of quantities of pollutants emitted during construction is difficult because it depends upon many factors including type and model year of vehicles, number, duty cycle, speed, cold operation fraction, and ambient temperature. Estimated vehicular emission rates (grams per second) during construction (EPA, 1976e) are as follows:

CO	1.37
Hydrocarbons	.117
NO_2	.212
SO_2	.020
Particulates	.015

Floating roof oil storage tanks that may be constructed include four 200,000 bbl tanks by DOE at the DOE tank farm, three 500,000 bbl tanks by Koch for DOE use, and ten 150,000 bbl tanks by Nordix for DOE use. All tanks would probably be spray painted with solvent based paints composed of relatively volatile, light hydrocarbons. The quantity of paint required depends on several variables. Here it is assumed, for purposes of evaluating a worst case, that 1 gallon would cover 100 square feet with 2 coats (the average of two estimates), that 1 gallon would weigh 15 pounds (the range is 10 to 15 pounds per gallon), and that half the weight is solvent (50 to 55 percent is normal). The estimated hydrocarbon emission rate based on a painting rate of 6000 square feet per day (60 gallons of paint per day) is 1.32 grams per second (g/s). At this painting rate, these emissions would be experienced for about 1-1/2 months at the DOE tank farm, 2 months at the Koch tank farm, and 2-1/2 months at the Nordix tank farm.

Dust emissions would result from construction activities associated with land clearing, excavation, cut and fill operations, and other activities. The amount of dust would vary from day to day depending on the activity and the weather. A large portion of the dust would be due to equipment traffic over temporary roads. Field measurements at apartment and shopping center construction sites yield an estimate of 1.2 tons of dust per acre of construction per month of activity (EPA, 1976e). This estimate is high for southern Louisiana because the estimate is for a semiarid climate. Dust emissions are often inversely proportional to the square of ground moisture. Since ground moisture in southern Louisiana is twice the semiarid level (EPA, 1976e), the dust emissions during construction are estimated to be 0.3 tons of dust per acre of construction per month of activity.

Impacts on Air Quality

The impact of the atmospheric emissions due to site construction is dependent on the ambient air quality and the dispersal characteristics of the atmosphere, both of which have been discussed in Section 3.2.3. Downwind concentrations were calculated using methods recommended by the Environmental Protection Agency (Turner, 1969) and averaged over appropriate time intervals.

Estimated pollutant concentrations at 1 kilometer (km) downwind from construction vehicles and paint solvents are as follows:

Pollutant	National and State Standards: Averaging Period	National and State Standards: Limit ($\mu g/m^3$)	Downwind Concentrations ($\mu g/m^3$) (Excluding background levels): Construction Vehicles	Downwind Concentrations ($\mu g/m^3$) (Excluding background levels): Paint Solvents
Particulates	1 yr.	75	0	0
	24 hr.	250	0	0
SO_2	1 yr.	80	0	0
	24 hr.	365	0	0
CO	8 hr.	10,000	33	0
	1 hr.	40,000	46	0
HC	3 hr.	160[a]	3	104
NO_2	1 yr.	100	0	0

[a] Non-methane hydrocarbons only; concentrations are for total hydrocarbons.

Concentrations were calculated using the emission rates given previously and projected worst case meteorological conditions (Appendix I). Downwind concentrations from the construction vehicles were calculated assuming an area source model with a construction area having dimensions of 250 meters on a side.

The amount of dust-producing construction at the terminal facilities would be relatively small. Most of the dust would settle within the terminal boundaries. The fugitive dust escaping the terminal area would not seriously impact the environment.

Downwind concentrations given in the table are well below State and national air quality standards. However, since background hydrocarbon levels often exceed the 3-hour standard in southern Louisiana, infrequent additional exceedances may be expected during tank painting. Since expected peak concentrations of SO_2, CO, NO_2, and particulates during construction are very small, no other exceedances of the State and national air quality standards are expected. All impacts during construction would be short-term and confined to a relatively small area. Because all pollutants released during construction are assumed to be ground-level releases, concentrations would decrease with increasing distance.

C.3.2.4 Noise

The major noise-producing equipment used during construction of the dock at the Koch terminal would be one or two pile drivers and trucks. For construction activity conducted 10 hours a day in the daytime, the equivalent sound level, L_{eq}, and the daytime sound level, L_d, contributions are estimated to be 71 dB and 69 dB, respectively. The three 500,000-barrel oil surge tanks would be prefabricated wth sections welded at the site. A concrete footing would be poured to support the tanks. For construction activity conducted 10 hours a day in the daytime, the equivalent sound level, L_{eq}, and the daytime sound level, L_d, contributions are estimated to be 67 dB at 500 feet and 65 dB at 500 feet, respectively. For construction of the pipeline between the dock and the oil surge tanks, the L_{eq} and L_d contributions are estimated to be, at 500 feet, 69 dB and 67 dB, respectively. The impact zone radii, the distance within which sound levels would be raised by 3 dB or more, has been estimated to be 2500 feet for dock construction, 1800 feet for pipeline construction, and about 1600 feet for tank construction. Up to 25 residences would be within these impact zone radii.

Construction noise sources at the Nordix terminal would be similar to those at the Koch terminal and would result in elevated noise levels (up to about 70 dB) at the terminal site. Noise levels at residences in nearby Sunshine should not be more than 56 dBA, which would not be detectable above ambient sound levels. A few scattered residences near the site would experience some elevated sound levels for several months, however. Along the proposed or alternate pipeline corridors, the equivalent sound level during construction is expected to be 68 dBA at 500 feet. Less than 10 residences should be affected by noise levels of 62 to 68 dBA for a few days. Perhaps 30 residences would experience sound levels of 56 to 62 dBA.

The four 200,000-barrel oil surge tanks constructed at the DOE terminal would be prefabricated with sections welded at the site. A concrete footing would be poured to support the tanks. For construction activity conducted 10 hours a day in the daytime, the equivalent sound level and daytime sound level contributions are estimated to be 67 dB and 65 dB, respectively. The impact zone radii are estimated to be 2500 feet for dock construction and 1600 feet for tank construction. Within these radii, 10 to 15 residences would be affected by construction noise.

C.3.2.5 Ecosystems and Species

Construction of the Koch terminal system would involve several impacts on the biota of the area. These impacts would include the loss of terrestrial and aquatic habitats, increases in turbidity, and indirect effects on fish and wildlife due to forced migration, increased noise, and human disturbance. Approximately 57 acres of cleared land would be regraded for component construction and would severely impact on any small invertebrates in the surface vegetation and topsoil. It may be assumed that, except in the case of avifauna, the available resources provided by this habitat would be permanently lost to many other wildlife groups, including non-migratory species of rodents, amphibians, and reptiles. Indirect effects of construction include impacts on wildlife of forced migration, increased noise, and human disturbance. The effects of migration would be dependent on the availability of space, protective cover, food, and the status of animal populations. Noise and human disturbance during construction would discourage wildlife within the area. Upon completion of construction activities, some wildlife species are likely to return to the impacted area.

The effects of pipeline construction on wildlife in cleared land habitats are expected to be minor and short term. Most of the wildlife species found in cleared lands are able to survive despite fluctuating conditions and altered habitats. Some loss of the less mobile species is anticipated during construction. The temporary loss of habitat and resources provided by the habitat would probably last 6 months to 1 year in pasture and old field areas. Other areas (urban and industrial) would require less recovery time. The effects of pipeline construction on wildlife at river crossings would be minimal and temporary. Construction activities would force most wildlife away from the crossings.

Most mammals, birds, and herptofauna would return to the area once human activities decrease.

Additional impacts would be caused by dredging approximately 745,000 cy at the dock site and for construction of the pipeline across the Mississippi River. Much of the spoil would be placed in a designated area of the river having water depths greater than 50 feet. Associated effects on benthos and organisms in the water column due to turbidity, siltation, and smothering would be locally severe. In relation to the amount of dredging activity occurring in the Mississippi River and the amount of silt transported by the river naturally, the degree of this impact would be small.

Construction of the Nordix terminal system would involve clearing or excavation on nearly 123 acres of land and would require some long-term alteration of habitat type or land use on nearly 50 acres. Most of the construction acreage affected would be within the 7-mile pipeline right-of-way, principally in bottomland forest, and on agricultural land. Most of the permanent habitat or land use alterations would occur at the oil surge tank site. The lands which would be affected by construction of the terminal system are not particularly high quality habitat for wildlife.

As a consequence, there should be very little adverse impact on terrestrial biota due to pipeline construction. The temporary loss of 55 acres of bottomland forest significantly reduces the extent of this habitat type locally. There is no shortage of wooded lands a few miles to the west, although they are less accessible to potential small game hunters or bird watchers. No threatened or endangered plants or animals should be affected by facility construction with the exception of a few alligators which might be temporarily displaced from the pipeline right-of-way adjacent to drainage canals or the Mississippi River.

Adverse impacts to aquatic life should also be of minor significance. Except for the Mississippi River, very little aquatic habitat would be affected. In the river itself, benthos populations are generally very low. Plankton and nekton inhabiting the water column are adapted to highly turbid conditions. Water quality degradation due to dredging and spoil disposal might have some temporary adverse impact on biota over a very small portion of the river. Some temporary benthic losses due to dredging and spoil disposal may occur on up to 100 acres.

For the 10-mile alternative pipeline from the Nordix terminal, the impacts would be similar to those stated minus the adverse impacts on aquatic life associated with dredging for the pipeline.

Impacts from the construction of four 200,000-barrel oil surge tanks, as a component of the DOE terminal system at St. James, Louisiana, would include the loss of terrestrial and aquatic habitats, increases in turbidity, and indirect effects on fish and wildlife due to forced migration, increased noise, and human disturbance. Approximately 36 acres of cleared land habitat would be regraded for the construction of four 200,000-barrel oil surge tanks and would severely impact on any small invertebrates in the surface vegetation and topsoil. It may be assumed that, except in the case of avifauna, the available resources provided by this habitat would be permanently lost to many other wildlife groups, including non-migratory species of rodents, amphibians, and reptiles. Indirect effects of construction on wildlife include forced migration, increased noise, and human disturbance. The effects of migration would depend on the availability of space, food, protective cover, and the status of animal populations. Noise and human disturbance would discourage wildlife within the area. Upon completion of construction activities, some wildlife species are likely to return to the impacted areas.

C.3.2.6 Natural and Scenic Resources

Construction of the components of either the Koch or the Nordix terminal system would not significantly affect any natural or scenic areas due to the extensive industrial development in the surrounding areas.

Construction of four 200,000-barrel oil surge tanks at the DOE terminal system would have no significant effect on natural or scenic resources in the vicinity of St. James, Louisiana, due to the extensive existing industrial development in the area.

C.3.2.7 Archaeological, Historical, and Cultural Resources

Development of the Koch terminal system would involve the construction of a tanker dock, three 500,000-barrel oil surge tanks, and a pipeline connection between these two components for the Koch terminal system at St. James, Louisiana. There should be no impact on archaeological, historical, or cultural resources resulting from that construction activity as the area has already experienced extensive industrial development.

Development of the Nordix terminal system would involve the construction of a tanker dock, ten 150,000-barrel oil surge tanks, and a 7.0 mile pipeline connection between the terminal and the Bayou Choctaw-St. James early storage pipeline, at Sunshine, Louisiana. There should be no impact on archaeological, historical, or cultural resources resulting from that construction activity as much of the area has been developed. The alternative 10 mile pipeline should also have no impact as stated above.

Development of the DOE terminal system would involve the construction of an additional four 200,000-barrel oil surge tanks at St. James, Louisiana. There should be no impact on archaeological, historical, or cultural resources resulting from that construction activity as the area has aready experienced extensive industrial development.

C.3.2.8 Socioeconomic Environment

The development of the Koch terminal system would involve the construction of one tanker dock, three 500,000 barrel oil surge tanks, and a pipeline connecting these two components for the Koch terminal system. Construction of these components, located near St. James, would not have a major effect on land use, requiring about 57 acres in an area previously developed. Construction would result in a semipermanent conversion of land to industrialized uses. Construction of the dock could impact transportation patterns in the vicinity of the site, as Route 44 provides the only access. Barge and/or truck and employee traffic to locations on either bank of the river could cause congestion. Construction of a pipeline under the Mississippi River may temporarily curtail or disrupt waterborne traffic. Minimal impacts on population and housing would occur, as the project would utilize local labor pools to the extent practicable. Construction activities would, similarly, provide a temporary stimulant to the local economy, to the extent that local goods and services are used. As the terminal system would remain in private ownership, there should be no loss to St. James Parish of property taxes. Little use of existing governmental services would be required.

The development of the Nordix terminal system would involve the construction of one tanker dock, ten 150,000-barrel oil surge tanks, and a 7-mile pipeline. Construction of these components, located near Sunshine, Louisiana, would not have a major effect on land use, requiring only about 123 acres in an area previously developed. Construction of the oil surge tanks and dock would occur in an area that is presently in industrial land use and the pipeline would occur principally in agricultural lands. Construction would result in a semipermanent conversion of land to industrialized uses. Terminal system construction could cause some congestion on State Highway 30 due to material transportation and commuting of workers. This congestion could last 6 to 8 months. Pipeline installation across the Mississippi River may cause some inconvenience and obstruction to commercial navigation for as long as 10 days during trench excavation and pipe laying. Minimal impacts on population and housing would occur, as the project would utilize local labor pools to the extent practicable. Construction activities would, similarly, provide a temporary stimulant to the local economy, to the extent that local goods and services are used. As the terminal system would remain in private ownership, there would be no loss of property taxes to Iberville Parish. Little use of existing governmental services is expected.

The socioeconomic impacts of the alternative 10-mile pipeline from Nordix would be similar to those described. However, because the pipeline river crossing already exists, there would be no interference with navigation during construction.

Development of the DOE terminal system would involve the construction of an additional four 200,000-barrel oil surge tanks. Construction of these components, located near St. James, Louisiana, would not have a significant effect on land use in the vicinity. About 36 acres would be required for the construction of these oil surge tanks and associated facilities, and would be a semipermanent conversion of land to industrialized uses. No major impacts on transportation systems or traffic patterns would be expected to result, as fewer than 50 persons would be employed and the roads providing access are not heavily travelled. The use of local labor pools would minimize by impact on population and housing as there would be little migration to the vicinity of St. James. The use of local goods, services, and labor would, however, provide a temporary stimulant to the local economy, to the extent that they are utilized. The removal of up to 36 acres from the tax rolls of St. James Parish should be offset by gains in construction employment payrolls. Little use of existing governmental services is expected.

C.3.3 Impacts from Operation

Should an oil supply interruption occur while oil is stored in the Capline Group SPR sites, oil would be withdrawn for distribution to the Capline pipeline or to tankers via the terminal system combination selected for use. This oil would be pumped from both the early storage sites and the SPR sites.

The following sections outline the expected and potential impacts resulting from operation of the terminal system combinations. These impacts reflect those arising from the use of the expanded tankage at the DOE terminal system at St. James in conjunction with either the Koch or Nordix terminal systems. The impacts from operation of the early storage components of the DOE terminal system are also given to provide a perspective on the total impacts of the program. Both the frequency and quantity of potential oil spillage and the quantity of hydrocarbons released to the atmosphere are largely determined by the quantity of crude oil throughput. As this quantity is dependent upon the development alternative and terminal system selected, the impacts of potential oil spills on water resources and hydrocarbon emissions on air quality are presented to reflect those differences. In subject areas where the expected or potential development alternative is not a variable, the environmental impact of the terminal system is presented.

C.3.3.1 Land Features and Geologic Impacts

Effects of operation of either the DOE/Koch or DOE/Nordix terminal system combination on land features are expected to be minimal. No significant disturbance of soils is anticipated after construction is completed. Soils will stabilize soon after they are revegetated. All terminals are seismically located in an area identified as Zone 1, that is, with an expectation of minor earthquake damage.

C.3.3.2 Water Resources

The principal potential impact on water resources resulting from operation of either of the two terminal systems combinations would be the possibility of oil spills, which would primarily occur during oil transfer operations. The location of these spills would be in the Gulf of Mexico, in the Mississippi River, and at the oil surge tanks at the terminals systems. Quantities of oil expected to be released from all components of the Capline group SPR program are listed by source and location in Tables C.2-1 to C.2-8. This section will address only those oil spills attributable to terminal system operation.

Normal operation of the DOE/Koch terminal system combination would involve up to five fill and withdrawal cycles of the stored oil. Because exposures are similar, the expected frequency and volume of oil spills is basically a function of storage capacity. Therefore, the frequency and volume of spills will vary from the proposed development to the alternative groupings as a function of throughput.

The total oil spillage resulting from normal operation of the DOE/Koch terminal system combination in conjunction with proposed development (early storage sites plus Napoleonville) is projected to be 15,794 barrels, of which 76 percent would occur during fill operations and 24 percent during withdrawal operations. The maximum credible spill events are estimated to be 60,000 barrels resulting from a tanker collision on the Mississippi River, 5000 barrels from terminal systems, and 500 barrels from terminal system transfer operation. Spill expectations for the other development alternatives as a function of terminal system combination are presented below:

DOE/Koch Terminal System Combination

	Proposed Development	Alternative Grouping No. 1	Alternative Grouping No. 2	Alternative Grouping No. 3
Total Projected Oil Spills (bbls)	15,794	13,476	13,772	18,001
Percent During Fill	76	72	76	76
Percent During Withdrawal	24	28	24	24

Oil spills at the terminal (from the surge tanks) would be controlled onsite. Spills at the docks, or from pipeline ruptures, would enter the Mississippi River where, as soon as oil is released, weathering of the oil would begin. The major weathering processes are evaporation, dissolution, emulsification, sedimentation, biological degradation, and chemical oxidation.

Low molecular-weight hydrocarbons and aromatics are the most immediately toxic components of crude oil. Evaporation results in selective loss of low molecular-weight hydrocarbons and aromatics, thus tending to reduce concentrations of the most toxic portions of the crude oil. Also, evaporation causes a surface residue, which has a higher concentration of sulfur and organics and may develop a specific gravity greater than water, especially if salt, clay, or organic particles are suspended in the water and available for attachment. As a result, this portion of crude oil will sink and may physically and chemically affect bottom organisms.

Dissolution in the water column is selective for low molecular-weight hydrocarbons and aromatics as well as some of the nonhydrocarbon components that are more polar. Most of the soluble material is produced later from biological and chemical oxidation. The solubility of the normal alkanes ranges from 40 ppm for C_6 molecules to 0.01 ppm for C_{12} molecules. For aromatics, solubility ranges from 1800 ppm for C_6 (benzene) to 0.075 ppm for C_{14} (amtracene). The proportion of various fractions of crude oil likely to go into solution in sea water are presented in Appendix B.

Emulsifications, which are crude oil globules in water columns, are dispersed easily by currents, and, it is believed, eventually dissolve or sink to the sediments after contact with suspended solids.

Sedimentation of oil is encouraged by evaporation and dissolution of the lighter weight fractions and by contact with suspended sediments and organic material. In shallow waters, contact with suspended solids is likely during periods of high runoff or stormy weather, which disturb bottom sediments. Sedimentation also can occur as a result of bacterial masses in the oil slick.

Bacterial degradation can occur in almost all crude oil fractions, but normal alkanes are attacked preferentially, and aromatics are least preferred. A supply of nitrogen, phosphorus, and oxygen is needed. In areas where oxygen concentrations are low, biodegradation is a slow, long-term process.

Oil spilled on the water's surface would initially spread under gravitational, viscosity, and surface-tension forces. The rate of spreading because of these forces would be a function of the initial chemical characteristics of the oil and the physical characteristics of the slick, such as viscosity, specific gravity, and thickness. The rate would also vary with time as weathering or degradative processes act on the spilled oil. In addition, surface currents and surface winds would transport the slick away from its point of origin.

Two potentially significant impacts of oil spills on water resources would be the potential for buildup of toxic fractions and depletion of oxygen levels in shallow, poorly flushed water bodies. The most likely location of such impacts would be in marshes along the lower Mississippi River Delta (including the vicinity of Passa Loutre and Delta Wildlife Refuges). Most of the spills would occur in the Mississippi River or in diked areas at the terminals.

Oil spills reaching the Mississippi River or the open Gulf should not have significant impacts on water quality, because of the potential for dilution and for oil recovery. Oil which sinks to the bottom or is deposited on the riverbank or shoreline may provide a local source of petroleum hydrocarbons to the water column for several weeks or even months, however.

Oil spills occurring anywhere on land outside diked areas or in the Mississippi River could affect human use of water (industrial, domestic, or recreational).

While the potential exists for relatively frequent and possibly large crude oil spills, calculations of spill probability and the nature of local water bodies indicates that significant impacts on water resources should be very infrequent.

Normal operation of the DOE/Nordix terminal system combination could involve up to five fill and withdrawal cycles of the stored oil. Because exposures at the terminal systems are similar, the expected frequency and volume of oil spills is basically a function of storage capacity and throughput. Therefore, the volume and frequency of oil spills will vary according to the storage capacity planned for each of the development alternatives.

The utilization of the Nordix terminal system presents a greater exposure to oil spills than does the Koch terminal system, due to its location 45 miles up the Mississippi River. The total oil spillage projected for the DOE/Nordix terminal system combination, when used in conjunction with the proposed development (early storage sites plus Napoleonville), is 16,778 barrels, of which 76 percent would occur during fill operations and 24 percent during withdrawal operations. The maximum credible spill events are estimated to be 60,000 barrels resulting from a tanker collision in the Mississippi River, 5000 barrels from the terminal systems, and 500 barrels from terminal system transfer operations. Spill expectations for the other development alternatives as a function of terminal system combination are presented below:

DOE/Nordix Terminal System Combination

	Proposed Development	Alternative Grouping No. 1	Alternative Grouping No. 2	Alternative Grouping No. 3
Total Projected Oil Spills (bbls)	16,778	14,196	14,506	19,129
Percent During Fill	76	72	75	75
Percent During Withdrawal	24	28	25	25

The impacts on water resources of an oil spill from the DOE/Nordix terminal system combination would be very similar to those described for the DOE/Koch terminal system combination. While the potential exists for selectively frequent and possibly large crude oil spills, calculations of spill probability and the nature of the local water bodies indicates that significant impacts on water resources should be very infrequent.

C.3.3.3 Air Quality

Strategic petroleum reserves are planned to minimize the effects of oil supply interruption. For worst case anaylsis, it has been assumed that five fill/withdrawal cycles would occur over the life of the project. However, it is unlikely that multiple cycles would occur and, therefore, intermittent and infrequent withdrawals would result in substantially less air quality impact than is presented in the following sections. Variations in the oil movement assumptions with regard to terminal usage would result in changes in the emissions totals that would be within the accuracy of the emission factors used.

C.3.3.3.1 Proposed Development - Early Storage Sites Plus Napoleonville

The largest potential effects on air quality associated with the operation of the proposed oil distribution system would result from hydrocarbon emissions during fill and withdrawal cycles. Data presented in Section B.2.3.3.2 indicate that non-methane hydrocarbon concentrations in the area frequently exceed the national and State standard of 160 $\mu g/m^3$ (3-hour average, 6-9 a.m.). Hydrogen sulfide losses are expected to be minimal, since most of the crude oil that is expected to be stored in the Capline system would have weathered sufficently during overseas transit to essentially eliminate the H_2S component.

Both average and maximum hydrocarbon emission rates are presented in this section (except for minor sources). During withdrawal operations, the crude oil is assumed to have an elevated temperature of 120^{0}F (except 100^{0}F for crude oil stored at Weeks Island). Elevated crude oil temperatures are expected to result from long-term storage in salt domes at temperatures of up to 150^{0}F. Appendix J describes how the crude oil temperature will change as it moves to the storage tanks. Average emissions are used to determine the total emissions expected over the assumed 22-year period of operation while maximum emissions are used to evaluate the worst case impact upon air quality. Emissions and impacts are given for the maximum use of the DOE/Koch or DOE/Nordix terminal system combinations.

Sources of Emissions

The quality of air during operation would be affected by the following pollution sources:

- o Fugitive Dust
- o Valves, Seals, and Gauges
- o Crude Oil Storage Tanks
- o Tanker and Barge Loading and Unloading Operations

Most fugitive dust emissions during facility operation would be due to general service vehicle travel over unpaved roads. Assuming an average vehicle speed of 40 miles per hour and a road surface silt content of 30 percent, the estimated dust emissions is 0.24 pounds per mile of unpaved road traveled (EPA, 1976e).

There would be a wide variety of valves, seals, and gauges associated with the pumping of crude oil through the pipelines between the terminal facilities and the storage cavities at Bayou Choctaw, Weeks Island, and Napoleonville. The small leakage that may occur would be tightly controlled in accordance with standard practice and thus of little consequence. It is estimated that these losses would be less than 5 tons/year during each fill or withdrawal cycle.

Standing storage vapor losses from floating roof crude oil storage tanks may be estimated using the empirical equation developed in API publication 2517 (API, 1962) and recently revised for the EPA (August 1976). However, recent studies performed by Chicago Bridge & Iron (CBI, 1976) indicate that the API methodology overestimates standing storage losses for crude oil by approximately 90 percent for modern tanks that have double seals installed. Since the CBI tests may not be applicable to all modern tanks and since other minor losses may occur (such as vapor losses due to the oil adhering to the tank sides during withdrawal), actual losses may be 75 to 80 percent less than the standing storage losses predicted by API 2517 methodology. Conservatively, 75 percent reduction was assumed in this report. Estimated hydrocarbon losses over an assumed 22-year period of operation (1979-2000), including continuous losses during standby storage are presented in Table C.3-1a for the two maximum terminal combinations and are based on average crude oil properties (Reid vapor presssure of 4 psia and molecular weight of 70 for fugitive losses). The tank usage assumed for each terminal combination and the average annual emission rates due to both SPR expansion and early storage operations are summarized below:

	Tank usage (bbl)		Average hydrocarbon Emissions (tons/year)		
Terminal combinations	Expansion	Early Storage	Expansion	Early Storage	Total
DOE/Koch	3-500,000 4-200,000	8-200,000	45	39	84
DOE/Nordix	4-200,000 10-150,000	8-200,000	65	39	104

TABLE C.3-1a Estimated hydrocarbon emissions[a] (tons) at terminal facilities accompanying the transport of oil for the proposed development[b], over the life of the project and assuming five fill/withdrawal cycles.

Location	Tankers/Barges Fills (5)	Tankers/Barges Withdrawals (5)	Storage Tanks[c]	150 MMB Expansion Total	Early Storage Total
A. DOE AND KOCH TERMINALS					
Gulf of Mexico	11,340	0	0	11,340	(13,834)
Mississippi River[d]	3,360	3,465	0	6,825	(7,596)
Terminals	6,615	4,600	986	12,201	(15,544)
	21,315	8,065	986	30,366	(36,974)
B. DOE AND NORDIX TERMINALS					
Gulf of Mexico	11,340	0	0	11,340	(13,834)
Mississippi River[d]	3,832	3,938	0	7,770	(7,596)
Terminals	6,615	4,600	1,430	12,645	(15,544)
	21,787	8,538	1,430	31,755	(36,974)

[a] Average conditions assuming a Reid vapor pressure of 4 psia. During withdrawal operations, the crude oil at the terminal is assumed to be at 120° F (except that crude stored at Weeks Island is 100° F).

[b] The emissions in this table are for expansion at Napoleonville with the total emissions for early storage at Bayou Choctaw and at Weeks Island given in brackets for comparison.

[c] Storage tank losses estimated to occur continuously for a 22-year period.

[d] Transit emissions, most of which occur along the Mississippi River.

These results include the additional emissions due to elevated crude oil temperatures during the 5 withdrawal cycles that are assumed to occur over the 22-year period of operation.

Estimated average static storage loss (no oil movement) at any location would be 54, 21, and 39 tons/year at the DOE, Koch, and Nordix tank farms, respectively, assuming the total number of tanks at each location are in use continuously. If withdrawal occurs during the year, the expected emissions at each location would increase about 60 percent due to elevated crude oil temperatures. Elevated crude oil temperatures are expected to result from long-term storage in salt domes at temperatures up to 150^{o}F; Appendix J describes how the crude oil temperature would change as it moves to the storage tanks at the terminals.

Estimated hydrocarbon emissions resulting from tanker loading and unloading operations including transit to and from the terminal docks are presented in Table C.3-1a for the two terminal combinations. These data represent the total emissions expected over an assumed 22-year period of operation (5 fills and 5 withdrawals) based on average crude oil properties (Reid vapor pressure of 4 psia and a density of 4.5 lbs/gal for fugitive losses). The minimal losses from ship's boilers have been neglected in these estimates.

Tanker and barge hydrocarbon emissions in Table C.3-1a are based upon the following activities: 1) transfer of oil from the very large crude carrier (VLCC) to 45 MDWT (45,000 dead weight ton) tankers 19 km (12 miles) offshore (emission factor of 0.72 lb/1000 gal); 2) "breathing" losses in transit by barge and tanker (emission factor of 0.0067 lb/hr/1000 gal at 70^{o}F, 0.0118 lb/hr/1000 gal at 100^{o}F and 0.01674 lb/hr/1000 gal at 120^{o}F); 3) transfer from 45 MDWT tankers to 20,000 barrel barges (for Bayou Choctaw early storage phase only, emission factor of 1.96 lb/1000 gal); 4) offloading 45 MDWT tankers at the terminal docks (emission factor of 0.42 lb/1000 gal); 5) loading 80 MDWT tankers at the terminal docks (emission factor of 0.63 lb/1000 gal at 100^{o}F and 0.73 lb/1000 gal at 120^{o}F); and 6) loading 20,000 barrel barges at Bull Bay (emission factor of 1.75 lb/1000 gal). Derivation of these emission factors is given in Appendix I.

Emissions during each fill are based on the delivery of up to 94 MMB to Bayou Choctaw, 89 MMB to Weeks Island, and 150 MMB to Napoleonville (total of up to 333 MMB). The basic mode of oil transport is as follows. During fill, oil would be transferred to 45 MDWT tankers in the Gulf of Mexico south of the Mississippi River, offloaded to surge tanks at the terminal locations and pumped through pipelines to storage at Bayou Choctaw, Weeks Island, and Napoleonville. During the early storage phase initial fill at Bayou Choctaw, 7.2 MMB of the oil would be transferred to barges at a transfer point on the Mississippi River and barged to the Bull Bay docks at the site.

During each withdrawal period, oil would be pumped to the terminal facilities by pipeline at 2.0 MMB/day. Sixty percent, or 1.2 MMB/day, are scheduled for delivery to the CAPLINE Pipeline system with no additional hydrocarbon losses. Emissions associated with tanker loading and transit to the 12-mile territorial limit were calculated for the remaining 0.8 MMB/day. At Bayou Choctaw, 7.5 MMB of oil during each withdrawal would be transferred to barges at Bull Bay and barged to Baton Rouge.

It should be noted that only 150 MMB of the 333 MMB to be stored under this group alternative are related to SPR expansion. The 94 MMB to be stored at Bayou Choctaw and the 89 MMB to be stored at Weeks Island are part of the early storage program described in FES 76-5 and FES 76/77-8. The emissions for the 150 MMB expansion at Napoleonville in Table C.3-1a represent only about 45 and 46 percent of the total emissions expected for the DOE/Koch and DOE/Nordix terminal combinations, respectively. The emissions related to the early storage program are given in brackets in the table.

Emissions are substantially larger for oil fill than for withdrawal. Two factors are responsible; first, the substantial emissions accompanying VLCC-tanker transfer operations would only occur during fill; second, during withdrawal only 40 percent of the oil stored would be transported by tankers to the Gulf of Mexico. Therefore, the tanker loading and transit emissions would also be substantially reduced. These factors more than offset the increased emissions due to elevated crude oil temperature during withdrawal.

Estimated annual hydrocarbon emissions at St. James and Nordix during peak fill and withdrawal operations (includes transfer emissions at the docks and storage tank losses) for the two terminal combinations were compared to recent parish totals from Section B.2.3.3.3. Annual withdrawal losses are based upon complete withdrawal during a calendar year. The resulting emissions and percent increases are summarized below:

	Annual HC Emissions (tons/yr) and Percent Increase During Both FIll and Withdrawal Operations			
	St. James		Nordix	
Existing Emissions (Parish)	22,870 (St. James)		11,167 (Iberville)	
DOE/Koch Combination	Fill	Withdrawal	Fill	Withdrawal
Expansion	603/2.6	983/4.3	0	0
Early Storage	1212/5.3	1050/4.6	0	0
Total	1815/7.9	2033/8.9	0	0
DOE/Nordix Combination				
Expansion	300/1.3	489/2.1	321/2.9	523/4.7
Early Storage	1212/5.3	1050/4.6	0	0
Total	1512/6.6	1539/6.7	321/2.9	523/4.7

Thus, the maximum increase in any one parish would be 8.9 percent at St. James for the DOE/Koch terminal system combination during withdrawal operations. In the absence of fill or withdrawal cycles during the year, annual emissions would be the same as those given for static storage losses. Furthermore, none of the emission total would add significantly (less than 1 percent) to the combined HC emission total of the five parishes (Ascension, East Baton Rouge, Iberville, St. James, and West Baton Rouge) most likely to be affected by these emissions. The total existing HC emissions for these parishes is about

225,600 tons/year; East Baton Rouge Parish alone accounts for 162,600 tons (Section B.2.3.3.3).

Because the NAAQS (guideline) for non-methane hydrocarbons is a 3-hour value (160 $\mu g/m^3$; 6-9 a.m.), worst case emissions were calculated at each location for an evaluation of the impacts on air quality.

Worst case hydrocarbon emissions due to oil transfer were calculated assuming maximum transfer rates and emissions factors based on a Reid vapor pressure of 5 psia (see Appendix I). During fill, the maximum emission rate is 6258 pounds per hour (P/H), assuming VLCC transfer to two 45 MDWT tankers in the Gulf simultaneously at a rate of 100,000 barrels per hour (B/H) (emission factor of 1.49 lb/1000 gal). During withdrawal, the maximum emission rate is 2434 P/H, assuming two 80 MDWT tankers loading simultaneously at each terminal location at a rate of 55,200 B/H (emission factor of 1.05 lb/1000 gal).

Maximum transit emissions were not calculated since they are non-point sources and occur over a 175-mile corridor. Worst case storage tank emission rates were calculated using the previously described methodology and tank characteristics, but using a conservative Reid vapor pressure of 5 psia and a crude oil temperature of 120°F.

Impacts on Air Quality

The environmental impact of the computed emissions is dependent on the ambient air quality and the dispersal characteristics of the atmosphere (Section B.2.3). Downwind centerline ground-level concentrations were calculated using the model described in Appendix I. Estimates were made using maximum emission rates and atmospheric conditions corresponding to worst case conditions ("D" stability and a wind speed of 1 meter per second (mps), except for 2 mps in the Gulf). These estimates apply to both the SPR expansion at Napoleonville and the early storage phase. Expansion, in most cases, increases the likely frequency and duration of maximum emission rates.

Fugitive dust raised by general service vehicles over unpaved roads would cause less impact than during the construction phase where it was estimated to be small (Section C.4.3.1.3).

The minimal HC losses from the crude oil pipelines (valves, seals, and gauges) are assumed to be continuous during the project lifetime since the pipelines would be kept filled and pressurized at all times. Since this leakage occurs over a large area, it would cause little impact on ambient air quality.

Hydrocarbon concentrations from storage tank losses are based on the assumption that the total storage tanks available at each tank farm would be in use at one time. Since these emissions occur over a large area, an area source correction was made as described in Appendix I. The release was assumed to be elevated (32 feet) with no plume rise. Estimated "worst case" HC concentrations for each tank farm, corrected to a 3-hour average (Turner, 1969), are:

Tank Farm	Total Tanks Available (bbl)	Maximum Emission Rate (g/s)	Downwind Concentrations ($\mu g/m^3$)			
			2 km	5 km	10 km	Baton Rouge
DOE	12-200,000	4.8	65	22	9	1
Koch	3-500,000	1.9	33	10	4	1
Nordix	10-150,000	3.5	58	18	7	4

These values are all well below the 3-hour standard of 160 $\mu g/m^3$. However, since the 3-hour HC standard is often exceeded in southern Louisiana, emissions from the storage tanks may cause infrequent additional exceedances nearby (less than 5 km downwind, generally). Baton Rouge is approximately 15 km (9 miles) north of Nordix and 50 km (31 miles) north of St. James. For the DOE/Nordix terminal combination, there would be negligible interaction from these emissions. Interactions between the emissions from the DOE and Koch tank farms are discussed in the following section.

Vapor emissions from ship loading and unloading activities are not regulated, downwind hydrocarbon concentrations were calculated in any case to provide an indication of the periodically high levels that may occur. Calculations of hydrocarbon concentrations from maximum tanker operations (VLCC transfer to two tankers in the Gulf at 100,000 B/H during fill and loading two tankers simultaneously at the terminal at 55,200 B/H during withdrawal) were made using the conservative assumption that the emissions at each location are point source releases at ground-level. Estimated maximum downwind distances over which 3-hour hydrocarbon concentrations would exceed 160 $\mu g/m^3$ are as follows:

Location	Maximum Emission Rate (g/s)	Maximum Downwind Distance (km) 3-Hour Concentration Exceeds 160 $\mu g/m^3$
Gulf of Mexico (19 km offshore)	789	34
Terminal Location	307	27

During fill, the maximum downwind distance with concentrations exceeding 160 $\mu g/m^3$ (3-hour average) is 34 km (21 miles) but much of this distance is over water. However, during peak withdrawal operations (2 tankers loading simultaneously) at a terminal location under unfavorable dispersion conditions, excessive hydrocarbon concentrations can be expected as far as 27 km (17 miles) downwind. Thus, for the Nordix terminal operation, the Baton Rouge industrial complex would be included in the envelope of concentration greater than 160 $\mu g/m^3$. However, this distance (27 km) is conservatively high for both operations since the calculation is based on the assumption that the wind direction is parallel (in line) to the tanker berths with no credit taken for tanker separation. During more normal dispersion conditions, downwind concentrations would be less than 20 percent of those during "worst case" conditions (and less than 5 percent of maximum concentrations at the terminals during fill). In addition, as previously noted, multiple cycles are unlikely to occur, and vapor emissions from ship loading and unloading activities are not regulated at this time. Interaction between the emissions from the Koch and DOE tanker docks are discussed in the following section.

Interaction Among Sources

In the preceeding paragraphs, storage tank and tanker transfer HC emissions at each terminal facility were considered as if each were a separate source impact. Actually, the emission sources in close proximity to each other would contribute to a cumulative effect on existing background HC concentrations. However, since the relative magnitude of the "worst case" emission rates from the tanker transfers would be much higher than the associated storage tank emissions at each terminal location, combined downwind concentrations resulting from the storage tanks and tanker transfer operations were not calculated. Moreover, the maximum transfer emission rate at each terminal location was based on two tankers loading simultaneously assuming a point source release, whereas the two tankers actually constitute an area source. Thus, the maximum 3-hour downwind hydrocarbon concentrations would not be expected to exceed 160 $\mu g/m^3$ beyond the distance given for the terminal docks alone (27 km).

However, during maximum usage of the DOE and Koch terminal facilities (assumed to be three docks and all storage tanks in use simultaneously) both of which are in the St. James vicinity, considerable interaction would be expected to occur under certain meteorological conditions.

The downwind impacts from the combined storage tank emissions are assessed because these represent long-term sources of HC emissions. The interactions between the 3 Koch 500,000 bbl storage tanks and the 12 DOE (200,000 bbl) storage tanks were evaluated assuming that the two tank farms are approximately 0.8 km (0.5 mile) apart. Concentrations were calculated using the dispersion model described in Appendix I, and worst case crude oil and meteorological assumptions, including wind direction parallel to the orientation of the tank farms. An area source correction was also applied as described in Appendix I. Resulting worst case 3-hour average hydrocarbon concentrations at 2, 5, and 10 km downwind and at Baton Rouge were calculated to be 84, 30, 12 and 2 $\mu g/m^3$, respectively. These results are approximately one-third higher than those presented in the preceeding section for the DOE tank farm, but they would occur so infrequently that the impacts would be essentially the same, i.e., infrequent additional exceedances of the 3-hour hydrocarbon standard, generally less than 5 km downwind, due to high background levels.

The maximum tanker transfer case is assumed to be two tankers loading at the DOE docks at the same time a third tanker is loading at the nearest Koch dock, approximately 1.6 km (1 mile) away. Using the dispersion model (Appendix I) and "worst case" crude oil and meteorological conditions, the downwind interaction of the three tanker docks was evaluated. Using a peak hydrocarbon emission rate of 153.5 g/sec from each of the three docks, the maximum downwind distance with concentrations exceeding 160 $\mu g/m^3$ is estimated to be 37 km (23 miles), compared to 27 km (17 miles) for each terminal location alone. However, this interaction would occur very infrequently since in addition to the conservative crude oil assumptions (Reid vapor pressure of 5 psia and temperature of 120^{O}F) and worst case meteorological conditions (wind speed of 1 m/sec and "D" stability), it was assumed that the wind direction was parallel to the orientation of the tanker docks, i.e. maximum interaction from three tankers loading simultaneously.

SUMMARY OF IMPACTS AT BATON ROUGE

Baton Rouge, the major industrialized, populated region near the SPR terminals is a non-attainment area for photochemical oxidants. Since hydrocarbon emissions are widely accepted as precursors to oxidant formation, impacts at Baton Rouge from operation of the terminal facilities at Nordix and St. James were addressed. Furthermore, existing hydrocarbon levels are known to be high in southeastern Louisiana (Section B.2.3.3.2).

Generally, the DOE-Nordix combination would have a more significant impact upon Baton Rouge since Nordix is only about 15 km (9 miles) south of it whereas St. James is about 50 km (31 miles) to the south. Effects during static storage (no oil movement) would have little impact upon Baton Rouge. For the DOE-Nordix combination, concentrations greater than 160 $\mu g/m^3$ would be expected at Baton Rouge from transfer operations during withdrawal under worst case assumptions. However, these levels would be expected to occur very infrequently. During more normal meteorological conditions, concentrations would be about 20 percent of maximum expected levels during withdrawal, but only 5 percent of maximum levels during fill. In addition, as previously indicated, it is highly unlikely that multiple withdrawals would occur. Therefore, transfer emissions would be intermittant and infrequent and the peak emission rate used in modelling would only occur during a national emergency.

In conclusion, significant impacts at Baton Rouge due to the DOE-Koch combination should be very infrequent. Although significant impacts at Baton Rouge due to the DOE-Nordix combination are more likely. they would be limited primarily to withdrawal operations during poor dispersion conditions.

C.3.3.3.2 Alternate Grouping No. 1 (Early Storage Sites Plus Expansion of Weeks Island)

The largest potential effects on air quality associated with operation of the early storage sites plus expansion of Weeks Island would result from hydrocarbon emissions during fill and withdrawal cycles. Data presented in Section B.2.3.3.2 indicate that non-methane hydrocarbon concentrations in the area frequently exceed the National and State standard of 160 $\mu g/m^3$ (3-hour average, 6-9 a.m.). Hydrogen sulfide losses are expected to be minimal since most of the crude oil that is expected to be stored in the Capline system would have weathered sufficiently during overseas transit to essentially eliminate the H_2S component.

Both average and maximum hydrocarbon emission rates are presented in this section (except for minor sources). During withdrawal operations, the crude oil is assumed to have an elevated temperature of 100^{o}F (except 120^{o}F for crude oil stored at Bayou Choctaw). Elevated crude oil temperatures are expected to result from long-term storage in salt domes at temperatures of up to 150^{o}F. Appendix J describes how the crude oil temperature will change as it moves to the storage tanks. Average emissions are used to determine the total emissions expected over the assumed 22-year period of operaton while maximum emissions are used to evaluate the worst case impact upon air quality. Emissions and impacts are given for the maximum use of either combination of terminal facilities, i.e. DOE/Koch or DOE/Nordix.

Generally, the emission sources and air quality impacts during operation of the proposed alternative would be similar to those described in Section C.3.3.3.1 for development of Napoleonville. However, since expansion capacity at Weeks Island would be 91 MMB compared to 150 MMB storage capacity at Napoleonville, the transfer and transit hydrocarbon emissions over the assumed 22-year period of operation would be substantially less, as indicated in Table C.3-1b. The total emissions from oil movements for early storage sites at Bayou Choctaw and Weeks Island are given in brackets. Total emissions (expansion only), including storage tank emissions are 17,733 and 17,710 tons, respectively, for the DOE/Koch and DOE/Nordix terminal combinations.

Storage tank vapor losses are slightly less than for the Napoleonville expansion since, during withdrawal operations, crude oil originating at Weeks Island is assumed to have an elevated temperature of 100^{o}F compared to 120^{o}F at Napoleonville. The average annual emission rates due to both SPR expansion and early storage operations are summarized below for each terminal combination. These results include the additional emissions due to elevated crude oil temperatures during the 5 withdrawal cycles that are assumed to occur over the 22-year period of operation.

	Tank usage (bbl)		Average hydrocarbon emissions (tons/year)		
Terminal combinations	Expansion	ESR	Expansion	ESR	Total
DOE plus Koch	3-500,000 4-200,000	8-200,000	41	39	80
DOE plus Nordix	4-200,000 10-150,000	4-200,000	60	39	99

The average static storage loss (no oil movement) at any location would be 54, 21, and 39 tons/year at the DOE, Koch, and Nordix tank farms, respectively, assuming the total number of tanks at each location are in use continuously. If withdrawal occurs during the year, the expected emissions at each location would increase about 20 percent due to elevated crude oil temperatures.

TABLE C.3-1b Estimated hydrocarbon emissions[a] (tons) at terminal facilities accompanying the transport of oil for development of alternative # 1[b], over the life of the project assuming 5 fill/withdrawal cycles.

Location	Tankers/Barges Fills (5)	Tankers/Barges Withdrawals (5)	Storage Tanks[c]	91 MMB Expansion Total	Early Storage Total
A. DOE AND KOCH TERMINALS					
Gulf of Mexico	6,880	0	0	6,880	(13,834)
Mississippi River[d]	2,040	1,486	0	3,526	(7,596)
Terminals	4,013	2,408	906	7,327	(15,544)
Total	12,933	3,894	906	17,733	(36,974)
B. DOE AND NORDIX TERMINALS					
Gulf of Mexico	6,880	0	0	6,880	(13,834)
Mississippi River[d]	2,327	1,689	0	4,016	(7,596)
Terminals	4,013	1,486	1,315	6,814	(15,544)
Total	13,220	3,175	1,315	17,710	(36,974)

[a] Average conditions assuming a Reid vapor pressure of 4 psia. During withdrawal operations, the crude oil at the terminal is assumed to be at 120° F (except that crude stored at Weeks Island is 100° F).

[b] The emissions in this table are for expansion at Weeks Island with the total emissions for early storage at Bayou Choctaw and at Weeks Island given in brackets for comparison.

[c] Storage tank losses estimated to occur continuously for a 22-year period.

[d] Transit emissions, most of which occur along the Mississippi River.

Estimated annual hydrocarbon emissions at St. James and Nordix during peak fill/withdrawal operations for the two terminal combinations compared to recent parish totals (Section B.2.3.3.3) are summarized below:

	Annual HC Emissions (tons/yr) and Percent Increase During Both Fill and Withdrawal Operations			
	St. James		Nordix	
Existing Emissions (Parish)	22,870 (St. James)		11,167 (Iberville)	
DOE/Koch Combination	Fill	Withdrawal	Fill	Withdrawal
Expansion	651/2.8	529/2.3	0	0
Early Storage	1212/5.3	1050/4.6	0	0
Total	1863/8.1	1579/6.9	0	0
DOE/Nordix Combination				
Expansion	324/1.4	263/1.1	345/3.1	288/2.6
Early Storage	1212/5.3	1050/4.6	0	0
Total	1536/6.7	1313/5.7	345/3.1	288/2.6

As previously indicated, none of the emission totals would add significantly (less than 1 percent) to the combined emission totals of the five parishes most likely to be affected by those emissions.

Maximum hydrocarbon emissions during fill and withdrawal operations are as previously given in Section C.3.3.3.1 since peak transfer rates and maximum use of storage tanks are assumed for the purpose of calculating worst case downwind concentrations. It was concluded in Section C.3.3.3.1 that storage tank emissions may cause infrequent additional exceedances of the 3-hour HC standard nearby (less than 5 km downwind, generally). For two tankers loading simultaneously, hydrocarbon concentrations in excess of 160 $\mu g/m^3$ would be expected up to 27 km (17 miles) downwind of each terminal location. Currently, vapor emissions from ship loading and unloading activities are not regulated.

Comments on emission source interaction and impacts at Baton Rouge in Section C.3.3.3.1 also applies to the Weeks Island expansion.

C.3.3.3.3 Alternate Grouping No. 2 - Early Storage Sites Plus Bayou Choctaw Expansion and Iberia

The largest potential effects on air quality associated with the operation of the early storage sites plus expansion of Bayou Choctaw plus Iberia would result from hydrocarbon emissions during fill and withdrawal cycles. Data presented in Section B.2.3.3.2 indicate that non-methane hydrocarbon concentrations in the area frequently exceed the National and State standard of 160 $\mu g/m^3$ (3-hour average, 6-9 a.m.). Hydrogen sulfide losses are expected to be minimal since most of the crude oil that is expected to be stored in the Capline system would have weathered sufficiently during overseas transit to essentially eliminate the H_2S component.

Both average and maximum hydrocarbon emission rates are presented in this section (except for minor sources). During withdrawal operations the crude oil is assumed to have an elevated temperature of 120^{o}F (except 100^{o}F for crude oil stored at Weeks Island). Elevated crude oil temperatures are expected to result from long-term storage in salt domes at temperatures of up to 150^{o}F. Appendix J describes how the crude oil temperature will change as it moves to the storage tanks. Average emissions are used to determine the total emissions expected over the assumed 22-year period of operation while maximum emissions are used to evaluate the worst case impact upon air quality. Emissions and impacts are given for the maximum use of either combination of the terminal facilities, i.e. DOE/Koch and DOE/Nordix.

Generally, the emission sources and air quality impacts during operation of the proposed alternative would be similar to those described in Section C.3.3.3.1 for development of Napoleonville. However, since expansion capacity at Bayou Choctaw plus Iberia would be 106 MMB compared to 150 MMB storage capacity at Napoleonville, the transfer and transit hydrocarbon emissions over the assumed 22 year period of operation would be substantially less as indicated in Table C.3-1c. (The total emissions from oil movements for early storage sites at Bayou Choctaw and Weeks Island are given in brackets.) Total emissions (expansion only),

TABLE C.3-1c Estimated hydrocarbon emissions[a] (tons) at terminal facilities accompanying the transport of oil for development of alternative #2[b], over the life of the project assuming 5 fill/withdrawal cycles.

Location	Tankers/Barges Fills (5)	Tankers/Barges Withdrawals (5)	Storage Tanks[c]	106 MMB Expansion Total	Early Storage Total
A. DOE AND KOCH TERMINALS					
Gulf of Mexico	8,014	0	0	8,014	(13,834)
Mississippi River[d]	2,379	2,449	0	4,828	(7,596)
Terminals	4,675	3,250	964	8,889	(15,544)
Total	15,068	5,699	964	21,731	(36,974)
B. DOE AND NORDIX TERMINALS					
Gulf of Mexico	8,014	0	0	8,014	(13,834)
Mississippi River[d]	2,714	2,783	0	5,497	(7,596)
Terminals	4,675	3,250	1,398	9,323	(15,544)
Total	15,403	6,033	1,398	22,834	(36,974)

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[a] Average conditions assuming a Reid vapor pressure of 4 psia. During withdrawal operations, the crude oil at the terminal is assumed to be at 120° F (except that crude stored at Weeks Island is 100° F).

[b] The emissions in this table are for expansion at Bayou Choctaw and Iberia with the total emissions for early storage at Bayou Choctaw and at Weeks Island given in brackets for comparison.

[c] Storage tank losses estimated to occur continuously for a 22-year period.

[d] Transit emissions, most of which occur along the Mississippi River.

including storage tank emissions, are 21,731 and 22,834 tons, respectively, for the DOE/Koch and DOE/Nordix terminal combinations.

Storage tank vapor losses are essentially the same as given for Napoleonville expansion in Section C.3.3.3.1. The average annual emission rates due to both SPR expansion and early storage operation are summarized below for each terminal combination. These results include the additional emissions due to elevated crude oil temperatures during the 5 withdrawal cycles that are assumed to occur over the 22 year period of operation.

	Tank Usage (bbl)		Average Hydrocarbon Emissions (tons/year)		
Terminal Combinations	Expansion	Early Storage	Expansion	Early Storage	Total
DOE/Koch	3-500,000 4-200,000	8-200,000	44	39	83
DOE/Nordix	4-200,000 10-150,000	4-200,000	64	39	103

The average static storage loss (no oil movement) at any location would be 54, 21, and 39 tons/year at the DOE, Koch, and Nordix tank farms, respectively, assuming the total number of tanks at each location are in use continuously. If withdrawal occurs during the year, the expected emissions at each location would increase about 50 percent due to elevated crude oil temperatures.

Estimated annual hydrocarbon emissions at St. James and Nordix during both fill and withdrawal operations for the two terminal combinations compared to recent Parish totals (Section B.2.3.3.3) are summarized as follows:

	Annual HC Emissions (tons/yr) and Percent Increase During Both Fill and Withdrawal Operations			
	St. James		Nordix	
Existing Emissions (Parish)	22,870 (St. James)		11,167 (Iberville)	
DOE/Koch Combination	Fill	Withdrawal	Fill	Withdrawal
Expansion	974/4.3	709/3.1	0	0
Early Storage	1212/5.3	1050/4.6	0	0
Total	2186/9.6	1759/7.7	0	0
DOE/Nordix Combination				
Expansion	485/2.1	352/1.5	506/4.5	384/3.4
Early Storage	1212/5.3	1050/4.6	0	0
Total	1697/7.4	1402/6.1	506/4.5	384/3.4

As previously indicated, neither emission total would add significantly (less than 2 percent) to the combined hydrocarbon emission totals of the five parishes most likely to be affected by those emissions.

Maximum hydrocarbon emissions during fill and withdrawal operations are as previously given in Section C.3.3.3.1 since peak transfer rates and maximum use of storage tanks are assumed for the purpose of calculating "worst case" downwind concentrations. It was concluded in Section C.3.3.3.1 that storage tank emissions may cause infrequent additional exceedances of the 3-hour hydrocarbon standard nearby (less than 5 km downwind, generally). For two tankers loading simultaneously, hydrocarbon concentrations in excess of 160 $\mu g/m^3$ would be expected up to 27 km (17 miles) downwind of each terminal location. Currently, vapor emissions from ship loading and unloading activities are not regulated.

Comments on emission source interaction and impacts at Baton Rouge in Section C.3.3.3.1 also applies to the Bayou Choctaw expansion plus Iberia.

C.3.3.3.4 Alternative Grouping No. 3 (Early Storage Sites Plus Chacahoula)

The largest potential effects on air quality associated with the operation of the early storage sites plus Chacahoula would result from hydrocarbon emissions during fill and withdrawal cycles. Data presented in Section B.2.3.3.2 indicate that non-methane hydrocarbon concentrations in the area frequently exceed the National and State standard of 160 $\mu g/m^3$ (3-hour average, 6-9 a.m.). Hydrogen sulfide losses are expected to be minimal, since most of the crude oil that is expected to be stored in the Capline system would have weathered sufficiently during overseas transit to essentially eliminate the H_2S component.

Both average and maximum hydrocarbon emission rates are presented in this section (except for minor sources). During withdrawal operations, the crude oil is assumed to have an elevated temperature of 120^{o}F (except 100^{o}F for crude oil stored at Weeks Island). Elevated crude oil temperatures are expected to result from long-term storage in salt domes at temperatures of up to 150^{o}F. Appendix J describes how the crude oil temperature will change as it moves to the storage tanks. Average emissions are used to determine the total emissions expected over the assumed 22-year period of operation while maximum emissions are used to evaluate the worst case impact upon air quality. Emissions and impacts are given for the maximum use of either combination of the terminal facilities, i.e. DOE/Koch or DOE/Nordix.

Generally, the emission sources and air quality impacts during operation of the proposed alternative would be similar to those described in Section C.3.3.3.1 for development of Napoleonville. However, since expansion capacity at Chacahoula would be 200 MMB compared to 150 MMB storage capacity at Napoleonville, the transfer and transit hydrocarbon emissions over the assumed 22-year period of operation would be substantially more as indicated in Table C.3-1d. The total emissions from oil movements for early storage sites at Bayou Choctaw and Weeks Island are given in brackets. Total emissions (expansion only), including storage tank emissions are 40,179 and 41,892 tons, respectively, for the DOE/Koch and DOE/Nordix terminal combinations.

Storage tank vapor losses are essentially the same as given for Napoleonville expansion in Section C.3.3.3.1. The average annual emission rates due to both SPR expansion and early storage operations are summarized

TABLE C.3-1d Estimated hydrocarbon emissions[a] (tons) at terminal facilities accompanying the transport of oil for development of alternative #3[b], over the life of the project and assuming five fill/withdrawal cycles.

Location	Tankers/Barges Fills (5)	Tankers/Barges Withdrawals (5)	Storage Tanks[c]	200 MMB Expansion Total	Early Storage Total
A. DOE AND NORDIX TERMINALS					
Gulf of Mexico	15,120	0	0	15,120	(13,834)
Mississippi River[d]	4,482	4,620	0	9,102	(7,596)
Terminals	8,820	6,132	1,005	15,957	(15,544)
Total	28,422	10,752	1,005	40,179	36,974
B. DOE AND NORDIX TERMINALS					
Gulf of Mexico	15,120	0	0	15,120	(13,834)
Mississippi River[d]	5,112	5,250	0	10,362	(7,596)
Terminals	8,820	6,132	1,458	16,410	(15,544)
Total	29,052	11,382	1,458	41,892	(36,974)

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[a] Average conditions assuming a Reid vapor pressure of 4 psia. During withdrawal operations, the crude oil at the terminal is assumed to be at 120° F (except that crude stored at Weeks Island is 100° F).

[b] The emissions in this table are for expansion at Chacahoula with the total emissions for early storage at Bayou Choctaw and at Weeks Island given in brackets for comparison.

[c] Storage tank losses estimated to occur continuously for a 22-year period.

[d] Transit emissions, most of which occur along the Mississippi River.

below for each terminal combination. These results include the additional emissions due to elevated crude oil temperatures during the 5 withdrawal cycles that are assumed to occur over the 22-year period of operation.

	Tank usage (bbl)		Average hydrocarbon Emissions (tons/year)		
Terminal combinations	Expansion	Early Storage	Expansion	Early Storage	Total
DOE/Koch	3-500,000 4-200,000	8-200,000	46	39	85
DOE/Nordix	4-200,000 10-150,000	4-200,000	66	39	105

The average static storage loss (no oil movement) at any location would be 54, 21, and 39 tons/year at the DOE, Koch, and Nordix tank farms, respectively. If withdrawal occurs during the year, the expected emissions at each location would increase about 75 percent due to elevated crude oil temperatures.

Estimated annual hydrocarbon emissions at St. James and Nordix during both fill and withdrawal operations for the two terminal combinations, compared to recent parish totals (Section B.2.3.3.3) are summarized below:

	Annual Hydrocarbon Emissions (tons/yr) and Percent Increase During Both Fill and Withdrawal Operations			
	St. James		Nordix	
Existing Emissions (Parish)	22,870 (St. James)		11,167 (Iberville)	
DOE/Koch Combination	Fill	Withdrawal	Fill	Withdrawal
Expansion	603/2.6	1294/5.7	0	0
Early Storage	1212/5.3	1050/4.6	0	0
Total	1815/7.9	2344/10.2	0	0
DOE/Nordix Combination				
Expansion	300/1.3	644/2.8	321/2.9	681/6.1
Early Storage	1212/5.3	1050/4.6	0	0
Total	1512/6.6	1694/7.4	321/2.9	681/6.1

As indicated previously, none of the emission totals would add significantly (1 percent of less) to the combined hydrocarbon emission total of the five parishes most likely to be affected by these emissions.

Maximum HC emissions during fill and withdrawal operations are as given in Section C.3.3.3.1, since peak transfer rates and maximum use of storage tanks are assumed for the purpose of calculating worst case downwind concentrations. It was concluded in Section C.3.3.3.1 that storage tank emissions may cause infrequent additional exceedances of the 3-hour hydrocarbon standard nearby (less than 5 km downwind, generally). For two tankers loading simultaneously, hydrocarbon concentrations in excess of 160 $\mu g/m^3$ would be expected up to 27 km (17 miles) downwind of each terminal location. Currently, vapor emissions from ship loading and unloading activities are not regulated.

Comments on emission source interaction and impacts at Baton Rouge in Section C.3.3.3.1 also applies to the Chacahoula alternative.

C.3.3.4 Noise

Operation of either the DOE/Koch or DOE/Nordix terminal system combination would have no significant noise impact during either fill or withdrawal activities. During a fill cycle, oil would arrive at the docks in tankers. The noise produced by the tankers would be of short duration, low frequency, and low intensity. The withdrawal cycle would involve the filling of tankers at the docks. Noise levels produced by the tankers, measured on land, would be negligible and of short duration.

C.3.3.5 Impacts of Ecosystems and Species

Normal operation of either the DOE/Koch or the DOE/Nordix terminal system combination would have little additional impact on the ecological aspects of the sites. Marine transport operations could affect the marine life in the Mississippi River, since ship passages may cause increased turbidity and shoreline erosion. Passage of a barge or tanker can resuspend sediments which require at least 2.5 hours to settle (U.S. Army Corps of Engineers, 1975). High turbidity may clog or abrade gills of fish and macrobenthos, or suffocate mollusks. It can also reduce plankton productivity, thus reducing the amount of food available to filter-feeding fish and mollusks. Existing turbidity levels in the river due to natural conditions, maintenance dredging, and existing ship traffic are high. Therefore, it is expected that impacts directly attributable to the tankers connected with the Capline Group SPR and early storage facility operations would be minor in comparison to the total impact from all ship traffic and dredging within the harbor.

Other operational impacts on the biological resources in the area would be principally related to the potential for oil spills. A summary of the expected frequency and volume of oil spills for either terminal system combination was presented in Section C.3.3.3. Because of the design safeguards provided in the systems and the relatively infrequent spill expectation, the potential biological impact from small, chronic spills is expected to be small. The oil surge tanks utilized in terminal system combinations would be diked to prevent escape of the oil in the event of a major spill.

Type of exposure to be expected differs in accordance with the mode of transport and handling (see Tables C.2-1 through C.2-8). Tanker casualty spills may be quite large but are relatively infrequent. The use of the Nordix terminal system would increase marine vessel casualty exposure in the Mississippi River by 30 percent of the exposure for the DOE and Koch terminal systems. This is the result of the Nordix terminal system being located 45 miles above the DOE or Koch terminal system. If a large spill reaches the marshes of the lower Mississippi River Delta, impacts could be severe, but the chance of such an event is fairly low (for example, one vessel casualty spill is projected to occur in the Gulf of Mexico or lower Mississippi River (below New Orleans) during each fill from the early storage and SPR operations). Effects on marsh inhabitants, such as waterfowl and fur animals, in addition to primary productivity, could be severe. The small spills accompanying oil transfer operations constitute the vast majority of oil spills expected from the SPR program. With appropriate deployment of booms and other oil recovery equipment, effects should be localized.

The impact of an aquatic oil spill becomes particularly far-ranging in highly turbid aquatic systems, such as the Mississippi River, since oil and petrochemicals are quickly absorbed by suspended matter such as clay. These particles may be transported over wide areas by the strong currents and large heavy oily globules may be formed and deposited on the river bottom far from the source. On the bottom, the globules can release water soluble substances which are toxic to aquatic life. Sediments which are covered by oil can become low in oxygen and subsequently may become anaerobic. Under these conditions, oil degradation is very slow and many of the toxic components are the slowest ones to be broken down (Murphy, 1971).

Petroleum products have been shown to damage aquatic biota in four principal ways (FWPCA, 1968):

- By direct contact with the organism
- By smearing gills or being swallowed with water and food
- By forming a surface film that may interfere with gaseous exchange or respiration
- By poisoning organisms with various water soluble substances leached from the oil

All components of aquatic ecosystems can be damaged. Phytoplankton and zooplankton, primary food sources in the food web, may be destroyed or coated with oily substances. If these coated plankton are ingested by fish, an oily smell and taste may be imparted to the fish flesh. Fish may also be impaired or killed directly when the epithelial surfaces of their gills become coated with a film, thereby inhibiting respiration. Oil which settles to the bottom may also coat river sediments and destroy benthic organisms and also interfere with spawning activities. The reproductive capacity of benthic organisms may also be impaired (Murphy, 1971).

The main groups of aquatic organisms which could be affected by oil spills into water at the docks include plankton, nekton, benthos, macrophytes, periphyton, microbes, and aquatic birds and mammals. Aquatic organisms associated with the water surface, the neuston, would presumably be most subject to the toxic or mechanical (smothering or coating) effects from contact with fresh oil slicks.

Under laboratory conditions, droplets of oil have been noted to adhere to spines of marine phytoplankton and zooplankton, especially after they had come in contact with the surface film (Ministry of Defense, 1973). Plankton, which float with the water currents at relatively slow speeds would be unable to effectively avoid the spill areas. Various physiological effects have been documented for phytoplankton in or near a large spill or in an area of chronic pollution. For example, photosynthetic activity was accelerated at lower concentrations (1 to 3 mg/l) and diminished at higher ones (6 to 20 mg/l) (Boesch et al., 1974). Eggs and larvae of many benthic organisms such as oysters, shrimp, crabs, and demersal fish are major temporary components of the zooplankton. These immature stages are often highly susceptible to toxic materials. Many zooplankton which exhibit a diurnal vertical migration in the water column could also be destroyed by a major oil spill. However, field data do not conclusively demonstrate a measurable effect. There is little evidence for concentration of oil ingested by zooplankton at higher trophic levels in the food web.

Fish usually are able to avoid spilled oil, and there is evidence confirming this avoidance (Boesch, et. al., 1974). Large fish kills have generally occurred in only restricted water bodies. These kills are attributable to direct toxic effects of the oil or lowered dissolved oxygen levels in the water, caused by restricted oxygen diffusion from the atmosphere, or the increase of biochemical oxygen demand by the oil particles or a combination of these factors. Fish appear to be more resistant to the toxicity of oil products than many other aquatic organisms, because the mucus coating on their exterior body surface is oil repellant (Boesch, et al., 1974). Direct toxic effects on fish exposed to oil spilled off the Louisiana coast showed the loss of gill tissue cells or "sloughing," and swollen branchial filaments (U.S. Environmental Protection Agency, 1972). It has been suggested that the toxic effects of aged crude oil may be greater than that of fresh crude oil (Bender, 1976). Fish may be contaminated because of intake of petroleum hydrocarbons during their feeding activities; this tainting may persist for several months (Boesch, et. al., 1974).

Benthic organisms would be mainly affected by oil that sank to the bottom and coated the plants and animals. Reduced oxygen levels in the benthos could be an important factor in this impact. All organisms are not equally successful at recolonizing polluted areas and several years may be required to reattain pre-impact levels of diversity and community structure. Some bottom organisms accumulate petroleum hydrocarbons in their tissue after ingestion (Boesch et. al., 1974).

Periphyton communities, which tend to be made up of very small organisms, are very dependent on substrate and therefore oil would probably have a very great impact on this community. However, since these organisms have very short life cycles they should be able to recolonize suitable surfaces relatively rapidly after the oil is degraded or has been removed.

C.3.3.6 Natural and Scenic Resources

Normal operation of either the DOE/Koch or DOE/Nordix terminal system combination is not anticipated to cause additional impacts on scenic, recreational, or natural resources. The potential, however, does exist for oil spills during the transportation of oil. Possible effects include the oiling of marshlands in the lower Mississippi River Delta, which are important for waterfowl and fur production (e.g. Pass a Loutre State Waterfowl Management Area and Delta National Wildlife Area).

C.3.3.7 Archaeological, Historical, and Cultural Resources

Normal operation of either the DOE/Koch or DOE/Nordix terminal system combination would have no impact on any of these resources.

C.3.3.8 Socioeconomic Environment

Operation of either the DOE/Koch or DOE/Nordix terminal system combination would have little impact on the socioeconomic environment. Primarily industrialized land would be utilized for terminal system components for the life of the project. Although tanker traffic on the

Mississippi River would increase, particularly during fill and withdrawal operations, it is not expected that undue congestion or safety hazards would result. As only a small number of workers would be required at the terminal systems during fill and withdrawal operations, and considering the availability of a large work force nearby, it is unlikely that any immigration of workers or increase in housing demand would result. The operation activities would have an insignificant impact on the local economy, as total payroll and purchases are expected to be small in comparison to the economic activity in the area. No increased demand on governmental services is expected. The continued Federal use of land associated with the terminal system combination would decrease local property tax revenue by a minor amount.

C.3.4 Impact Due to Termination and Abandonment

No specific plan for termination and abandonment of any of the terminal systems has been established. However, the DOE will be required to develop such a plan near the termination of the action. In the case of the Nordix terminal system, it is possible that the Nordix Company may be able to utilize the docks and tankage at Sunshine, Louisiana. In the case of the Koch terminal system, the system would be constructed and operated by the Koch Oil Company, who may similarly be able to utilize the components developed as a part of this program. The DOE terminal may also be converted to uses in the public or private sector.

C.3.5 The Relationship of the Proposed Actions to Land-Use Plans, Policies, and Controls for the Affected Areas

There are presently no official plans, policies, or controls established by Federal, State, or local government agencies in St. James or Iberville Parishes. Furthermore, lands under consideration for use in developing the Strategic Petroleum Reserve terminal system at St. James and Sunshine are presently devoted to industrial uses.

Although a Coastal Zone Management Plan is in preparation in Louisiana, there is no apparent project conflict with the basic concepts established by the Louisiana Advisory Commission on Coastal and Marine Resources (1973), which are expected to be an important part of the ultimate plan.

Thus, development would occur at previously established industrial sites and oil transportation would follow established corridors. It is not anticipated that the Strategic Petroleum Reserve oil distribution terminal systems would be in conflict with any land use policies or plans.

C.3.6 Summary of Adverse and Beneficial Impacts

Development and operation of the Capline Group oil distribution terminal systems would not be likely to generate significant regional environmental impacts except for the possibility of a major oil spill and the uncontrolled release of hydrocarbon vapor during oil transportation operations.

Table C.3-2 and C.3-3 provide a summary tabulation of the findings of the various discipline analyses of impacts of terminal system development and operation. The data provided are in both qualitative and quantitative form, as appropriate.

TABLE C.3-2 Summary of environmental impacts caused by construction of terminal facilities for proposed or alternative Capline storage site groupings.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT - PROPOSED TERMINAL FACILITIES
Geology and Land Features	DOE terminal facility site and immediate vicinity (near St. James)	Site Preparation 112,000 cy of fill for oil surge tanks, access roads, and other surface facilities. Direct impacts on 36 acres.
	Koch terminal facility site and immediate vicinity (near St. James)	Site Preparation and Pipeline Connections 15,000 cy of excavation and 745,000 cy of dredging for pipelines, tanker dock and other surface facilities. Direct impacts on 57 acres.
	Nordix terminal facility site and immediate vicinity (near Sunshine)	Site Preparation and Pipeline Connections 82,000 cy of fill for oil surge tanks, 53,000 cy of excavation and 745,000 cy of dredging for pipelines, tanker dock and other surface facilities. Direct impacts on 139 acres.
		Site Preparation and Alternative Pipeline 82,000 cy of fill for oil surge tanks, 123,300 cy of excavation and dredging for pipelines, surface facilities and tanker dock. Direct impacts on 96 acres.
Water Resources	Mississippi River	Koch Terminal Construction Dredging of Mississippi River for dock and pipeline crossing near St. James would have locally significant, short-term impact. Pipeline and terminal construction would induce minor local increases in sediment in local tributaries.
		Nordix Terminal Construction Dredging of Mississippi River for dock and pipeline crossing near Sunshine would have locally significant, short-term impact. Pipeline and terminal construction would induce minor local increases in sediment in local tributaries.
		Nordix Terminal and Alternative Pipeline Construction Some dredging of Mississippi River for dock near Sunshine would have locally significant, short term impact. Pipeline and terminal construction would induce minor local increases in sediment in local tributaries.
		DOE Terminal Construction Pipeline and terminal construction near St. James would induce minor local increases in sediment in local tributaries.
Air Quality	All terminal sites	Site Preparation and Painting Minor quantitites of particulates - SO_2, CO, HC, and NO_2 released from construction equipment. Minimal effect. Short-term HC concentrations of up to 104 $\mu g/m^3$ at one kilometer downwind during painting of tanks; possible exceedance of ambient air quality standards due to high background levels during 1 to 3 month period.

TABLE C.3-2 continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT - PROPOSED TERMINAL FACILITIES
Noise Level	DOE terminal facility site vicinity (near St. James)	Site Preparation Maximum zone of noise impact, 1600 feet; 10 to 15 residences may be affected.
	Koch terminal facility site vicinity (near St. James)	Site Preparation Maximum zone of noise impact, 2500 feet; up to 25 residences may be affected.
	Nordix terminal facility site vicinity (near Sunshine)	Site Preparation and Proposed or Alternative Pipeline Maximum zone of noise impact, 2500 feet; up to 30 residences may be affected.
Species and Ecosystems	Terrestrial:	
	Agricultural or Cleared Land	DOE terminal site preparation Loss of 36 acres for terminal site construction.
		Koch terminal site preparation Loss of 57 acres for terminal site construction.
		Nordix terminal site preparation Loss of 68 acres for terminal site and pipeline construction.
		Nordix terminal site and alternative pipeline preparation Loss of 21 acres for construction.
	Bottomland Forest	Nordix terminal site perparation Loss of 55 acres for terminal site and pipeline construction.
		Nordix terminal site and alternative pipeline preparation Loss of 74 acres for construction.
	Aquatic:	
	Mississippi River (and local tributaries)	DOE, Koch and Nordix terminal site preparation Minimal local impacts due to erosion and runoff.
		Koch and Nordix dock and pipeline construction Significant, short-term impact due to dredging. (See water resources, above.)
		Nordix dock and alternative pipeline Minimal and local impacts due to erosion and runoff. Small, short term impact due to dredging for dock.
Natural and Scenic Resources	All Construction Areas	Locally significant impact due to construction of terminals.
Socioeconomic Conditions	Land Use	DOE terminal Alteration of land use on a total of 36 acres in St. James parish.
		Koch terminal Alteration of land use on a total of 57 acres in St. James parish.

TABLE C.3-2 continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT - PROPOSED TERMINAL FACILITIES
		Nordix terminal Alteration of land use on a total of 123 acres in Iberville parish.
		Nordix terminal and alternative pipeline Alternation of land use on a total of 95 acres in Iberville parish.
	Economy	DOE terminal Construction wages approximately $0.6 million, much of which would be spent outside the local area.
		Koch terminal Construction wages approximately $1.3 million, much of which would be spent outside the local area.
		Nordix terminal and proposed or alternative pipeline Construction wages approximately $0.8 million, much of which would be spent outside the local area.
	Government	Possibly significant loss of property and severance tax revenues.

TABLE C.3-3 Summary of environmental impacts caused by operation of terminal facilities for proposed and alternative site groupings.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT - PROPOSED TERMINAL FACILITIES
Water Resources	Mississippi River	Oil Spills (all terminals) Could have significant local impacts.
	Ground Water	Oil Spills (all terminals) Very slight chances of local ground water pollution due to surface oil spill.
Air Quality	Terminal Sites, Mississippi River and Gulf of Mexico	Emissions from terminal, transfer, and transit a) Proposed storage site grouping (Napoleonville dome, plus early storage at Weeks Island and Bayou Choctaw) Total emissions from 330 MMB oil storage facility for 5 fill/withdrawal cycles range from approximately 67,300-68,700 tons; 46% due to the Napoleonville expansion. Distribution of emissions includes: 37% in the Gulf of Mexico, 22% in transit and at the docks, and 44% at the terminals. b) Alternative storage site grouping No. 1 (Expansion of Weeks Island dome, plus early storage at Weeks Island and Bayou Choctaw) Total emissions from 274 MMB oil storage facility for 5 fill/withdrawal cycles are approximately 54,700 tons; 32% due to the Weeks Island expansion. Distribution of emissions includes: 38% in the Gulf of Mexico, 20% in transit and at the docks, and 42% at the terminals. c) Alternative storage site grouping No. 2 (Expansion of Bayou Choctaw plus Iberia dome, and early storage at Weeks Island and Bayou Choctaw) Total emissions from 289 MMB oil storage facility for 5 fill/withdrawal cycles range from 58,700 - 59,800 tons; 38% due to the Bayou Choctaw expansion and Iberia. Distribution of emissions includes: 37% in the Gulf of Mexico, 21% in transit and at the docks, and 42% at the terminals. d) Alternative storage site grouping No. 3 (Chacahoula dome plus early storage at Weeks Island and Bayou Choctaw) Total emissions from 200 MMB oil storage facility for 5 fill/withdrawal cycles range from 77,200 - 78,900 tons; 53% due to the Chacahoula facilities. Distribution of emissions includes: 37% in the Gulf of Mexico, 22% in transit and at the docks, and 41% at the terminals.

TABLE C.3-3 continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT - PROPOSED TERMINAL FACILITIES
Noise	All Terminal Sites and immediate vicinity	No significant increase in ambient sound levels on or adjacent to the terminai sites due to operation of terminals.
Species and Ecosystems	Terrestrial:	Oil Spills
	Agricultural or Cleared Land	Possible oil spills would have local, short-term adverse impacts.
	Aquatic:	Oil Spills
	Mississippi River	Potential oil spill impacts could be locally significant, especially at dock site and in lower delta.
	Gulf of Mexico	Expected oil spill volumes could significantly affect marine biota. Estimated total 1250 barrels of oil from all SPR operations in the Gulf during project lifetime. Possibly very large or maximum credible oil spill could have significant impacts to several thousand acres of shallow water or marsh if spill reaches shore before cleanup.
Natural and Scenic Resources		Oil Spills
		Adverse impacts associated with possible large oil spill which could foul swamp forest and marshes and contaminate water with oil.

C.4 PROPOSED DEVELOPMENT - EARLY STORAGE SITES PLUS NAPOLEONVILLE

The following sections detail the expected and potential environmental impacts associated with the proposed development of the Capline Group. Sections C.4.1 and C.4.2 very briefly summarize the types of impacts associated with development and use of the Bayou Choctaw and Weeks Island early storage sites which are treated in detail in previously published EIS's. Section C.4.3 considers impacts associated specifically with the Napoleonville SPR expansion site and also with significant cumulative impacts associated with full development of the Capline Group.

C.4.1 Bayou Choctaw Dome Early Storage Site

Environmental impacts related to the development of Bayou Choctaw dome as an early storage site having a capacity of up to 94 MMB are discussed in FES 76-5 (Section 3.0) and its supplements. Construction impacts include those associated with the following activities:

- o onsite grading and construction of surface facilities;
- o construction of a 39 mile pipeline to the Mississippi River near St. James;
- o construction of a tanker dock, 4-200,000 barrel oil storage tanks, and associated terminal facilities at St. James.

Significant operational impacts would include:

- o Possible oil and brine spills;
- o Withdrawal of surface water for oil displacement;
- o Disposal of brine during oil fill;
- o Hydrocarbon emissions during oil transport and handling;
- o Maintenance clearing on project lands.

C.4.2 Weeks Island Dome Early Storage Site

Development of Weeks Island dome as an early storage site having a capacity of 89 MMB will have anticipated environmental impacts as detailed in Section 4.0 of FES 76/77-8 and its supplements. Construction of proposed facilities would have impacts associated with the following activities:

- o temporary shutdown of Morton Salt Mine and loss of employment for local workers;
- o onsite grading and construction of surface facilities;
- o construction of a 64.4-mile pipeline to the Mississippi River near St. James;
- o construction of a tanker dock, 4-200,000 barrel oil storage tanks, and associated terminal facilities at St. James.

Significant operational impacts would include:

- o Possible oil spills;
- o Hydrocarbon emissions during oil transport and handling;
- o Maintenance clearing on project lands.

C.4.3 Proposed Site Napoleonville Dome

Development of 150 MMB storage facility at Napoleonville would have impacts similar in type to those at Bayou Choctaw. Approximately 30 to 45 MMB of storage capacity presently exists. New facilities required for SPR site expansion include the following: 10 leached storage cavities bringing the total site capacity to 150 MMB (and the Group capacity to as much as 333 MMB); a pump station/control house; a brine settling pond and 28 deep disposal wells; onsite oil, brine, and raw water pipelines and access roads; an onsite gas turbine power plant; a raw water supply line from Bayou Lafourche; and lift pumps at Donaldsonville; and an oil pipeline to the terminal facilities. Most of the pipelines would parallel the existing right-of-way (ROW) for the planned Weeks Island to St. James pipeline (Figure A.4-1).

System alternatives at Napoleonville include: construction of a 74.4-mile brine disposal pipeline to the Gulf diffuser site; and raw water taken from Grand Bayou, from the Gulf of Mexico, from subsurface aquifers or from the Mississippi River at St. James. Impacts of development and use of these alternatives are also considered in the following subsections.

C.4.3.1 Impacts of Site Preparation and Construction

The following section describes impacts resulting from construction of storage site facilities and related projectives at Napoleonville. Impacts resulting from construction of terminal facilities are described in Section C.3.

C.4.3.1.1 Land Features

Proposed Facilities

Quantities of material to be excavated or filled and acreages of land to be affected by grading and other construction activities at the Napoleonville dome and along pipeline routes are listed in Table A.4-1.

Grading at the 437-acre fenced Napoleonville site would be confined to about 63 acres, of which only a small portion would occur in areas already disturbed. The plant area, cavern wellheads and containment dikes, brine disposal wellfield roadways, and other site construction would require 261,000 cubic yards (cy) of fill and 144,000 cy of excavation.

Pipeline construction would temporarily disturb 152 acres of land and require 480,000 cubic yards of earth excavation. Before revegetation of disturbed areas is complete, some erosion of the soil may be expected.

Leaching of 10 storage cavities in the Napoleonville salt dome would involve removal of about 100 to 120 MMB of salt by leaching for disposal in deep saline water bearing sands. This is equivalent to as much as 25×10^6 cy of salt. Sufficient wall thickness would be maintained between cavities to maintain cavern integrity (Section A.3.2.1.2).

Excavation along the pipeline routes, except where canals are necessary through the marsh, is primarily short term.

Alternative Facilities

Quantities of material to be excavated or filled and acreages of land to be affected by grading and other construction activities at the Napoleonville dome and along pipeline routes, are listed in Table A.4-2. Obtaining water from Grand Bayou would substantially reduce the amount of land and soil excavated. Construction of the alternative raw water supply system at the Mississippi River would have little additional effect on land use since this line would follow the crude oil pipeline right-of-way from Napoleonville to St. James.

Construction of a brine disposal system to the Gulf of Mexico diffuser would require a 42.3 mile on-land pipeline over which 17 acres of cleared land, 5 acres of bottomland forest, 45 acres of deciduous swamps, and 25 acres of marshes would be altered. Approximately 620,000 cy of soil would be displaced and the excavated material reused for backfill. Approximately 153 acres would be affected along the pipeline right-of-way onshore. Alteration of existing land features would only be temporarily affected providing recontouring and revegetation is carried out.

C.4.3.1.2 Water Resources

Site preparation and construction of the proposed facilities at Napoleonville may directly affect several water bodies, including: Grand Bayou; canals and small water bodies onsite; Bayou Lafourche; small bayous and canals crossed by the pipeline ROW; the Mississippi River; and ground water aquifers. Potential impacts are treated according to specific aspects of facility development.

Construction of Storage Site Facilities

Onsite construction at Napoleonville would require 144,000 cy of excavation, 261,000 cy of fill and 63 acres of direct land disturbance (Table A.4-1).

Sediment represents the major nonpoint source of water pollution on most construction sites, especially on those which require extensive grading. Sediment includes solids and organic materials detached from the ground surface by erosion and carried into the drainage system principally by runoff. The introduction of sediment into various natural bodies of water and the associated turbidity and deposition of solids result in numerous adverse physical, chemical, and biological effects. Suspended sediment ultimately reduces the storage capacity of waterways, increases flooding hazards, fouls and destroys aquatic habitats, diminishes recreational and property values, and enhances the transport of other harmful pollutants such as human and animal sanitary wastes, pesticides, and petrochemicals.

The site preparation and construction activity at Napoleonville dome would involve a significant amount of earth movement. Approximately 405,000 cubic yards of earth would be displaced during this process and approximately 63 acres of land would be disturbed. The land overlying the dome is a mixture of farmlands, woods, and swamp with an elevation of less than five feet above sea level. Because of the high level of annual precipitation encountered in the region, a significant amount of sediment may be transported from the disturbed surface areas into the surrounding surface water system. This sediment should pass initially into the swamps and canals in the vicinity of the dome. Some of the sediments would move into Grand Bayou (Figure A.4-1) which is located about 0.5 miles west of the site. The sediments would then be transported to Lake Verret to the south. Standard engineering practices such an interceptor ditches, dikes, and sedimentation ponds would be utilized where necessary to prevent any significant degradation of water quality due to plant site runoff.

Numerous solid and liquid products, both organic and inorganic, used in construction are a source of water pollution. The major sources of construction-related chemical pollution can be broadly grouped under the following headings:

- Petroleum products
- Herbicides and pesticides
- Fertilizers
- Metals
- Soil additives
- Construction chemicals
- Miscellaneous wastes

Of these, petroleum products, herbicides and pesticides, and fertilizers appear to be the best known and the best documented source of chemical pollution.

Pollution from petroleum products generally occurs from improper disposal of waste materials such as crankcase oil and various cleaning solvents, leekage of fuels and oil from storage facilities, and damaged or improperly maintained vehicles; fuel spills during equipment refueling operations; and the use of oils for dust control on roadways.

Herbicides and/or pesticides are used on some construction sites to control undesirable vegetation, insects, and rodents. The primary cause of pollution from the use of these chemicals are in the improper use, handling, and disposal of waste materials.

Fertilizers are extensively utilized in the revegetation of areas affected by grading operations. Like herbicides and pesticides, the primary causes of damaging pollution are improper use, i.e., applying too much fertilizer or improper preparation of the ground surface prior to application.

The biological pollutants which generally enter receiving streams and other water bodies as a result of construction activities are bacteria, fungi, worms, viruses, and other less prevalent organisms. Biological pollution is primarily a result of poor sanitary conditions at a construction site; generally improper disposal of human wastes, garbage, and other organic material. The disturbance, exposure and subsequent erosion of surface soils that contain bacteria and other organisms are also contributing factors. Regardless of their origin, biological pollutants of major concern are the pathogenic organisms associated with human wastes.

Prediction of the impact of such chemical and biological contaminants is quite difficult because of the human element involved. Assuming that effective waste management procedures are observed and that personnel are properly indoctrinated, the impact on the water environment should be minimal.

<u>Raw Water Supply System Construction</u>

<u>Effects on Water Source</u> The proposed source of raw water for leaching the Napoleonville SPR facilities during the mining cycle is Bayou Lafourche. Water would be obtained through a 4.6-mile pipeline terminating at an intake structure on the right bank of the channel in the vicinity of Klotzville (Section A.4.5.4.1 and Figure A.4-1).

The water would be supplied by additional pumpage from the Mississippi River to Bayou Lafourche at Donaldsonville, located approximately 12 miles upstream of the water supply intake structure. The average water supply rate during the mining cycle would be 885,000 barrels per day (B/D), or approximately 58 cfs. In comparison, the average daily flow of the Mississippi River is on the order of 1,000,000 cfs, as discussed in Section B.2.2.1.2. Since the amount of water withdrawn would constitute a minor fraction of the Mississippi River flow, no significant impact on water supply would result.

As discussed in Section B.2.2.1.2, Bayou Lafourche has an average daily flow of 252 cfs at the USGS Donaldsonville gaging station. The additional pumpage of 58 cfs required during the mining cycle would increase the average flow in Bayou Lafourche approximately 23 percent between Donaldsonville and the water supply intake structure. The increase in stage of Bayou Lafourche would be approximately 0.20 foot at Donaldsonville, and less downstream toward the intake structure. A minor water quality impact in the form of increased turbidity would result in Bayou Lafourche between Donaldsonville and the water supply intake, due to the velocity increase in the Bayou.

Under normal operating conditions, use of Bayou Lafourche as a channel for delivering Mississippi River water to the intake structure should have little or no effect on water quality or quantity below Klotzville. However, whenever the intake pumps at Bayou Lafourche are shut down, pulses of higher-than-normal flow rate would travel down stream in Bayou Lafourche, increasing turbidity and stream bank erosion. In many cases, the lift pumps at Donaldsonville can be shut down simultaneously with, or prior to, the intake pumps, so that the downstream impacts should not be significant.

Pipeline Construction Effects Construction of the proposed raw water supply system would include the installation of 4.6 miles of buried pipeline between the plant area and the intake structure on Bayou Lafourche (see Section A.4.5.4.1), using installation techniques as described in Section A.3.4. No major water ways would be crossed, though several small streams and about 1 mile of swamp forest would be crossed on the dome (Figure A.4-4).

Water quality impacts of constructing pipelines can include changes in water-flow patterns, BOD, dissolved oxygen, pH, nutrients, heavy metal concentrations, salinity, and turbidity. The disturbance of bottom sediments has the potential of: (1) creating low oxygen conditions by exposing the BOD of sediments to dissolved oxygen in surface water, (2) lowering the pH of waters by exposing sulfides to oxidation and creating sulphuric acid, (3) increasing heavy metal concentrations by exposing complex metals to low pH conditions, (4) releasing trapped nutrients, thereby stimulating local eutrophication, and (5) creating highly turbid conditions from mixing of water with the sediments.

The amount of material released to interact with the air and water as a result of pipeline excavation depends upon (1) the excavation process, (2) the total amount of sediment excavated, (3) the amount of sediment excavated per unit time and distance, and (4) the physical-chemical characteristics of the sediment.

The raw water supply pipeline would involve the excavating of 74,000 cubic yards of material at the rate of about onehalf mile or 3000 cubic yards per day. Based on the the assumption that 50 percent of the excavated material is water (LSU, 1975) and that no more than 10 percent of the water in the sediments will drain into surrounding water in any short time period (less than one week), about 2.5 acre-feet of interstitial water could drain to surrounding lands. Depending on water depths and mixing conditions, a 60-acre area of swamp forest and shallow water could be affected by low pH, low dissolved oxygen and high nutrient concentrations. These effects should dissipate within a week of occurrence due to reaeration of water and use of nutrients by biota.

Impact of Brine Disposal System Construction

Effects on Receiving Aquifers The proposed method for brine disposal is by emplacement in sands containing saline water. This can impact ground water supplies in various ways including increasing the salinity of the injection sands, displacing moderately saline water from one portion of the injection sands into fresh water portions of the same sands, or inducing migration of brine or moderately saline water from the injection sands into a fresh water aquifer via such avenues as abandoned wells or faults.

The proposed receiving formations for injection of brine at Napoleonville range in depth from -5000 feet to -8000 feet, well below any aquifers containing fresh or slightly saline water. The increase in salinity, therefore, would be restricted to water that would not be economically competitive for desalination due to the large quantities of fresh and slightly saline water (1000 mg/l to 3000 mg/l) available in the region.

The likelihood of the occurrence of problems caused by abandoned wells is small because generally the only wells extending to the depth of the injection zone are oil wells whose locations are usually well documented.

In certain geologic provinces where the rock is under stress it may be possible to generate earthquakes or activate faults by high pressure injection of fluids. However, in southern Louisana, the geologic formations are not in a state of stress and are relatively permeable; thus, they provide the path of least resistance to flow, in preference to flow along faults. Standard operating procedures and routine monitoring of injection pressures should preclude hydrofracturing of the rock surrounding injection wells. In addition, the extremely dense brine would tend to move downdip in the receiving formation; the relatively slow movement would not induce mixing with the fluids already present.

It may thus be concluded that no adverse impact on water quality would occur from the use of deep well injection as the method of brine disposal. Additional site-specific studies would need to be conducted to confirm the technical feasibility of injecting brine in the proposed quantities, however.

Pipeline Construction Effects Construction of the proposed brine disposal injection well system would require installation of 6.7 miles of buried pipeline between the plant area and the wellheads southeast of the dome (Figure A.4-4). A permanent roadway would be constructed to each well head; therefore the 106,000 cubic yards of required excavation would be performed using conventional techniques. Releases of interstitial water resulting from construction could be 3.5 acre-feet. As no major water bodies or other sediment transporting waterways would be crossed by the system, only minimal impact on water quality due to sediment release and drainage from spoil would be anticipated.

Impact of Oil Distribution System Pipeline Construction

Construction of the proposed oil pipeline would require that 19.1 miles of pipe be installed. All but the westernmost 0.5 mile of the pipeline would utilize existing rights-of-way. Quantities of excavation required to lay the pipeline would be similar to those required for a new right-of-way. Additional clearing of vegetation is expected to be limited to 20 feet directly adjacent to the existing ROW. Bayou Lafourche is the only significant waterway crossed by the route, along with several smaller streams (e.g., Bayou Verret).

A combination of push-ditch and conventional pipelaying methods would be used, involving 300,000 cubic yards of trench excavation. About one-half mile of pipeline would be constructed per day. About 9.5 acre-feet of interstitial water could drain to surrounding areas, affecting about 185 acres adjacent to the pipeline corridor. The effects would be locally severe but temporary, and not of significance to the region.

Accidental Brine Release

The estimated quantity of brine spilled during leaching of the Napoleonville expansion cavities is 50 barrels onto lands crossed by the pipelines leading to the disposal wells. Water quality impacts should be neglibile. Maximum credible spills of up to 30,000 barrels are considered possible, though highly unlikely (see Appendix E). Such spills could have very serious effects on local water quality, vegetation, and wildlife.

A brine spill at the site or along the disposal pipeline could locally impact the water quality in the upper unit of the Plaquemine aquifer. The brine would tend to migrate downward within the formation and downdip along the formation due to density differences. A massive spill, although highly unlikely, could possibly impact the quality of municipal water supplies pumped from aquifers in the area by causing increased salinities in those aquifers. However, as the Plaquemine aquifer is contained by a 100-foot layer of clay and silt, potential spills from the membrane-lined brine pit or from the pipeline are likely to have negligible impact on water quality.

Storm surge studies conducted by the U.S. Army Corps of Engineers indicate that the 100-year flood elevation at Napoleonville is +6.5 feet MSL (Roy, personal communication). As the brine pond would be protected by a levee of minimum elevation +15.0 feet MSL, there is little likelihood of a catastrophic failure resulting in release of up to 100,000 barrels of brine.

Construction of Alternative Facilities

Alternative systems to provide raw water for cavern leaching include use of Grand Bayou, pumping it from the Mississippi River, withdrawal from the Gulf of Mexico, and pumping of moderately saline ground water. An alternative brine disposal method is disposal in the Gulf of Mexico through a diffuser.

Alternative Raw Water Source - Grand Bayou Grand Bayou would be reached via a 0.4 mile pipeline to an intake structure west of the storage plant area (Figure A.4-6). Withdrawal of the required 58 cfs of water would have a significant effect on flow in the Bayou, being approximately 30 percent of the estimated 200 cfs average flow. The decrease in stage of Grand Bayou would be on the order of 1.2 feet, with lesser effects extending some distance upstream. There is no data available on low flow rates in Grand Bayou. The bayou is up to 10 feet deep and 200 feet wide and drains a substantial area of swamp and bottomland forest in Iberville and Assumption parishes. During low flow periods, withdrawal of 58 cfs would lower the water level in surrounding wetlands and substantially reduce the inflow of water to Lake Verret.

For the pipeline connecting the intake structure to the plant about 2100 cubic yards of material would be excavated for pipe installation, with up to 0.06 acre-feet (21,000 gallons) of interstitial water being released to drain to surrounding waters. The area affected by the action is estimated to be about 4 acres.

Alternative Raw Water Source - Mississippi River Water would be pumped from the Mississippi River at St. James via a 19.1 mile pipeline. Withdrawal at an average water supply rate of 885,000 BD or 58 cfs would have an insignificant effect on flow in the river. The average daily flow of the Mississippi River is on the order of 1,000,000 cfs as discussed in Section B.2.2.1.2. Since the amount of water withdrawn would constitute a minor fraction of the Mississippi River flow, no significant impact on water supply or water quality would result from the withdrawal or desander system. The intake structure on the Mississippi would be sized to meet EPA intake design standards of a maximum velocity 0.5 feet per second to reduce fish impingement on the intake screen.

The pipeline would be installed adjacent ot the Napoleonville oil pipeline right-of-way for the entire 19.1 mile length which would require an additional land area of approximately 20 feet adjacent to the existing ROW. Bayou Lafourche is the only significant waterway crossed by the route along with several other streams. About 300,000 cy of excavation will be required for pipeline construction. About 9.5 acre-feet of interstitial water could drain to surrounding areas, affecting about 185 acres adjacent to the pipeline corridor. The effects would be locally severe but temporary, and not of significance to the region.

Alternative Raw Water Source - Gulf of Mexico A pipeline to a raw water intake on the coast of the Gulf of Mexico could supply the raw water requirements of the Napoleonville site with insignificant effects on the quantity or quality of water in the Gulf of Mexico. Pipeline construction effects would be more significant than for other alternatives. A 42.3-mile long pipeline could have an estimated total on-land excavation of about 620,000 cubic yards. Releases of interstitial water could total 19 acre-feet, affecting as much as 400 acres of nearby wetlands.

The pipeline would be installed adjacent to the Weeks Island oil pipeline right-of-way, which crosses the ICW, the Atchafalaya Basin and River, and Bayou Teche. The intake would be located in West Cote Blanche Bay south of Weeks Island (Figure A.4-1).

Alternative Raw Water Source - Ground Water Ground water from aquifers in the site vicinity is an alternative source for leaching water in the event constraints were placed on use of surface water it would be possible to install large capacity wells in the lower unit of the Plaquemine aquifer and pump the required quantities of moderately saline water (3,000 to 10,000 milligrams per liter dissolved solids) for leaching of the storage cavities and for displacement of oil from storage. Leaching operations would require water over a three year period at a rate of about 26,000 gpm.

Impacts that might result from withdrawal of such large quantities of water include lowering of the piezometric level in the pumped zone, land subsidence, and intrusion of the pumped zone by waters of different salinities. Land subsidence and salt water intrusion result directly from drawdown or reduction of the piezometric level in the aquifer. This, in turn depends upon such factors as pumping rate, well spacing and completion, and aquifer thickness. With due consideration to well spacing and completion methods and given the great thickness and high permeability of sands containing moderately saline water in the site vicinity, it should be possible to provide the required quantities of water with less than 100 feet of drawdown in the vicinity of the well field. Data provided in publications by Pettit and Windslow (1957), Hammond (1969) and Sandeen and Wesselman (1973) indicate that about one foot of subsidence results from 100 feet of drawdown in the Texas coastal area. However, there is apparently no documented evidence of subsidence associated with ground water withdrawal in the Capline project area. This may be partly due to the relative lack of development of ground water resources in the area. The impact of those ground water withdrawals on water quality would be primarily an increase in salinity of the water in the production zone. This would be due to a decrease in pressure inducing migration from underlying more saline zones. The increase in salinity can be minimized by proper spacing and completion of wells. In addition, the proposed production zone contains moderately saline water (3,000 to 10,000 milligrams per liter dissolved solids) which is not economically attractive for desalination because of the large quantities of slightly saline water (1,000 to 3,000 milligrams per liter dissolved solids) available in the site region.

Construction of the well field would require a total of 4.9 miles of pipeline trench, with 78,000 cubic yards of excavation. Approximately 2.5 acre-feet of interstitial water could be released to nearby water bodies as a result of construction.

Alternative Brine Disposal System - Gulf of Mexico On-land construction of a brine disposal pipeline would affect water quality since it would cross bayous, canals, and wetlands. Runoff from the spoils could affect adjacent surface waters by causing eutrophication from nutrient runoff, high turbidity, lowered pH and dissolved oxygen and increased heavy metal and pesticide concentrations. In the sluggish streams and bayous, sedimentation and altered water flow may occur. Surface drainage patterns and rates may also be changed. After backfilling, appropriate measures to prevent erosion would be required.

In addition, a 40-mile pipeline would be constructed through the shallow waters of West and East Cote Blanche Bays, terminating in 20 feet of water in the Gulf 11.5 miles south of Marsh Island. The same brine diffuser location as planned for Weeks Island SPR expansion (Section C.5.2.1) would be used. Potential impacts to offshore water quality due to construction would include dredging for laying pipe and disposal of brine used in leaching and would be similar to those described in Section C.5.2.1.2.

C.4.3.1.3 Air Quality

The quality of air in the vicinity of Napoleonville dome and along the pipeline rights-of-way would be slightly affected during site preparation and construction. The sources of emissions would generally be short-term and over a small area. The principal pollutant of concern would be hydrocarbon emissions since the data presented in Section B.2.3.3.2 indicate that hydrocarbon (and oxidant) concentrations in southern Louisiana frequently exceed the NAAQS.

Sources of Emissions

The quality of air during construction would be affected primarily by the following pollution sources:

- General Construction Vehicles
- Drilling Rig Engines
- Paint Solvent on Storage and Surge Tanks
- Fugitive Dust

During the site preparation phase there would be clearing operations, road construction, drilling, and landfill. A number of machines and heavy vehicles would be used. The diesel and gasoline engines would emit hydrocarbons (HC), SO_2, CO, NO_x, and particulates. Accurate prediction of quantities of pollutants emitted during construction is difficult because it depends upon many factors including type and model year of vehicles, number, duty cycle, speed, cold operation fraction, and ambient temperature. The vehicular emission rates given in Table C.4-1 were calculated using emission factors from the USEPA publication AP-42 (EPA, 1976e) and estimates of the amount and projected use of construction equipment. The onsite vehicle sources are assumed to be 10 heavy duty gasoline and 10 heavy duty diesel vehicles with a conservative duty factor of 2000 hours/year and speed of 10 miles per hour.

Drill rig equipment typically includes three large engines and other smaller engines. These motors would be assumed to total 3000 horsepower and, as a worst-case, to be heavy duty diesels. The drill rig equipment is assumed to operate at 50 percent load for about 7000 hours/year. Estimated emission rates are also given in Table C.4-1 based on emission factors given in AP-42. Except for CO, the estimated drill rig equipment emissions are much larger than the vehicular emissions. These rates apply at Napoleonville dome only.

It is assumed that one 40,000 barrel oil surge tank would be constructed at Napoleonville. The tank would probably be spray-painted

TABLE C.4-1 Onsite emission rates during construction.

Pollutant	Vehicles[a] (g/sec)	Drill Rig[b] (g/sec)	Paint Solvent[c] (g/sec)
CO	1.37	0.972	
Hydrocarbons	.117	0.361	1.32
NO_2	.212	5.14	
SO_2	.020	0.324	
Particulates	.015	0.313	

[a] 10 heavy duty gasoline vehicles plus 10 heavy duty diesel vehicles at a conservative duty factor of 2000 hr/yr, each.

[b] Assuming 1 heavy-duty diesel drill rig, 3000 horsepower operating at 50 percent load, 20 hours per day.

[c] Assuming 6000 ft^2/day painting rate, 2 coats at 200 ft^2/gal/coat.

Source: Compilation of Air Pollutant Emission Factors, Second Edition, U.S. Environmental Protection Agency, February, 1976.

with solvent-based paints composed of relatively volatile, light hydrocarbons. The quantity of paint required depends on several variables. Here it is assumed (for purposes of evaluating a "worst-case") that one gallon would cover 100 square feet with 2 coats (the average of two estimates), that one gallon would weigh 15 pounds (the range is 10 to 15 pounds (the range is 10 to 15 pounds per gallon), and that half the weight is solvent (50 to 55 percent is normal). The estimated hydrocarbon emission rate based on a painting rate of 6000 square feet per day (60 gallons of paint per day) is 1.32 grams per second (g/s) as shown in Table C.4-1. At this painting rate, these emissions would be experienced for about 3 days at Napoleonville.

Dust emissions would result from construction activities at Napoleonville and along the pipeline right-of-way. The dust would be associated with land clearing, excavation, cut and fill operations, and other activities. The amount of dust would vary from day to day depending on the activity and the weather. A large portion of the dust would be due to equipment traffic over temporary roads. Field measurements at apartment and shopping center construction sites yield an estimate of 1.2 tons of dust per acre of construction per month of activity (EPA, 1976e). This estimate is high for southern Louisiana because the estimate is for a semiarid climate. Dust emissions are often inversely proportional to the square of ground moisture. Since ground moisture in southern Louisiana is twice the semiarid level (EPA, 1976e) the dust emissions during construction are estimated to be 0.3 tons of dust per acre of construction per month of activity.

Impacts on Air Quality

The impact of the atmospheric emissions due to site construction is dependent on the ambient air quality and the dispersal characteristics of the atmosphere, both of which have been discussed in Section B.2.3. Downwind concentrations were calculated using methods recommended by the Environmental Protection Agency (Turner, 1969) and averaged over appropriate time intervals.

Pollutant concentrations at one kilometer (km) downwind from construction vehicles, drill rig equipment, and point solvents are shown in Table C.4-2. The concentrations were calculated using the emission rates given in Table C.4-1 and projected "worst-case" meteorological conditions (Appendix I). Downwind concentrations from the construction vehicles were calculated assuming an area source model with a construction area having dimensions of 250 meters on a side.

The amount of dust-producing construction at Napoleonville would be relatively small. Most of the dust would settle within the site boundaries. The fugitive dust escaping the dome site would not seriously impact the environment. Fugitive dust along the pipeline right-of-way would be transient in nature.

Downwind concentrations given in Table C.4-2 are all well below state and national air quality standards. However, since background HC levels often exceed the 3-hour standard in southern Louisiana, infrequent additional exceedances may be expected during site construction (especially tank painting). Since expected peak concentrations of SO_2, CO, NO_2, and particulates during construction are very small, no other exceedances of the state and national air quality standards are expected. All impacts during construction would be short-term in nature and confined to a relatively small area. Because all pollutants released during constrution are assumed to be ground-level release, concentrations would decrease with increasing distance.

Alternatives

Use of alternative sources of raw water would have some effect on construction emissions. Development of a ground water well field south of the site would increase drill rig emissions by an estimated 50 percent. Construction of a 0.4 mile pipeline to Grand Bayou would reduce pipeline emissions by roughly a factor of 10 compared to use of Bayou Lafourche. Construction of a 42.3 mile pipeline to West Cote Blanche Bay would increase total emissions by a factor of 10, though they would not be concentrated in any one area for more than a few days. Construction of a 19.1 mile pipeline to the Mississippi River would increase pipeline construction emissions by roughly a factor of 4.

TABLE C.4-2 Estimated pollutant concentrations at 1.0 kilometers downwind of construction activities.

	National and State Standards		Downwind Concentrations ($\mu g/m^3$)[a]		
Pollutant	Averaging Period	Limit ($\mu g/m^3$)	Construction Vehicles[b]	Drill Rig	Paint Solvents
Particulates	1 yr.	75	0	1	0
	24 hr.	250	0	12	0
SO_2	1 yr.	80	0	1	0
	24 hr.	365	0	12	0
CO	8 hr.	10,000	33	65	0
	1 hr.	40,000	46	93	0
HC	3 hr.	160[c]	3	28	104
NO_2	1 yr.	100	0	16	0

[a] Excluding background levels.

[b] Based on area source model for a construction area of 250 x 250 meters.

[c] Non-methane hydrocarbons only; concentrations are for total hydrocarbons.

Construction of a 74.4-mile pipeline for brine disposal in the Gulf would replace a significant source of continuous emissions at Napoleonville (well field drill rig emissions) with emissions associated with pipeline construction dispensed over a wide geographical area.

C.4.3.1.4 Noise

The following sections describe the analysis of possible construction impacts on noise levels at locations and residences near the Napoleonville site and other facilities associated with SPR development. Noise levels associated with the major construction equipment are specified. Using hemispherical sound radiation assumptions, the noise levels are extrapolated to nearby locations off the site to determine the effect on ambient sound levels. Terminology used in this section is defined in Appendix B.2.4.

Noise Sources

Drilling New Cavity Entrance and Brine Disposal Wells Conventional oil well drilling rigs would be used for drilling the new cavern entry wells. It is estimated that four large drills may be operating simultaneously on the site. The equivalent sound level, L_{eq}, contribution of this activity is estimated to be 67 decibels (dB) at 500 feet. Assuming that drilling activity is continuous throughout a 24-hour day, the daytime and nighttime equivalent sound level L_d and L_n contribution to ambient noise levels are both estimated to be 67 dB at 500 feet. Development of each storage cavern would require 60 to 90 days of rig time, brine disposal wells would require 30 days of rig time. Assuming 10 new cavern wells and 28 disposal wells, drilling operations would last 300 to 450 days.

Activities associated with conversion of existing caverns to storage facilities would contribute negligibly to ambient sound levels.

Leaching of Cavities Leaching is accomplished by pumping raw water into the drill holes and displacing the resulting brine. The major noise sources associated with leaching are pumps. These pumps would be housed within a sheet metal pumphouse. Outdoor pump sound levels add negligibly to the ambient sound at 500 feet, due to wall attenuation at the pumphouse.

Construction of Support Facilities Facilities to be constructed on the site include the main pump building, control building, warehouses, laboratory, offices, surge ponds, oil tanks and oil and water metering equipment. Access roads and onsite piping would also need to be constructed. The sound levels associated with equipment used for construction of these facilities are summarized in Table C.4-3. The equivalent sound level, L_{eq}, contribution at 500 feet is estimated to be 68 dB. Since construction would take place for 10 hours per day, a daytime equivalent sound level contribution of 66 dB at 500 feet is estimated.

Pipeline Construction Raw water supply, brine disposal and crude oil distribution would require construction of pipelines. Three basic techniques can be used for pipeline construction: 1) flotation canal method; 2) push-ditch method; and 3) conventional dry method. Typical equipment and the sound levels associated with each of these methods are presented in Table C.4-4. Since various methods would be employed for specific sections of the pipeline, a conservative estimate is made. An L_{eq} of 69 dB at 500 feet and an L_d of 67 dB at 500 feet is estimated for pipeline construction.

Roadways would be constructed along the pipeline rights-of-way and landfill would be required. It is assumed that two dump trucks and one bulldozer would be used for this road construction. Table C.4-5 presents sound levels and usage factors for this equipment. The L_{eq} is estimated to be 68 dB at 500 feet; the daytime equivalent sound level, L_d, assuming construction activity takes place 10 hours per day is 66 dB at 500 feet.

Summary of Construction Noise Sound levels from construction activities presented above are summarized in Table C.4-8.

Ambient Sound Levels During Construction of Proposed Facilities

Major construction activities would occur at the Napoleonville SPR site and along the pipeline route to the oil distribution terminal, the brine disposal well field and the raw water supply source. Since no site-specific prefacility ambient noise levels are available, the estimates discussed in Section B.3.3.4 are used. It is assumed that within the

TABLE C.4-3 Equipment sound levels due to construction of support facilities at Napoleonville site.

Equipment	Sound Level (dBA) at 50 feet	Usage Factor for Construction Phase[a]				
		Clearing	Excavation	Foundation	Erection	Finishing
Air compressor	81	--	1.0	0.4	0.4	0.4
Backhoe	85	0.04	0.16	0.4	--	0.04
Concrete mixer	85	--	--	0.4	0.16	0.16
Concrete pump	82	--	--	0.05	0.16	0.08
Concrete vibrator	76	--	--	0.2	0.1	0.04
Crane, derrick	88	--	--	--	0.04	0.02
Crane, mobile	83	--	--	--	0.08	0.04
Dozer	87	0.2	0.4	--	--	0.04
Generator	78	0.4	0.4	--	--	--
Grader	85	0.05	--	--	--	0.02
Paving breaker	88	--	0.1	0.04	0.04	0.04
Loader	84	0.16	0.4	--	--	0.04
Paver	89	--	--	--	--	0.12
Pile driver	101	--	--	0.04	--	--
Pneumatic tool	85	--	--	0.04	0.1(3)	0.04
Pump	76	--	0.4	1.0(2)	0.4	--
Rock drill	98	--	0.02	--	--	0.003
Roller	80	--	--	--	--	0.1
Saw	78	--	--	0.04(2)	0.1(2)	--
Scraper	88	0.14	--	--	--	0.08
Shovel	82	--	0.4	--	--	0.06
Truck	88	0.16(2)	0.26(2)	--	--	0.16

[a]Fraction of time equipment is in its noisiest mode.

Source: "Background Document for Proposed Portable Air Compressor Noise Emission Regulations", U.S. Environmental Protection Agency, EPA-550 90 9-74-016 (October 1974)

TABLE C.4-4 Noise created by pipeline construction equipment.

Equipment	Number	A-Weighted Sound Level at 50 Feet	Sound Level at 500 Feet	Usage Factor[a]
Dry Land Method[b]				
Truck	2	83	63	0.16
Backhoe	1	85	65	0.4
Concrete Mixer	1	85	65	0.16
Welding Machine	1	83[b]	63	15[b]
Scraper	1	88	68	0.08
Crane	3	83	63	1.0
				L_{eq} = 68 at 500 feet
Push-Ditch Method				
Backhoe	1	85	65	0.4
Dragline	1	80	60	1.0
Dozer	2	87	67	0.4
Diesel Winch	1	83	63	0.4
Marsh Buggy	1	78	58	0.5
Welding Machine	1	83	63	0.5[b]
				L_{eq} = 69 at 500 feet
Flotation Canal Method				
Dredge	1	63	43	1.0
Barge	5	63	43	1.0
Boats	3	63	43	1.0
Welding Machine	1	83[b]	63	0.5[b]
				L_{eq} = 61 at 500 feet

Source: U.S. Environmental Protection Agency, 1974.

[a]Fraction of time equipment is in its noisiest mode.

[b]Estimated.

TABLE C.4-5 Noise created by pipeline access road construction.

Equipment	Number	A-Weighted Sound Level at 50 Feet	A-Weighted Sound Level at 500 Feet	Usage Factor[a]
Truck	2	88	68	0.4
Bulldozer	1	87	67	0.4

Source: U.S. Environmental Protection Agency, 1974.

[a]Fraction of time equipment is in its noisiest mode.

TABLE C.4-6 Equipment sound levels for construction of storage tanks at the oil distribution terminal.

Equipment	Number	A-Weighted Sound Level at 50 Feet	A-Weighted Sound Level at 500 Feet	Usage Factor[a]
Concrete Mixer	1	85	65	0.4
Crane, Mobile	1	83	63	0.08
Generator	2	78	58	0.4
Truck	2	88	68	0.26

Source: U.S. Environmental Protection Agency, 1974.

[a]Fraction of time equipment is in its noisiest mode.

TABLE C.4-7 Noise created by loading dock construction equipment.

Equipment	Number	A-Weighted Sound Level at 50 feet (each unit)	Sound Level at 500 Feet	Usage Factor[a]
Pile Driver	2	101	81	0.04
Trucks	2	88	68	0.16

Source: U.S. Environmental Protection Agency, 1974.

[a]Fraction of time equipment is in its noisiest mode.

TABLE C.4-8 Summary of construction activity noise levels contributions at 500 feet.

		Sound Level, dB	
Activity	L_{eq}	L_d	L_n
Drilling Shafts	67	67	67
Support Facilities Construction	68	66	--
Pipeline Construction	69	67	--
Access Roadway Construction	68	66	--

site area, the prefacility ambient day/night sound level, L_{dn}, is on the order of 53 dB. This is a conservatively low estimate. Construction activity noise levels are extrapolated using hemispherical sound radiation to determine the distance to which construction activity would contribute significantly to the ambient sound levels. Within a circle defined by this radius, with its center at the center of the activity, (or in the case of pipeline construction, within a corridor width along the pipeline defined by this distance), average day/night sound levels would be increased by at least 3 dB, a discernible amount. These distances are presented in Table C.4-9. Figure C.4-1 shows these impact zones. The assumption of hemispherical radiation does not account for attenuation due to foliage, air, or ground effects, and is therefore conservative. Furthermore, populated areas would probably have prefacility day/night sound levels higher than 53 db, and therefore the impact zones at these locations would be appreciably smaller.

Since pipe laying and access road construction progresses along the pipeline route at approximately one-half mile a day, areas would be impacted for only a short duration. Since most of the pipelines run through uninhabited marshlands, the impact would be negligible.

The state of Louisiana has no noise regulation limiting the proposed activity.

The U.S. Environmental Protection Agency has identified that annual day/night average ambient sound levels below an L_{dn} of about 55 dB do not degrade the public health and welfare. Within the areas indicated on Figure C.4-1, the L_{dn} would be above 55 dB during construction activity. Since the towns of Grand Bayou and Westfield lie within the impact zone defined for drilling activities, residents may be exposed to day/night sound levels above 55 dB. There are 76 structures within the impact zone. It is probable, however, that prefacility sound levels in Grand Bayou and Westfield are higher than the 53 dB level used for the contour development. Also, the vegetation at the site should reduce sound levels at these populated areas. Therefore, impact on these residents should be minor.

TABLE C.4-9 Summary of construction noise impact, Napoleonville SPR development.

Area	Activity	Impact Zone Radius (feet)[a]
Napoleonville Dome	Drilling New Cavern Wells	5000
	Support Facilities Construction	2000
Pipeline Routes	Laying of Pipes	1800
	Access Road Construction	1600

[a]This is the distance within which sound levels are raised three decibels or more by activity described. Center of this circle is at center of activity site. For pipeline construction activity the radius describes a corridor along the pipeline. A baseline ambient day/night sound level of 53 dB is assumed for the calculations.

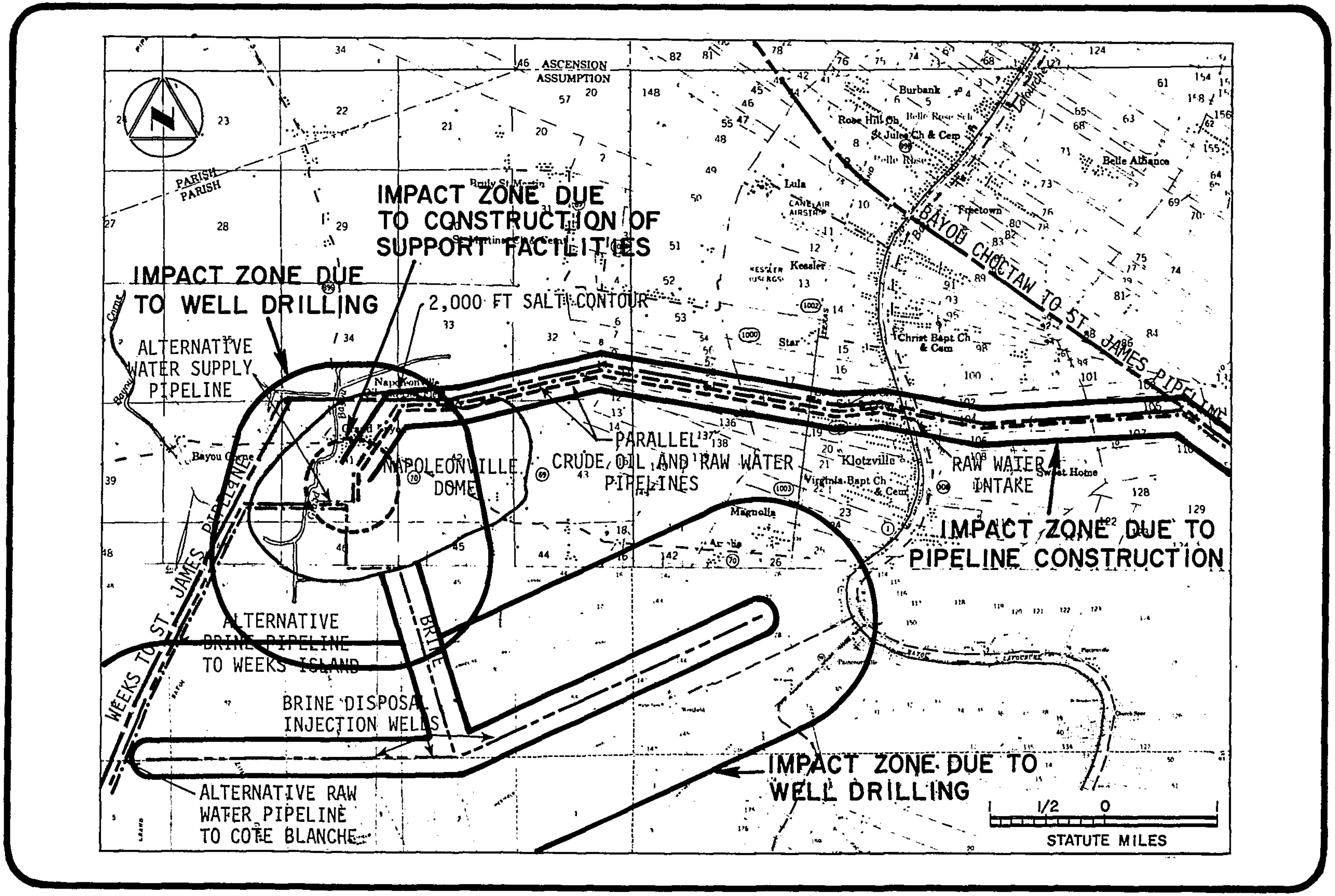

FIGURE C.4-1 Noise impact zones - Napoleonville dome.

Noise impacts due to pipeline construction would be most significant where the raw water supply and oil pipelines cross the Bayou Lafourche ridge at Klotzville. In excess of 50 residences would be exposed to sound level increases of more than 3 dB for periods of up to 1 week.

Ambient Sound Levels During Construction of Alternative Facilities

Construction of either the brine disposal or raw water supply pipeline to the Gulf would produce elevated noise levels for more than one hundred residences, particularly in the vicinity of Franklin on the Bayou Teche ridge (Figure A.4-1). Duration of impacts would be less than one week.

Construction of the 0.4 mile raw water pipeline to Grand Bayou should have no effect on noise sensitive areas.

Construction of the raw water supply wells along the pipeline route between Grand Bayou and Bayou Lafourche may elevate noise levels at 100 or more residences over a period of 3 weeks to one month. As some of the wells would be drilled on agricultural land, noise attenuation due to vegetation would be negligible. Construction of the raw water pipeline to the Mississippi River would affect the same area as for the crude oil pipeline to St. James.

C.4.3.1.5 Impact on Ecosystems and Species

Salt Dome Development

Development of the Napoleonville site would involve several impacts on the biota of the area. These impacts include loss of terrestrial and aquatic habitats, increases in turbidity, and indirect effects on fish and wildlife due to forced migration, noise, and human disturbance. The total area involved for each habitat is presented in Tables A.4-1 and B.3-4.

Approximately 63 acres of bottomland forest and deciduous swamp would be cleared and filled onsite. Grading this area to a depth of up to one foot (Section A.4), would also severely impact any small invertebrates in the surface vegetation and topsoil. Populations of nematodes, mites, collembola (springtails), insect larvae, spiders, and oligochaetes (worms) would be destroyed. Secondary productivity by these groups, while unknown exactly for the site, is probably moderate due to the characteristic of gradual nutrient turnover in the habitat. Loss of primary and secondary terrestrial production would be localized but permanent.

If construction is completed relatively early in the growing season, a plant community would become established on the banks and cleared areas within several months. This vegetation would help retard runoff, thereby reducing soil erosion and associated turbidity. It would also serve as cover and a source of food for some species of birds, small mammals, and other wildlife which frequent areas of human activity.

Approximately 63 acres of wildlife habitat would be lost due to grading associated with storage site development within the fenced 437 acre storage site. Habitat types to be affected include deciduous swamp and bottomland forest, and freshwater wetlands (creeks, bayous, and marshes). Since 437 acres at the site will be enclosed by fencing, it can be assumed that, except in the case of avifauna, the available resources provided by the habitat would be permanently lost to many other wildlife groups. Species likely to be affected by construction are mentioned in Section B.3.3.5.

Wildlife species to be directly affected by construction include non-mobile species of small rodents, amphibians and reptiles. Direct effects on resident wildlife (mammals, birds, amphibians, and reptiles) would vary depending on whether or not construction can be avoided during the nesting and youngbearing season. Direct effects of the construction (other than death resulting directly from construction activities) include permanent habitat loss (loss of food, cover, nesting and breeding areas), forced migration of resident wildlife, and animal loss resulting from increased activity and road traffic.

Indirect effects of construction include impacts on wildlife of forced migration, increased noise, and human disturbance. The effects of migration would be dependent upon the availability of resources in an adjacent habitat. Critical factors include availability of space, protective cover, food, and the status of existing animal populations. Noise and human disturbance during construction would discourage wildlife within the area; species are noted in Table B.2-15 under the appropriate habitat types to be affected. Upon completion of construction activities, some wildlife species are likely to return to the impacted area. However, due to the extensive fencing planned for the area, some wildlife species would be permanently displaced.

Earth moving activities for leach pad construction, roads, and other construction operations would increase turbidity and add nutrients to swamps and other surface water systems in the area. Increases in turbidity from construction would affect most of the surface water onsite by decreasing light penetration and hence possibly reducing plankton production. However, an influx of nutrients from the sediments and fill could increase phytoplankton, periphyton, and macrophyte production in areas not buried by fill, thus mitigating the effects of reduced light levels on plant productivity. Community composition also could be affected since different species have different physiological tolerances and ecological dependencies.

Leach pad, roads, and other construction operations would result in the filling of about 33 acres of aquatic (swamp) habitat. Most benthic invertebrates, an integral part of the aquatic food web (Odum, 1971), covered by fill would be eliminated and most fish would be displaced to new habitats.

Siltation caused by construction activities might eliminate a small number of benthic invertebrates in the unfilled parts of the site or might affect their feeding, respiration, or reproduction. This reduction of invertebrate numbers in the aquatic system and food web would be of only local significance and, for the most part, would be temporary. Many species of sunfish and other freshwater fish which feed mainly by sight would be forced to migrate from the area in order to find food. The invasion of surrounding, undisturbed areas by displaced fish could result in stressing those fish populations already present. The expanse of interconnected and contiguous waters would cause the stress levels to be lower than they would be within a smaller or closed system. Fish should move back within a short time after turbidity settles and disturbances cease, if construction of brine disposal components takes place in summer months. Mollusks (e.g., snails and bivalves) covered by siltation from rain runoff from the fill areas could suffocate or suffer gill abrasion. This could also occur with fish and crayfish. Crayfish can survive in water made turbid by a high content of detrital matter and presumably could tolerate high turbidity produced by other sources. Crayfish may temporarily decline in the areas affected by high turbidity at the dome because of a decline in food supply (decomposed organic matter) and disturbed habitats.

Brine Disposal

The proposed brine disposal system would include 6.7 miles of pipeline, associated roads, disposal well pads and other construction operations covering a total of 76 acres (see Section A.4 and Figure A.4-4). Biological impacts include loss of terrestrial and aquatic habitat, increases in turbidity, and indirect effects on fish and wildlife due to forced migration, noise, and human disturbance. The total area involved for each habitat is presented in Table B.3-4.

The elimination of the cover vegetation within the pipeline right-of-way is expected to have a significant though short-term adverse impact in areas of high precipitation and soil moisture. In efforts to reduce this impact, the felling of large trees and disturbance to natural plant communities adjacent to the proposed pipeline right-of-way would be avoided.

Clearing of the cover vegetation and removal of topsoil from the proposed pipeline right-of-way would cause several secondary impacts. Most important of these is a decrease in productivity of forage material within the right-of-way corridor. Another impact results from altering the composition of the vegetation community; an example is the "invasion" of the right-of-way by low-productivity "decreaser" plant species having little or no forage value. In addition, clearing and/or spraying the right-of-way would have the secondary effect of increasing the fire danger due to drying out the brush and increasing human activity.

Restoring the topsoil and reseeding the right-of-way with native grasses would serve to minimize the impacts of construction.

Another direct impact of construction of the proposed pipeline is the compaction and random mixing of the soil by heavy equipment and vehicles within the right-of-way. This impact would be minimized by the methodology used to ditch and backfill. A majority of the topsoil would end up at or near the top of the ditch by reversing the ditching steps when backfilling.

Human activities, construction, and the release of dust, dirt, and fumes would most likely cause the migration of resident wildlife species from the direct impact areas due to loss of protective cover, and feeding, breeding, and nesting areas. Some animal losses are expected from the direct and indirect effects of pipeline construction. Animal losses are expected to be greatest among the small rodents and other less mobile wildlife species. The potential losses resulting from pipeline construction would be greatest during the major nesting and young-bearing season.

The effects of pipeline construction on wildlife in cleared land habitats are expected to be minor and short-term. Most of the wildlife species commonly found in cleared lands are able to survive despite fluctuating conditions and altered habitats. Some loss of the less mobile species is expected during construction. The temporary loss of habitat and resources provided by that habitat would probably last 6 months to 1 year in old field and pasture areas. Other areas (urban and industrial) would probably require less recovery time.

The effects of pipeline construction on wildlife at river crossings would be minimal and temporary. Construction activities would force most wildlife away from the crossings. Most mammals, birds, and herpetofauna would return to the area once human activities decrease.

Permanent loss of habitat is expected in the wooded bottomlands and swamps. Brush and trees would be completely removed within the right-of-way in these areas. This removal would result in a loss of habitat, feeding areas, protective cover, and nesting areas for woodland species.

Arboreal species of wildlife and woodland perching and nesting avifauna would be adversely affected. Some species within these groupings include the squirrels, raccoon, opossum, broadheaded skink, eastern gray treefrog, red-tailed and red-shouldered hawks, other hawks (Buteo spp.), owls, and most passerines (Appendix B, Table B.2-18). The loss of feeding areas would be permanent for some species (i.e., squirrels ; however, once recovery of grasses, shrubs, and emergent macrophytes takes place, the area may provide a food source for some wildlife species. Loss of protective cover and nesting areas in the pipeline right-of-way in bottomland woods and swamps would be permanent for most species of wildlife unless dense stands of tall, herbaceous vegetation are permitted to remain.

A positive factor derived from construction is the creation of an "edge effect", a transitional area where two major biotic communities meet and blend together. An edge includes organisms common to the communities on both sides of it, as well as other more versatile species. It allows a diversity of habitat that in turn provides resources for a more diverse fauna. The edge may serve as a food source for animals of the forest or travel lanes for large and medium-sized mammals. Many important game species are characterized as "edge" species, including quail, rabbits, and the white-tailed deer.

The effects of pipeline construction on wildlife that inhabit the swamps and wetland habitats would probably be significant because of the vast number of wildlife species that inhabit these areas. Habitat loss in the swamps and wetlands may be temporary, however, alteration of existing drainage patterns in the wetlands could force water-dependent herpetofauna species into marginal habitats where their chances of survival would be greatly reduced.

A large number of furbearers, waterfowl (winter), and marsh-inhabiting bird species would be adversely affected by pipeline construction in that some feeding and nesting areas would be lost. The mobility of avian species would reduce some of the anticipated impacts. Effects of construction on swamp and wetland areas may be evident for one to two years or more.

The primary impacts from pipeline construction on the aquatic environment are the destruction of benthic habitat where wetlands and streams (or other water bodies) are crossed, and the turbidity caused by instream construction and land runoff. The biological details of these impacts were discussed earlier in this section.

Water bodies that would be affected by pipeline construction include the swamp to the south of the site, little Grand Bayou, and several smaller creeks and canals.

Raw Water Supply

The proposed raw water supply system from Bayou Lafourche has a 4.6 mile long pipeline which will use 14 acres of terrestrial habitat (Table B.3-4, Figure A.4-4). Since a major portion of the area used by this system would be on cleared or developed land and adjacent to the Weeks Island pipeline corridor, the terrestrial impacts would be minimal in these areas, though of the same type as those discussed for the brine disposal system.

The primary aquatic impact related to the raw water supply system would be the entrainment of plankton, drifting invertebrates, and larval fish from Bayou Lafourche, and the impingement of juvenile fish on the intake screen. Entrained organisms would be lost since they would be unable to withstand the high salinity within the cavities. Assuming an even distribution of entrainable organisms, about 19 percent would be lost, based on an average daily flow in Bayou Lafourche of 310 cfs (including increased pump capacity) and a maximum intake rate to the storage site of 25,800 gpm. (58 cfs). Although this is a moderately high proportion of the total flow in Bayou Lafourche, it is only a small fraction of a percent of the flow of the Mississippi River (from which most of the water in Bayou Lafourche is is pumped). Therefore, the overall impact would be moderate to low for the overall system.

The impingement of aquatic organisms on the intake screen would be primarily limited to juvenile fish (usually less than about 4 inches long). Since all of the impinged fish would be returned to the bayou, it is likely that many may survive. The actual survival rate would depend on flume design, and location and operating procedures used for the intake structure. Assuming that the intake structure is not located in the vicinity (or just downstream) of major fish spawning areas such as bars and backwater areas, the impact probably would be small.

Increased turbidity caused by higher flow velocities in Bayou Lafourche may decrease stream productivity and further stress fish and benthos populations. Present water quality is already turbid, thus minimizing possible adverse impacts.

Oil Pipeline Construction

The proposed oil pipeline from Napoleonville to the terminal would follow the planned Weeks Island pipeline ROW for all but the western most 0.6 mile of the route. A new construction right-of-way of 80 feet would be needed for the first segment and a 20-foot widening of the Weeks Island ROW would be required for the remainder of the route. A total disturbance of 62 acres would be required over a distance of 19.1 miles, 40 percent in swamp forest and the remainder in agricultural land. Aquatic and terrestrial habitat impacts would be similar to those described for the brine disposal system and for the Weeks Island pipeline (Supplement to the Weeks Island mine EIS, 1977). An extensive swamp forest wetland area is crossed in St. James Parish just west of the terminal site. The only major water crossing would be Bayou Lafourche where increased turbidity and local destruction of benthic habitats would occur.

Proper construction methods, backfilling of the pipeline trench, and use of an existing ROW should minimize the significance of short term impacts and the potential for long term disruption of surface flow patterns.

Accidental Brine Release

The expected quantity of brine accidentally spilled from the retention pond onsite or from the brine injection system during leaching is 50 barrels (Appendix E and Section C.2). These spills would not be anticipated to have significant adverse impacts on more than an acre or two of terrestrial or aquatic habitat in the vicinity of the site. A maximum credible spill of up to 30,000 barrels of brine could have significant local impacts on both the vegetation and animals in the spill area; however, the probability of such a spill is extremely small.

Should a maximum credible brine spill occur on the salt dome or along the brine disposal pipeline, the brine could spread across the swamp and bottom land forest possibly reaching Grand Bayou to the west. Impacts on vegetation and on animal life which could not avoid the brine in these areas would be locally devastating. Tens of acres of habitat could be destroyed and the resulting salt concentrations in the soil could remain above levels tolerated by growth of new vegetation for several years. However, it must be emphasized that such a spill is statistically very unlikely to occur, especially from so short a section of pipeline.

Construction of Alternative Facilities

Alternative Raw Water Source - Grand Bayou

The alternative raw water supply system from Grand Bayou has a 0.4 mile long pipeline which would use 4 acres of terrestrial habitat (Table B.3-4, Figure A.4-4). The terrestrial impacts of this system would be minimal due to its short length, but they would be of the same kind as those discussed for the primary brine disposal system. The impacts related to the aquatic ecosystem would be similar to those discussed for the proposed raw water system. However, entrainment and impingement impacts would be greater, since about 30 percent of the bayou water would be used (assuming an average flow of 200 cfs) and because resident fish populations are expected to be more abundant. Also, since there is no flow augmentation, reduced water levels may affect habitat quality.

Alternative Raw Water Source - Mississippi River

The alternative raw water pipeline from the Mississippi River would follow the crude oil pipeline right-of-way from Napoleonville for a distance of 19.1 miles. A 20-foot widening of the oil right-of-way would use 62 acres of swamp and agricultural land. Terrestrial habitat impacts would be similar to those described for the crude oil pipeline. An extensive forest wetland area is crossed in St. James Parish just west of the terminal site. The only major water crossing would be Bayou Lafourche where increased turbidity and local destruction of benthic habitats would occur.

The primary aquatic impacts related to the raw water supply system would be the entrainment of plankton, drifting invertebrates, and larval fish from the Mississippi River and the impingement of juvenile fish on the intake screen. Since the intake structure would be in an area of relatively low productivity, and the area potentially impacted would be a small portion of the Mississippi River, the aquatic impacts would be negligible.

Alternate Raw Water Source - Gulf of Mexico

The alternative raw water supply system from the Gulf of Mexico would follow the same route as the Weeks Island pipeline; a short pipeline would lead to West Cote Blanche Bay (Figure A.4-4). An additional 20-foot ROW is expected to be required adjacent to the Weeks Island corridor. Acreages of various habitats directly affected are given in Table B.3-4. Entrainment and impingement of marine organisms would affect large numbers of individuals but a very small proportion of the existing bay populations.

Alternative Raw Water Source - Ground Water

The alternative raw water supply system from the well field north of the site has a 4.9 mile long pipeline and would use 27 acres of terrestrial habitat (Table B.3-4, Figure A.4-4). The only adverse effects on biota would occur as a result of pipeline and well field construction.

Alternative Brine Disposal System - Gulf of Mexico

Construction of the 74.4 mile brine disposal pipeline would traverse 42.3 miles of cleared land, deciduous swamps, marshes, and streams. The impacts on these habitats would be similar to those described previously in this section. In addition, the pipeline would underlie 32.1 miles of bay and gulf waters. Since the underwater pipeline would be the same as that proposed for the Weeks Island expansion, the impacts would be similar to those described in Section C.5.2.1.5.

An additional impact which must be considered is the effect of brine disposal during cavern leaching on the aquatic biota of the Gulf of Mexico. A description of expected biological impacts of brine on organisms in the water column and on the ocean bottom near the diffuser is given in Section C.5.2.1.5. In summary, it is expected that brine disposal in the Gulf should not have a significant regional effect on plankton or nekton. Increases in salinity may affect species diversity and populations on the bottom near the diffuser. Also it is possible that altered salinity levels could slightly modify migration patterns of shrimp near the diffuser.

C.4.3.1.6 Natural and Scenic Resources

Storage Sites

Construction at the storage site would diminish the quality of the natural and scenic resources in the immediate vicinity of the dome. Loss of trees and other vegetation would occur due to construction of well pads, roads and the plant area. Grading and filling at the site would further alter the natural terrain. Dust, noise, fumes and siltation would have a significant adverse effect during construction. For the most part, these impacts would not be visible from Route 70 or from the town of Grand Bayou.

Oil Distribution Pipeline

The oil pipeline to Napoleonville would parallel the Weeks Island and Bayou Choctaw pipelines for 18.5 miles of its 19.1 mile length. This segment would not be in a natural state due to previous development. Construction activities would however, disrupt additional natural vegetation adjacent to the right-of-way.

The remaining 0.6 mile of pipeline crosses swamp and bottomland forest north of the storage site, causing the removal of trees and other vegetation from the right-of-way. Both sections of the pipeline would be visible at some points from public roadways.

The pipeline construction activities would have significant adverse impact on the natural areas crossed. The dust, noise, fumes and vibration of construction would also have negative impacts on the aesthetic quality of the areas crossed particularly on the Lafourche ridge. These effects would be temporary in most cases.

Brine Disposal System

The brine disposal system would impact both cleared land areas and natural swamp environments. The 6.7 miles of 80 foot right-of-way would also cross little Grand Bayou. This construction would significantly affect the natural qualities of the area by clearing vegetation and disrupting habitat. For the limited number of individuals passing the area during construction the scenic qualities of the area would be significantly diminished. However, this area does not offer any unique habitat types that could not be found elsewhere.

Raw Water Supply

The intake structure for raw water supply would significantly diminish the scenic or natural qualities of the area along the pipeline route because it would be located within the right-of-way for the oil distribution pipeline. The impacts of this pipeline have been discussed previously.

Alternative Systems

Raw Water The use of Grand Bayou could have a significant adverse effect on the natural and scenic resources along this waterway as the waterways ability to meet the water demands of the project is uncertain.

The use of ground water would require a slight addition to the land required for the oil distribution pipeline which it would parallel. The additional impact to scenic and natural resources would be minor or insignificant.

The use of the Mississippi River as a raw water source would require that a pipeline be constructed alongside the crude oil distribution pipeline. The additional impact to scenic and natural resources would be minor or insignificant.

Construction of a raw water pipeline to the Gulf of Mexico would cause a significant increase in the adverse impact of the project on natural and scenic resources. Although the pipeline would follow existing pipeline rights-of-way, the construction impacts would affect many miles of natural marshland, coastal swamps, agricultural land, and transportation corridors.

Brine Disposal The alternative brine disposal system to the Gulf of Mexico would have impacts similar to those described for the raw water supply from the Gulf.

C.4.3.1.7 Archaeological, Historical and Cultural Resources

Storage Site

There are numerous sites of historic, archaeological or cultural significance in the area immediately surrounding the storage site. While no direct impact on any of these resources is anticipated, new sites may be discovered during development. If any archaeological or historic material were found, it would be immediately reported to State officials so that appropriate action could be taken to preserve or protect the material.

Oil Distribution Pipelines

There are no known areas of historic, archaeological or cultural significance in the right-of-way at this time. Several sites are located north of the corridor but would not be impacted by construction.

Raw Water Supply System

This system would follow the oil distribution network with no anticipated impacts.

Brine Disposal System

The brine disposal field would be located just north of an area of known archaeological significance. At this time, no impact on similar sites is expected due to construction.

Alternative Physical Facilities

No anticipated adverse impacts are expected as a result of developing a raw water supply at Grand Bayou or a ground water well field along the pipeline route.

The brine disposal and raw water supply lines to the Gulf of Mexico cross a substantial amount of land with potential for cultural sites. However, the additional ROW required for each line is only 20 feet. Furthermore, the cultural survey to be conducted for the Weeks Island pipeline should establish the likelihood of sites existing adjacent to the ROW.

C.4.3.1.8 Socioeconomic Environment

Storage Site

Land Use Construction activities would have a significant impact on land use at the storage site. Much of the land has been previously disrupted during brining operations. Conversion of existing facilities and development in new areas would impact some previously undisturbed wooded areas.

The project would require fencing of a 437 acre tract of land at the storage site for the plant area, roadways, wellheads, pipelines and brine pond. Approximately 63 acres of land within this tract would be directly developed with facilities. An additional 152 acres would be developed offsite.

Transportation Construction at the Napoleonville storage site would have a significant impact on traffic in the surrounding area. The current average daily traffic on Route 70 at the junction with Route 69 just west of Grand Bayou was 1,830 vehicles in 1976 (Louisiana Department of Highways, 1977). Assuming 10 percent of the traffic would occur during each peak traffic hour, the highest hourly volume experienced near the site entrance would be 183 vehicles. During peak construction months (700 onsite workers) the traffic in the area would increase significantly due to employees commuting and increased truck traffic supplying materials to the site.

The traffic impacts would be determined by the location of employees relative to the site. From the Baton Rouge, Plaquemine and White Castle areas access to the site would be via Route 60. The Donaldsonville, Thibodaux and Houma work force would approach the site via Routes 1 and 70 from the east, and Morgan City traffic would follow Route 70 from the west (Figure B.2-21). If labor is drawn from each of these markets, the traffic impacts would be distributed over several areas. It is not anticipated that major traffic congestion would result from project construction. Some minor increases in existing traffic problems may occur in localized areas, however. To the extent that traffic associated with the project does not coincide with existing peak hours the impacts would be reduced. Construction workdays frequently coincide with the available daylight hours. The impacts would also be reduced due to the use of three shifts per day for some tasks.

Other modes of transportation are not expected to be significantly impacted during construction at the storage site.

Population Construction of the Napoleonville site is not likely to significantly change population in Assumption Parish. While the daytime population would increase, most of the construction workers are expected to commute from their current residences in nearby parishes leaving the permanent local population unchanged for the most part. Even those workers who move to the area for the duration of construction are likely to reside in areas such as Donaldsonville, Thibodaux, Houma, or Morgan City where more urban services are available.

Housing Housing, like popultion, is not expected to be significantly impacted during the construction phase. There is a large pool of labor within commuting distance of the site and it is unlikely these workers would relocate their households for the short period during which most of the construction would take place.

Should some workers wish to relocate closer to the site, there are relatively few housing units available in the Napoleonville or Donaldsonville areas. Those wishing to move to these areas would be forced to wait for new units to be constructed or import portable housing to the area.

Economy The large increase in daytime population in Assumption Parish related to storage site construction for the Napoleonville site would stimulate the local economy significantly. In the Grand Bayou area local retail services, such as gas and food sales would experience significant increased demand.

To the extent that local contractors or workers are employed, further stimulation to the local economy would occur. The surrounding parishes, such as Iberville, Ascension, Lafourche and St. Mary's would also be affected. The Baton Rouge area would also receive the benefits from construction due to the concentration of construction firms and workers skilled in this type of construction located in that area.

Project employment would be greatest during the first eight months of construction. The peak in employment would occur during the second month when 746 workers would be employed. The payroll during the peak period would approach $4.6 million, while the total wages paid throughout construction would be approximately $14.2 million (see Table C.4-10). During the latter months of construction, employment and wages would drop to a level of 60 workers and $105,000 in wages for months 21-52, and to 15 workers and $26,250 in wages for months 53-57.

The project would displace some Dow Chemical employees currently working in the brine field. Depending on the number of employees involved and their place of residence the impact could be locally significant (especially if many of these employees are residents of Grand Bayou). The project would further remove an important site of brine production from operation. It is expected that additional brining operations would be initiated by Dow so that employment losses would be temporary.

Construction is unlikely to induce a large amount of economic growth in Assumption Parish due to the regional market from which it would draw materials and labor and due to its short duration. Most of the wages earned through construction would be spent in areas outside Assumption Parish. Some minor secondary growth would occur in the local economy, however, inducing additional employment in the service sectors.

The project would have a beneficial impact on unemployment in Assumption Parish if local labor is used. The beneficial impact on unemployment would not be large enough to substantially reduce the large pool of unemployed workers in surrounding parishes; however.

<u>Government</u> Construction of the site would remove a valuable source of revenue from the Parish and State tax rolls. Not only does the site contribute to property tax revenues, it also provides severance tax revenues. Ownership and operation by the Federal government would make the property tax-exempt. Personal income related to the project may bring a slight increase in sales and property taxes in the Parish.

TABLE C.4-10 Estimated Monthly Employment and Payroll - Napoleonville

Month	Monthly Employment	Monthly Wages
0-1	390	$ 682,500
1-2	746	1,305,500
2-3	724	1,267,000
3-4	377	659,750
4-5	371	649,250
5-6	356	623,000
6-7	311	544,250
7-8	264	462,000
8-15	244	2,989,000 (x 7)
15-21	152	1,596,000 (x 6)
21-52	60	3,255,000 (x 31)
52-57	15	131,250 (x 5)
	TOTAL	$14,164,500

The project would slightly increase the demands on local services such as police and fire. Increased traffic and daytime population in the area could increase police calls. In case of large scale accidents local police and fire services might be required to provide auxiliary services.

Medical facilities in the area are not expected to be significantly impacted by normal construction operations. Should a large scale disaster occur transport of some of the injured to larger urban medical facilities may be necessary.

Because most employees are expected to commute from their present residential areas, no significant increase in school enrollment locally is anticipated.

Oil Distribution Pipeline

Land Use Most of the construction on the oil distribution pipeline would occur within the existing Weeks Island ROW to the DOE Terminal thus minimizing the effect of this pipeline on land use. The connection from the Napoleonville storage site to the existing pipeline route would be 0.6 miles in length and require the conversion of 6 acres of wooded swampland and bottomland forest to developed use. An additional 56 acres would be converted, at least temporarily, along the existing ROW. Portions of areas would be allowed to return to their natural state if not required for pipeline access.

Transportation Construction of the oil distribution system would have a minor impact on transportation. Pipeline construction would cross several roads including Routes 70, 1, 308 and 18. In addition the construction would cross several waterways including Bayou Lafourche, Bayou Verret and several small canals. The pipeline would also cross the Southern Pacific and Texas and Pacific Railroads. In most cases it would be possible to bore under the roads and railroads minimizing the effect on local traffic. However, some of the waterways may require more disruptive construction techniques. Overall the construction impacts should not be felt in any single location for more than one to two weeks. The construction activity would require the transport of materials to the point of activity. This could cause minor traffic congestion on two-lane highways if slow-moving vehicles are used. Pipeline work areas would be set up to accomplish most of the installation work. Local traffic congestion could occur in these areas.

Population Construction of the pipeline, like storage site construction, is not expected to significantly affect population in Assumption Parish or the region.

Housing With a large pool of labor within commuting distance, the effects on housing nearby the pipeline route is anticipated to be minimal. Little housing is available in urban areas along the route.

Economy The economic effects of pipeline construction are included in those discussed for the storage site above. The employment for pipeline construction would occur during a five month period and employ a significant portion of the total work force (up to 220 men) required for the project. To the extent local workers and services are employed the income would affect the local economy. Services in the small towns nearby the pipeline route would receive a small temporary stimulant to their economy.

Government Construction would provide a source of revenue to local parish and state governments. The income taxes and sales taxes collected would probably exceed the loss in property taxes associated with the removal of 62 acres of land from the tax rolls.

It is unlikely that construction would place unusually severe demands on local services such as police, fire or schools. Only in case of accidents would medical facilities be impacted.

Raw Water Supply System

Land Use Construction of the proposed raw water supply system would have a minor impact on land use. The planned pipeline route would follow the right-of-way used for the oil distribution pipeline to Bayou Lafourche, requiring 13 additional acres for construction. At Bayou Lafourche, one to two acres of land would be required to construct an intake structure for raw water. At the Mississippi River a small area would be required for additional lift pumps to supply the necessary water to Bayou Lafourche. All these facilities would have small effects on land use.

Transportation The construction of the proposed water supply system would cause no additional impacts on transportation beyond those that would occur during oil pipeline construction.

Population The effects are the same as for oil pipeline construction.

Housing No significant effects on housing are anticipated as discussed for the oil distribution system.

Economy Construction would provide a small stimulant to the economy that would be insignificant relative to the overall economic activity.

Government Construction of the water supply system would place no demands on local governments during normal operations. The construction would remove a few acres of land from the tax rolls but would also produce some sales tax revenues.

Brine Disposal

Land Use Construction of the brine disposal system would occur in previously undeveloped areas, namely wooded swamps and cleared agricultural land. This would permanently affect land use, converting these areas to industrial uses. Wooded areas along the rights-of-way would not be allowed to revegetate; some agricultural lands surrounding the facilities could be replanted soon after construction.

The brine disposal field would require a total of 76 acres of land, including roadways, drill pads, and pipelines. This would cause a significant impact on existing land use in the area.

Transportation Brine disposal system construction would have a minimal impact on transportation. The system would cross Little Grand Bayou, however, it is not considered commercially navigable. Some increase in traffic related to this system would occur on roads surrounding the Napoleonville site but this would only be a small addition to the traffic associated with construction at the dome itself.

Population Construction of this facility would have an insignificant impact on population as discussed earlier for storage site construction.

Housing Like population, no significant impact on housing is expected due to brine disposal facility construction.

Economy Construction would serve as a temporary minor stimulant to the economy. Only a small portion of the total labor force associated with this storage facility, as described in the section on the storage site itself, would be employed in construction of brine disposal facilities.

Government The brine disposal system would require the removal of 76 acres of land from the local tax rolls. It is impossible to tell at this time whether income generated from its construction would outweigh this loss. No special government services are expected to be required during construction, except in case of accidents.

Alternative Facilities

Raw Water Supply

Intake at Grand Bayou This alternative would have a minor effect on land use in the area adjacent to Grand Bayou. Some trees would be removed and excavation for a trench would be required. This would constitute a notable change in land use but would occur in a small area adjacent to other planned development. The additional impact would be insignificant. Should use of water from Grand Bayou significantly reduce the local water level, this could cause a change in land use of more significance, affecting nearby swamp, forest, and recreational sites.

If adopted, this alternative would shift some traffic associated with construction from along the pipeline route to within the storage site area. While this would increase the traffic volume at shift changes near Grand Bayou, no significant congestion is expected.

Use of this alternative would not significantly alter the anticipated impacts to local population, housing, economy, and urban services.

Intake at the Mississippi River Construction of this alternative raw water supply system would have little additional effect on land use since this line would follow the crude oil pipeline right-of-way from Napoleonville to St. James. Due to the additional construction necessary for this right-of-way, traffic volume would be increased along the pipeline and in the St. James area, but no significant congestion is expected.

Use of this alternative would have similar impacts as the oil distribution pipeline on population housing, economy, and government.

Ground Water Use of ground water instead of the proposed system would require 27 acres of agricultural land north of the storage site. This would convert land from crop production to industrialized use, a minor addition to the land use impacts of the project.

This alternative would tend to increase traffic slightly in the area immediately north and east of the storage site, but no significant adverse impact is anticipated. There may also be a slight increase in labor and materials requirements for this alternative, but the economic effect of the project as a whole would not be significantly altered.

No significant change in the impact on population, housing or urban services would occur with this alternative. A slight loss of locally taxable land would occur, however.

Gulf of Mexico Construction of a raw water supply line to the Gulf of Mexico would require an additional 163 acres of land along the Weeks Island right-of-way to the Gulf. Much of the land crossed would be swamp forest, coastal marsh, and agricultural land. The impact on land use would be minimized by use of existing rights-of-way for nearly all of the 42.3 miles to the Gulf. Construction would, however, briefly disturb the vegetation along the edge of the right-of-way.

This type of water supply system would require additional construction materials and workers beyond those required for the proposed system. The resulting effects on local transportation would be to spread traffic over a larger area west and south of the project toward Morgan City, Franklin, and Weeks Island. Because much of the pipeline would be constructed by push ditch, the impacts on local traffic would be concentrated near access roads. The pipeline route would cross two major roads (Routes 70 and 90) and several waterways (Bayou Teche, Atchafalaya River, the Intracoastal Waterway, etc.) but the construction impacts are anticipated to be temporary and nondisruptive. This alternative would cause a significant increase in the regional economic effects of the project, increasing purchases of labor, materials, and services. To the extent that local markets provide these inputs, the local economies would benefit.

No significant effects on housing or population are expected, as most of the laborers used are expected to commute from their current area of residence. Similarly, normal construction efforts would not impact local urban services; however, in case of accidents, police, fire and hospital services could be affected.

Brine Disposal

Gulf of Mexico Construction of a pipeline for brine disposal to the Gulf would follow the same route as the water supply line to the Gulf. If both are built, the additional impacts resulting from construction of the brine pipeline would be minimal. Some additional labor and materials would be necessary to lay the second pipeline and the diffuser into the Gulf. If the brine line alone were constructed, the impacts would be almost the same as those for the water supply line.

C.4.3.2 Impacts from Operation and Standby Storage

The following section describes impacts resulting from operation of storage site facilities and related pipelines. Impacts resulting from operation of terminal facilities are described in Section C.3.

Should an oil supply interruption occur while oil is stored at Napoleonville, a total of as much as 333 MMB would be available for distribution, either by tanker or by the CAPLINE Pipeline. Oil would be pumped from both the early storage sites at Weeks Island and Bayou Choctaw and the expanded SPR storage caverns at Napoleonville using separate 36-inch diameter pipelines. Oil would also be injected into the storage cavities via the same facilities. Until an oil supply interruption occurs these facilities would be maintained in readiness by monitoring storage cavity systems, leak-checking pipelines, activating valves, and other standard procedures.

Thus, SPR development at Napoleonville would not introduce any new or unique operational impacts to the program but would require extended use of existing terminal systems to accommodate a capacity increase from approximately 183 to 333 MMB (82 percent increase). Principal impacts of the Napoleonville SPR operation are associated with hydrocarbon emissions and oil or brine spills. Impacts expected to accompany early storage facility operation and Napoleonville facility operation are both given where appropriate to provide a perspective on program expansion impact significance.

C.4.3.2.1 Land Features and Geologic Impacts

Effects of operation and standby of the Napoleonville storage site on land features are expected to be minimal. Compared to the 589 acres required during construction offsite and within the 437 acre fenced area, 531 acres would need to be maintained during operation. No significant disturbance of site soils is expected after construction is completed. Soils will stabilize soon after they are revegetated.

Napoleonville is located in an area identified as Seismic Zone 1, that is with an expectation of minor earthquake damage (Figure B.2-8). Underground storage caverns are much less susceptible to damage from seismic events than surface tanks.

It is conceivable, though extremely unlikely, that the salt roof over one of the caverns could collapse. Appendix F considers the possible mechanism by which such an event could occur. A possible result would be the formation of a deep surface depression, probably resulting in a lake over the dome. Should such an event take place, significant quantities of oil or brine could be released to the surface or to shallow ground water aquifers. Impacts on surface storage equipment would be potentially significant. The structural integrity of the storage cavities would be monitored and every available measure would be taken to preserve cavern integrity (Appendix E).

Alternatives

Use of alternative raw water, brine, or oil transportation systems would impact land features during project operation and standby storage only through required maintenance of pipeline right-of-way (Table A.4-2). The brine disposal and raw water supply pipeline to the Gulf would have much greater maintenance requirements than the proposed system. Compared to the 163 acres required during construction of the brine disposal pipeline, only 57 acres would be required for maintenance.

C.4.3.2.2 Water Resources

Impacts to water resources during facility operation may occur as a result of raw water withdrawal for oil displacement, brine disposal during oil filling, and possible oil or brine spills.

Operation of Storage Site

During construction of the Napoleonville storage site measures would be incorporated into the design to minimize sediment transport and erosion at the site. These measures would include grading, diking and reseeding. Runoff from precipitation would therefore have minimal impact on water systems.

All sanitary wastes from the storage facility would be conveyed to a treatment plant sized to conform to Louisiana Health Department Standards, then routed to a receiving stream. As the number of operational employees would be small, no adverse impact on stream water quality would be expected.

Operation of Raw Water Supply System

Operation water requirements for the storage site would be based on the 65 cfs (29,200 GPM) used for crude oil displacement during the 150-day with-drawal period. As expected for the 58 cfs withdrawal necessary for a period of about four years during the leaching cycle, the slightly higher rate during 5 anticipated withdrawals is not expected to have significant impact on Mississippi River flow conditions.

The additional pumpage of 65 cfs into Bayou LaFourche would increase the average daily flow (velocity) of the Bayou between Donaldsonville and the water supply intake structure at Klotzville by approximately 26 percent. The increase in stage of the Bayou would be approximately 0.25 feet at Donaldsonville, and less downstream toward the water supply intake structure. The increased velocity may result in increased water turbidity over this reach of the Bayou. Below the intake structure, impacts on water quality or supply in the Bayou would occur only when the pumps are shutdown occasionally (Section C.4.3.1.2).

Zinc anodic protection would be used along the raw water supply pipeline at intervals of approximately 1000 feet. This may result in the release of 0.6 grams of zinc per square meter of pipe surface area per year (the exact mechanisms of the release are not clearly understood). Since the pipeline would be buried under several feet of sediment, little of the zinc would be expected to enter the water column unless sediments were disturbed for pipeline repairs. Operation of the pipeline would have no significant effect on hydrology.

Operation of Brine Disposal System

When oil is pumped into the storage caverns, brine would be displaced to the injection wells at an average rate of 175,000 B/D and at a maximum rate of 240,000 B/D. Filling would take 857 days at the average rate. As even the maximum expected fill rate is only 27 percent of the planned brine disposal rate during cavern leaching (Section C.4.3.1.2), there should be no adverse effect on the condition of ground water aquifers.

Oil or Brine Spills

During project operation, oil spills could occur from pipelines con-necting the storage site with the terminal storage tanks, and from the well heads at Napoleonville (releases from the underground storage caverns are not quantified, see Appendix E). Brine spills could occur from the brine disposal pipeline and from the brine reservoir. A thorough description of possible modes of spills, methodologies of spill calculations quantification of expected spill volumes and frequencies, spill dispersion characteristics, and spill prevention and control measures is provided in Appendix E. A summary of oil and brine spill expectations is also given in Appendix C.2 and in Tables C.2-1, through C.2-9. Possible effects on water resources are considered in this section.

In the watershed east of Grand Bayou, spills from the Napoleonville site and connecting pipelines leading toward Bayou LaFourche would tend to enter a low area of swampy land and bayous drained by Grand Bayou (Figure A.4-4). Drainage from the area would most likely enter Grand Bayou and eventually Lake Varret. The flushing of this bayou is fairly slow, which would not aid actual cleaning processes but would be well suited for containment of the floating oil by booms.

Oil spills would enter Bayou LaFourche only if they occurred within the short segment between either bank. Containment sites would be set up easily as there is ready access along the entire waterway. On the levee ridge, itself, oil would tend to pool or would enter shallow drainage canals which lead away from the Bayou toward the adjoining swamp forest.

East of the Lafourche ridge, the pipeline enters the upper reach of the Barataria - Salvador - Des Allemands drainage basin. An oil spill in this section would enter highly productive swamp forest drained by several small bayous and by Bayou Verret. Oil released into this area would be very difficult to recover.

Quantities of oil and brine expected to be released from the early storage and Napoleonville facilities are listed by source and location in Tables C.2-1 through C.2-9. Total oil spillage from pipelines and at the storage site for five fill/withdrawal cycles is projected to be 970 barrels for the early storage facilities and an additional 527 barrels for the Napoleonville facilities. The distribution of spills is projected to include 833 barrels at the storage site and 664 barrels from the connecting pipelines. The maximum credible spill events are estimated to be 10,000 barrels from a pipeline rupture, 6000 barrels from storage site.

Brine spills would occur only from the piping system at Napoleonville and south along the disposal pipeline. Total spillage is estimated to be 138 barrels from Napoleonville, and 49 barrels from Bayou Choctaw (Weeks Island early storage facilities do not use brine to displace oil from storage) (Table C.4-3). The maximum credible spill event is estimated to be 30,000 barrels.

An "average" crude oil has 30 percent paraffin hydrocarbons (alkanes), 50 percent napthene hydrocarbons (cycloalkanes), 15 percent aromatic hydrocarbons, and 5 percent nitrogen, sulfur, and oxygen-containing compounds. As soon as oil is released to the water environment, weathering begins. The major weathering processes are evaporation, dissolution, emulsification, sedimentation, biological degradation, and chemical oxidation.

Low molecular-weight hydrocarbons and aromatics are the most immediately toxic components of crude oil. Evaporation results in selective loss of low molecular-weight hydrocarbons and aromatics, thus tending to reduce concentrations of the most toxic portions of the crude oil. Also, evaporation causes a surface residue, which has a higher concentration of sulfur and organics and may develop a specific gravity greater than water, especially if salt, clay, or organic particles are suspended in the water and available for attachment. As a result, this portion of crude oil will sink and may physically and chemically affect bottom organisms.

Dissolution in the water column is selective for low molecular-weight hydrocarbons and aromatics as well as some of the nonhydrocarbon components that are more polar. Most of the soluble material is produced later from biological and chemical oxidation. The solubility of the normal alkanes ranges from 40 ppm for C_6 molecules to 0.01 ppm for C_{12} molecules. For aromatics, solubility ranges from 1800 ppm for C_6 (benzene) to 0.075 ppm for C_{14} (amtracene). The proportion of various fractions of crude oil likely to go into solution in sea water are presented in Appendix D.

Emulsifications, which are crude oil globules in water columns, are dispersed easily by currents and, it is believed, eventually dissolve or sink to the sediments after contact with suspended solids.

Sedimentation of oil is encouraged by evaporation and dissolution of the lighter weight fractions and by contact with suspended sediments and organic material. In shallow waters, contact with suspended solids is likely during periods of high runoff or stormy weather, which disturbs bottom sediments. Sedimentation also can occur as a result of bacterial masses in the oil slick.

Bacterial degradation can occur in almost all crude oil fractions, but normal alkanes are attacked preferentially, and aromatics are least preferred. A supply of nitrogen, phosphorus, and oxygen is needed. In areas where oxygen concentrations are low, biodegradation is a slow, long-term process.

Oil spilled on the water's surface would initially spread under gravitational, viscosity, and surface-tension forces. The rate of spreading because of these forces would be a function of the initial chemical characteristics of the oil and the physical characteristics of the slick, e.g., viscosity, specific gravity, slick thickness, and so forth. The rate would also vary with time as weathering or degradative processes act on the spilled oil. In addition, surface currents and surface winds would transport the slick away from its point of origin.

The broad geographical distribution of possible spill sites creates a wide range of oil spill situations. Many of these may be mitigated by oil spill response efforts (for example in the Mississippi River, or Gulf of Mexico). Spills occurring in swamp forests or marsh land would be difficult to control, however.

Two potentially significant impacts of oil spills on water resources would be the potential for buildup of toxic fractions and depletion of oxygen levels in shallow, poorly flushed water bodies. The most likely location of such impacts would be in swamp forests along the pipeline route to the terminal and in marshes located along the lower Mississippi River Delta (including the vicinity of Pass a Loutre and Delta Wildlife Refuges). Most of the spills would occur in the Mississippi River or from diked areas at the terminals.

Oil spills reaching the Mississippi River or the open gulf should not have significant impacts on water quality because of the potential for dilution and for oil recovery. Oil which sinks to the bottom or is deposited on the riverbank or shoreline may provide a local source of petroleum hydrocarbons to the water column for several weeks or even months, however.

Oil spills occurring anywhere on land outside diked areas or in the Mississippi River could affect human use of water (industrial, domestic or recreational).

The Plaquemine aquifer is overlain by about 100 feet of clay and silt in the vicinity of Napoleonville and St. James. Oil spilled from the pipeline should not reach potable ground water supplies.

Should a subsurface spill occur, either from a defective well casing or collapse of a storage cavity, then oil would tend to collect at the water table and migrate laterally along the water surface. Crude oil tends to migrate very slowly through subsurface formations, and then only under pressure. However, some components of the oil, particularly the lighter aromatic hydrocarbons might be sufficiently soluble to impart an objectionable taste and odor to the water. This taste and odor could potentially reach users in the Plaquemine-Donaldsonville area as most domestic water supplies are taken from the Plaquemine aquifer.

Spills of brine or saline water have less potential for adverse effects on water quality than do oil spills because of the limited spill potential. Except for a very large brine spill, normal flushing of local water bodies (i.e., Grand Bayou) would quickly dilute salt concentrations to normal levels, resulting in very temporary water quality degradation. Flushing is not as effective in shallow water bodies or in the swamp forest, however; salinity excesses would continue for several days or weeks and may remain in the substrate.

The potential exists for relatively frequent and possibly large crude oil spills from the Capline Group of SPR sites. Calculations of spill probability and the nature of local water bodies, indicates that significant impacts on local water resources should be very infrequent.

Hazards Due to Flooding

Surface facilities at Napoleonville would not be subject to flooding caused by hurricanes or tropical storms. Surface elevations over the dome are approximately +5 feet, MSL. Data supplied by the U.S. Army Corps of Engineers indicates that the 100-year flood level at Napoleonville is +6.5 feet MSL. There should not be any destructive currents or waves to threaten surface facilities, however.

Storm floods greater than the 100-year event could occur and could damage surface facilities. In the event of an oncoming storm oil would be removed from the surface tanks, thus eliminating the largest spill potential. If surface piping is ruptured, a few barrels of oil could escape but would be retained within the storage area. Damage to well head piping could result in loss of a few barrels from the cavern. Brine from the settling pond would be quickly diluted by flood waters.

As only limited quantities of oil could be released in the event of a damaging storm flood, environmental effects due to the flood waters and winds are expected to be much greater than due to loss of oil or brine.

Alternative Facilities

Operation of the brine disposal pipeline to the Gulf of Mexico would increase the potential for brine spills by a factor of about 10. Nearly half this exposure would occur in the Gulf, but, due to dilution, would have less potential for adverse impacts on water quality.

Discharge of up to 240,000 BPD to the Gulf would occur at the brine diffuser during operation. The water quality impacts would differ slightly from the leaching procedure but would be similar to the Weeks Island operational brine discharge described in Section C.5.2.2.2.

Use of alternative raw water supply systems for oil displacement would have similar impacts on water supply as described for leaching. Water withdrawal rates are about the same in both cases.

C.4.3.2.3 Air Quality

The largest potential effects on air quality associated with the operation of the proposed oil distribution system would result from hydrocarbon emissions during fill and withdrawal cycles. Data presented in Section B.2.3.3.2 indicate that non-methane hydrocarbon concentrations in the area frequently exceed the national and state standard of 160 $\mu g/m^3$ (3-hour average, 6-9 a.m.). Hydrogen sulfide losses are expected to be minimal since most of the crude oil that is expected to be stored in the Capline system would have weathered sufficiently during overseas transit to essentially eliminate the H_2S component.

Both average and maximum hydrocarbon emission rates are presented in this section (except for minor sources). Average emissions are used to determine the total emissions expected over the assumed 22-year period of operation while maximum emissions are used to evaluate worst case impact upon air quality.

Sources of Emissions

The quality of air during operation would be affected by the following pollution sources:

- Fugitive Dust
- Valves, Seals, and Gauges
- Flaring at Weeks Island Cavern
- Crude Oil Surge Tanks
- Brine Ponds

Most fugitive dust emissions during facility operation would be due to general service vehicle travel over unpaved roads. Assuming an average vehicle speed of 40 miles per hour and a road surface silt content of 30 percent, the estimated dust emission is 0.24 pounds per mile of unpaved road traveled (EPA, 1976e).

There would be a wide variety of valves, seals, and gauges associated with the pumping of crude oil through the pipelines between the terminal facility and the storage cavities at Bayou Choctaw, Weeks Island, and Napoleonville. The small leakage that may occur would be tightly controlled in accordance with standard practice and thus of little consequence.

At the Weeks Island site, flaring would be conducted at the surface outlet of vent pipes, which would be sunk to the cavern chamber. Flaring would occur only during the filling process. The main purpose of flaring would be to prevent the volatile oil fractions from collecting in the upper atmosphere of the chamber and in the vicinity of the aboveground facilities, thus reducing the explosive hazard potential. In addition to reducing the explosive potential, flaring would reduce odors emanating from the caverns by converting the hydrogen sulfide (H_2S) gases into odor-less sulfur dioxide (described in Appendix F of FES 76-8) and would also reduce hydrocarbon emissions by converting the vapors into CO_2 and water vapor.

Surge Tank and Brine Pond Emissions

Total hydrocarbon losses from the surge tanks to be located at Napoleonville and Bayou Choctaw over the life of the project are estimated to be 35 tons at each location based on average crude oil properties (RVP of 4 psia and molecular weight of 70 for fugitive losses). The maximum hydrocarbon emission rate is estimated to be 0.15 g/sec based on a conservative RVP of 5 psia.

Another source of hydrocarbon (HC) emissions would be the dissolved oil present in the brine removed during each fill and passed through the brine pond. Assuming a dissolved oil content of 10 parts per million (ppm), an average weight of 250 pounds per barrel (basically light ends), that 50 percent remains dissolved in the brine, and a peak refill rate of 240,000 B/D, a maximum emission rate of 1.58 g/s was calculated. The total emissions for four refills is 375 tons at Napoleonville, while an additional 235 tons would be emitted due to the early storage phase at Bayou Choctaw.

Impacts on Air Quality

The environmental impact of the computed emissions is dependent on the ambient air quality and the dispersal characteristics of the atmosphere (Section B.2.3). Downwind centerline ground-level concentrations were calculated using the model described in Appendix I. Estimates were made using maximum emission rates and atmospheric conditions corresponding to worst case conditions ("D" stability and a wind speed of 1 meter per second (mps), except 2 mps in the Gulf). These estimates apply to both the SPR expansion at Napoleonville and the early storage phase. Expansion, in most cases, increases the likely frequency and duration of obtaining these emission rates.

Fugitive dust raised by general service vehicles over unpaved roads would cause less impact than during the construction phase where it was estimated to be small (Section C.4.3.1.3).

The minimal HC losses from the crude oil pipelines (valves, seals, and gauges) are assumed to be continuous during the project lifetime since the pipelines would be kept filled and pressurized at all times.

Since this leakage occurs over a large area and would be tightly controlled, it would cause little impact on ambient air quality.

Since flaring at Weeks Island would reduce hydrocarbon emissions and would convert any residual H_2S gases into SO_2, there would be no significant impact on air quality.

Worst case HC concentrations (3-hour average), at 1 km downwind of the 40,000 bbl surge tanks at Napoleonville and Bayou Choctaw would only be about 10 $\mu g/m^3$. Even though the 3-hour HC standard is occasionally exceeded in the area, these concentrations would have little impact on ambient air quality.

Hydrocarbon concentrations from brine pond emissions are based on an area source model assuming a one acre brine pond and a maximum emission rate of 1.58 g/s assuming a peak refill rate of 240,000 B/D at each dome site. Estimated "worst case" pollutant concentrations, corrected to a 3-hour average (Turner, 1969), at 2, 5, and 10 km downwind are 22, 6, and 2 $\mu g/m^3$, respectively. These results apply at the Napoleonville and Bayou Choctaw sites. Even though the 3-hour HC standard is often exceeded in the area, the low concentrations expected from brine pond emissions during each refill cycle would have little impact on ambient air quality. This would be true even if it is conservatively assumed that 100 percent of the oil dissolved in the brine is evaporated (the basis of the above impacts is 50 percent evaporation), essentially doubling emissions and resulting concentrations.

C.4.3.2.4 Noise

Operation Sound Sources

Principal sound sources during the operation of the storage facility would be material handling equipment such as pumps for filling and emptying the storage facility. These electric motor driven pumps would be mounted in a pump house with corrugated steel sides and roof.

Operation sound levels from the facilities described above are estimated from measurements at a similar facility in New York State. The facility is a liquefied propane gas storage plant with similar material handling and processing equipment. The major differences are that the pumps are located outdoors and dehydrators and trucks are used at the New York State facility.

From these measurements, it is estimated that unenclosed pumps at Napoleonville would produce sound levels of 75 dB(A) at 50 feet. Typical wall attenuation for a corrugated steel building is 20-25dB. Therefore, the equivalent sound level contribution for the proposed facility at Napoleonville to the ambient sound level is estimated to be 30-35 dB at 500 feet. This contribution is negligible compared to existing ambient sound levels of 53 dB.

Alternatives

None of the alternative systems proposed for the Napoleonville storage site would contribute significant sound levels at nearby noise-sensitive areas.

C.4.3.2.5 Species and Ecosystems

Operational impacts of the proposed SPR facilities on biological resources in the area are principally related to the potential for oil or brine spills. Also, raw water must be withdrawn from Bayou Lafourche (and in turn pumped from the Mississippi River) to displace oil from the caverns; brine is discharged to deep salt water-bearing sands during oil filling, with no resulting effects on aquatic resources. Normal surface activities at the storage site would exclude wildlife from the immediate 437-acre project vicinity (and 94 acres offsite for pipeline maintenance). This is an expansion of the existing industrial use of the project lands but is not a new or significantly adverse impact.

Surface Operations

Operations of the storage facilities at Napoleonville should have little additional effect on the ecological aspects of the sites. Minor adverse impacts such as weed control, periodic brush removal, increased noise and air quality changes should have little impact on the plants and wildlife. Human activity associated with fill, withdrawal, and standby operations would result in increased site activity but these activities would have only minor effects on area wildlife. The greatest impacts from normal operations and standby activities at the Napoleonville site would be from withdrawal of raw water to displace oil and from possible oil spills (considered in succeeding subsections).

Approximately 30.4 miles of offsite pipeline (oil, water, and brine) right-of-way and 9 miles of onsite pipeline right-of-way must be maintained clear of woody vegetation to allow immediate access in case of system malfunction. Normally, up to a 50-foot wide right-of-way is required; however, as the water supply line and oil line are to be installed parallel to an existing pipeline only an additional 10 to 15 feet of maintenance right-of-way is expected for each. A summary of construction and maintenance right-of-way acreages for the proposed (and alternative) facilities is given in Table A.4-1.

The most significant adverse impact associated with ROW maintenance is the long term loss of vegetation productivity and wildlife habitat in the swamp and bottomland forest. Though grasses, shrubs and shallow water may provide some utility for forage and nesting, there is expected to be a net loss in carrying capacity. On cleared lands normal agricultural practices can be continued so that no additional biological impacts are expected.

Brine Disposal Systems

The predominant impact on vegetation and wildlife from normal operation of the brine disposal system (or one of the alternative systems) will result from the periodic maintenance required along the pipeline routes for access, surveillance, and monitoring. The impacts from these efforts are expected to be minor when compared to those which occur during construction.

During the operational phase of the proposed pipeline, the impact of right-of-way maintenance will cause a disruption in the soil and vegetation brought on by vehicular movement and chemical spraying for weed control. Spraying and mowing operations could increase the fire hazard potential unless proper procedures are utilized. The overall impact of pipeline maintenance can be minimized if care is taken to ensure that minimum vehicular movement in the right-of-way occurs, and weed control spraying is selective, localized, and performed only with biodegradable herbicides having short half-lives and minimum toxicity to animals and man.

Noise from operation may have an adverse effect upon wildlife, however, very limited noise increases would be associated with the brine disposal system.

Maintenance of the pipeline and the elimination of cover may have adverse effects on some wildlife species. Continued clearing of brush would prevent small rodents and other wildlife from becoming established on the pipeline corridor. The brush clearing would maintain the "edge" effect and would encourage new growth of established plant species, thus providing a continued food source for herbivorous wildlife.

Human intrusion during operation and maintenance of the pipeline would have minimal short-term effects on wildlife. These brief periods of human activity along the pipeline may cause wildlife to leave the immediate area, but only for a short period of time (in most instances, a matter of hours).

Raw Water Supply

The predominant impact on vegetation and wildlife of normal operation of the raw water supply system (or one of the alternatives) would also result from the periodic maintenance required for the pipeline routes and would be the same as those discussed for the brine disposal systems.

Impacts to the aquatic environment would be primarily related to entrainment and impingement of aquatic organisms. The impacts due to entrainment and impingement are discussed in Section C.4.3.1.5 with respect to construction of the raw water supply systems. However, the magnitude of the impacts during operation would be slightly less than during construction because the raw water requirements would be about 12 percent lower (see Section A.4.5.6).

Oil Delivery System

The predominant impact on vegetation and wildlife of normal operation of the oil delivery system would result from periodic maintenance required for the pipeline routes and would be the same as those discussed for the brine disposal system. There would be no impact on the aquatic environment from normal operation of the system. However, in the unlikely event of a major pipeline oil spill extensive and significant impacts to the environment are probable. The extent of these impacts would be directly related to the magnitude, location and duration of the spill. Oil spill risk, size frequency, and a discussion of the rate of oil spillage are discussed in Section C.2; potential environmental effects on terrestrial and aquatic environments are addressed in a later subsection. The most sensitive areas with respect to oil spills from the storage site and oil distribution pipelines are the swamps and wetlands adjacent to the site and Bayou Lafourche, a major waterway to be crossed by the pipeline.

Accidental Oil or Brine Release

The potential for oil or brine spills during project operation is described in Appendix E; expected annual spill volumes by mode of operation and by geographical location are summarized in Section C.2, particularly Tables C.2-1 through C.2-9. In the event of an oil or brine spill, the expected movement from various spill locations, the weathering processes likely to occur, and the potential for water quality degradation are described in Section C.4.3.2.2. This section treats some of the biological effects which can occur as a result. A more complete treatment is given in Appendix D.

The information on frequency and volume of expected oil and brine spills for Napoleonville and early storage development of Weeks Island and Bayou Choctaw was summarized in Section C.4.3.2.2.

Brine spills would occur only from the piping system at Napoleonville and south along the disposal pipeline corridor. Total spillage is estimated to be 138 barrels from Napoleonville and 49 barrels from Bayou Choctaw (Table C.2-9). Weeks Island early storage facilities do not use brine to displace oil from storage. The maximum credible spill event is estimated to be 30,000 barrels of brine (excluding possible release of up to 100,000 barrels of brine due to possible breaching of the brine reservoir).

Frequencies of spills are also given in the summary tables. Except for transfer spills, all modes of spills are expected to be fairly infrequent. The following recurrence interval is calculated (Appendix E) for oil pipelines: 27 years for spills greater than 1000 barrels. For brine spills, there is a 94.1 percent chance of having no spills during the project lifetime for Napoleonville.

Because of the design safeguards provided in the storage system and the relatively infrequent spill expectation, the potential biological impact from small, chronic oil spills at the Napoleonville storage site and along the oil pipeline system is expected to be small. The well-heads at Napoleonville would be diked to contain minor spills.

Cowell (1970) describes two forms of chronic pollution: 1) pollution that results from small successive spills occurring with a frequency greater than that which would allow complete recovery of the ecosystem; and 2) pollution that results from continuous discharge of low levels of oil and effluents such as those from refinery outfalls. Species have been shown to vary considerably in their tolerance to successive spillage, with annuals being the most susceptible and perennials somewhat more tolerant. Seedlings and annuals seldom recover from either acute or chronic oil spillage, but perennials are capable of producing new shoots from unaffected root systems, some within three weeks after contamination (Cowell, 1971). When oiling of vegetation occurs during floral induction, seed germination of marsh species is reduced and flowering is inhibited (Baker, 1971c).

The effects of oil on vegetation depends upon several factors such as species and age of plant, time of year, whether plants are actively growing or dormant, the amount and type of oil involved and the degree of weathering of the oil (Baker, 1970). Physical weathering total chemical decay, and biological breakdown are important in the degree and rate of degradation, but the relative importance of each factor has not been ascertained. Baker (1971a) concluded that a single oil spill does not cause long-term damage to marsh vegetation but successive spills result in a rapid decline of vegetation (Baker, 1971b). The primary effect of an oil spill on vegetation is that of developing an oil film on the stems and leaves of the plant. The film is difficult to wash off and subsequently the leaves turn yellow. Successive oil spills of any significant magnitude have been shown to be statistically unlikely for the SPR expansion facilities.

Short term exposures of marsh plants to small or intermediate oil spills have been reported not to be exceedingly harmful, but chronic releases are lethal. The active growth process of many plants during the spring season is adversely affected. Annual plants tend to be affected more if they are coated with oil during these active growth periods but perennial plants have been shown to regenerate new stems if their root systems are protected. The influence of oil spills on swamp forest systems or cleared land is even less well known than the influence of oil on coastal marshes but it may be assumed that factors influencing damage to these systems would be similar to those described for marshland.

Biological degradation of crude oil appears to be an important factor in vegetative recovery after a spill. The rate of degradation is related to the type of oil, temperature, and the makeup of soil microfauna. Soil organisms such as bacteria, fungi, algae, etc., would not be affected uniformly since under conditions of a good oxygen, phosphate, and nitrogen supply these organisms such as bacteria, fungi, algae, etc., could grow and eventually degradation can take place (Davis, 1976). This degradation is an important factor to the recovery of the vegetation following a spill. The rate of degradation is related to the type of oil spilled, the ambient temperature, and the composition of the soil microfauna.

If a large oil spill occurred along the Napoleonville pipeline the direct effect upon land mammals could be significant. Although most land mammals are highly mobile and could escape small spills on land, a large spill could cover a wide area in a short time by the spreading oil. Animals that cannot escape the oil may be killed by ingestion of contaminated foods and from products contacting the skin, or may suffer chemical burns from being coated (Texas A&M University, 1972). Oil spills on land may also adversely affect large areas of habitat, making it necessary for animals to leave the area. All habitats have a carrying capacity that limit the number of organisms supported without placing any undue stress upon individuals in the area. The introduction of large populations from one area to another can adversely affect the populations already inhabiting the area and death from over-crowding, starvation, predation, and disease may occur. These impacts would be especially severe among terrestrial mammals suited to wetland habitats since these areas are easily destroyed by oil pollution.

Oil spills can also affect the various species of herpetofauna through direct contact of the oil on the skin; some species of frogs and toads breathe through their skin and oil contact would reduce their rate of respiration, possibly resulting in death. Large oil spills adjacent to flooded swamp land could spread rapidly across wet areas and could destroy the vegetative cover that serves as habitat for many species of herpetofauna. These spills could also kill many insect species that are aquatic during their reproductive cycles and provide food for other animal species.

Bird life in the swamp forest along the pipeline route could be affected by direct contact with the oil and by loss of food and cover since many species of birds utilize these wetlands. Data are not available to provide an estimate of the number of birds that may be directly affected, but the losses due to a large oil spill could be severe. The primary factors which would influence the extent of the damage of a major spill on bird life are:

- The location, size, and duration of the spill
- The particular species present and their behavior
- The time of year
- The reproductive capacity of the species involved.

The primary causes of bird mortality due to oil spills are: destruction of the waterproofing and insulating properties of feathers and the ingestion of the oil when the birds attempt to clean themselves. Oil-fouled birds preen excessively in their attempt to remove the contaminant.

Autopsies have shown this preoccupation to be so great as to supercede the need for food; most gastrointestinal tracts of autopsied birds contain little, if any, food. Physiological weakening of the body, coupled with reduced food intake, will eventually result in the death of the bird. Experience has shown that 20 percent or less of the birds directly affected can be expected to survive (Boesch, et al., 1974). Indirect effects may be caused when birds eat oil-contaminated food or due to the loss of a food supply.

Reduction in the insulating capacity of the feathers causes an increase in metabolic rate to maintain the bird's body temperature. Heat loss in an oil-fouled bird has been shown to be approximately twice that of a normal bird (Hartung, 1967). Dietary intake must then be doubled to maintain body temperature and this is difficult because energy is expended during the increased foraging activities and because the ingestion of oil has reduced the efficiency of the body's system. Increased metabolic rate requires an increase in energy intake; however, in reality, the bird may give up foraging to rest on the shore. Thus foraging may decrease and actually cease altogether, resulting in starvation. The metabolic rate has been shown to increase linearly with a decrease in the ambient temperature; therefore, the rate of starvation can be accelerated by cold weather (Hartung, 1967).

Although some cattle graze in pasture land along the Bayou Lafourche levee, the effects of oil spills upon livestock are limited. Spills may result in short term damage to the vegetation, however.

The impact of an aquatic oil spill becomes particularly far-ranging in highly turbid aquatic systems, such as the Mississippi River, since oil and petrochemicals are quickly absorbed by suspended matter such as clay. These particles may be transported over wide areas by the strong currents and large, heavy oily globules may be formed and deposited on the river bottom far from the source. On the bottom, the globules can release water soluble substances which are toxic to aquatic life. Sediments which are covered by oil can become low in oxygen and subsequently may become anaerobic. Under these conditions, oil degradation is very slow and many of the toxic components are the slowest ones to be broken down (Murphy, 1971).

Petroleum products have been shown to damage aquatic biota in four principal ways (FWPCA, 1968):

- By direct contact with the organism
- By smearing gills or being swallowed with water and food
- By forming a surface film that may interfere with gaseous exchange or respiration
- By poisoning organisms with various water soluble substances leached from the oil

All components of aquatic ecosystems can be damaged. Phytoplankton and zooplankton, primary food sources in the food web, may be destroyed or coated with oily substances. If these coated plankton are ingested by fish, an oily smell and taste may be imparted to the fish flesh. Fish may also be impaired or killed directly when the epithelial surfaces of their gills become coated with a film, thereby inhibiting respiration. Oil which settles to the bottom may also coat river sediments and destroy benthic organisms and also interfere with spawning activities. The reproductive capacity of benthic organisms may also be impaired (Murphy, 1971).

The main groups of aquatic organisms which could be affected by oil spills into water at the dock include plankton, nekton, benthos, macrophytes, periphyton, microbes, and aquatic birds and mammals. Aquatic organisms associated with the water surface, the neuston, would presumably be most subject to the toxic or mechanical (smothering or coating) effects from contact with fresh oil slicks.

Under laboratory conditions, droplets of oil have been noted to adhere to spines of marine phyto- and zooplankton, especially after they had come in contact with the surface film (Ministry of Defense, 1973). Plankton, which float with the water currents at relatively slow speeds would be unable to effectively avoid the spill areas. Various physiological effects have been documented for phytoplankton in or near a large spill or in an area of chronic pollution. For example, photosynthetic activity was accelerated at lower concentrations (1 to 3 mg/l) and diminished at higher ones (6 to 20 mg/l) Boesch et al., 1974). Eggs and larvae of many benthic organisms such as oysters, shrimp, crabs and demersal fish are major temporary components of the zooplankton. These immature stages are often highly susceptible to toxic materials. Many zooplankton which exhibit a diurnal vertical migration in the water column could also be destroyed by a major oil spill. However, field data do not conclusively demonstrate a measurable effect. There is little evidence for concentration of oil ingested by zooplankton at higher trophic levels in the food web.

Fish usually are able to avoid spilled oil and there is evidence confirming this avoidance (Boesch, et. al., 1974). Large fish kills have generally occurred in only restricted water bodies. These kills are attributable to direct toxic effects of the oil or lowered dissolved oxygen levels in the water, caused by restricted oxygen diffusion from the atmosphere, or the increase of biochemical oxygen demand by the oil particles or a combination of these factors. Fish appear to be more resistant to the toxicity of oil products than many other aquatic organisms because the mucus coating on their exterior body surface is oil repellant (Boesch, et al., 1974). Direct toxic effects on fish exposed to oil spilled off the Louisiana coast showed the loss of gill tissue cells or "sloughing," and swollen branchial filaments (U.S. Environmental Protection Agency, 1972). It has been suggested that the toxic effects of aged crude oil may be greater than that of fresh crude oil (Bender, 1976). Fish may be contaminated because of intake of petroleum hydrocarbons during their feeding activities; this tainting may persist for several months (Boesch, et. al., 1974).

Benthic organisms would be mainly affected by oil that sank to the bottom and coated the plants and animals. Reduced oxygen levels in the benthos could be an important factor in this impact. All organisms are not equally successful at recolonizing polluted areas and several years may be required to reattain pre-impact levels of diversity and community structure. Some bottom organisms accumulate petroleum hydrocarbons in their tissue after ingestion (Boesch et. al., 1974).

Periphyton communities, which tend to be made up of very small organisms, are very dependent on substrate and therefore oil would probably have a very great impact on this community. However, since these organisms have very short life cycles they should be able to recolonize suitable surfaces relatively rapidly after the oil is degraded or has been removed.

Effects of oil on bacteria, fungi and yeasts are not well known (Boesch, et. al., 1974); however, bacteria are generally ascribed to contribute greatly to the degradation of oil in the sea.

In summary, the impacts to biota due to normal operation of the Napoleonville storage site are expected to be rather small. Even in the case of occasional small oil spills, impacts are not expected to be widespread or serious. However, depending on the specific conditions, including location, season, volume, and spill control effectiveness, a large oil spill may have a serious impact on the biota in the local environment. Furthermore, cumulative spill effects due to development of the full 333 MMB Capline Group capacity may be locally significant.

The type of exposure to be expected differs in accordance with the mode of transport and handling (see Tables C.2-1 through C.2-10). A pipeline spill would likely have the most intensive, localized biological impact. The recurrence interval of an oil spill greater than 1000 gallons, even with oil left in the line during standby storage, is 27 years. It is therefore likely that no large spills would occur during the lifetime of the SPR project.

Several scenarios may be described to evaluate potential effects of maximum credible spills for various oil spill modes. The bases of selected maximum credible spill sizes are provided in Appendix E. Ecological impacts are quantified on the basis of acres expected to be severely impacted using 25 barrels per acre of fresh crude causing 100 percent loss of vegetation for a period of at least two years in wetlands. In open water bodies, it has been estimated that, on the basis of a damage threshold of 10 ppm hydrocarbon, a contamination of 6 barrels per acre could cause total loss of productivity in shallow waters (2 to 4 feet deep) for periods of two weeks to several months, depending on water circulation and species affected (Dames & Moore, 1975).

Using the above oil spill damage parameters as indicators, the following impacts may be estimated. For a pipeline spill of 10,000 barrels, assuming 20 percent lost to evaporation and none recovered, a possible wetland impact of 320 acres or a shallow water impact of 1340 acres might result. The swamp forests at Napoleonville and west of St. James are potentially vulnerable.

A 30,000 barrel spill of brine from the brine injection system would have serious biological impact. No comparable damage parameters are available to estimate acreage impacts. However, 30,000 barrels is approximately 4 acre-feet of brine. Assuming uniform mixing, it would take several hundred acrefeet of fresh water to dilute the brine a few ppt, a reasonable threshold for measurable salinity effects. Thus, the potential for adverse impact in Grand Bayou and wetlands at Napoleonville is great should a maximum credible brine spill occur.

In summary, it may be concluded that the very low frequency of oil and brine spills indicates that chronic biological impacts should generally not be experienced. Very large spills are fairly improbable and represent a small likelihood of regionally significant adverse impact.

Alternatives

Construction of a pipeline for brine disposal in the Gulf of Mexico would increase the potential for brine spills by a factor of ten and would expose additional areas of wetlands to possible brine spills. During operation, the discharged brine and its components would have similar impacts to aquatic organisms in the region of the diffuser site as described for the Weeks Island diffuser (Section C.5.2.3.5).

C.4.3.2.6 Natural and Scenic Resources

Normal operation of the Napoleonville site and associated facilities is not anticipated to bring additional impacts on scenic, recreational, or natural resources. In some cases the impacts would be reduced during this stage as some areas at the storage site and along the pipelines would be allowed to revegetate.

The potential does exist for oil spills in the process of transporting oil to and from storage. Effects on scenic, recreational, and natural resources are possible due to spills from the oil pipeline between St. James and Napoleonville, which could degrade the scenic and recreational potential of sections of swamp forest or waterways crossed by the right-of-way.

Brine spills could degrade scenic and natural resources along the 6.7-mile brine disposal pipeline leading south from Napoleonville.

The utilization of commercial power at the site necessitates a four-mile cleared transmission corridor southeast of the dome. The corridor would be visible from public highways.

Alternative oil distribution systems would have little effect on the type or degree of possible adverse impacts. Construction of the 74.4-mile brine disposal pipeline to the Gulf would subject extensive additional areas of swamp forest and marshland to brine spills.

C.4.3.2.7 Archaeological, Historical, and Cultural Resources

Following construction, none of the operational characteristics of any of the facilities are expected to negatively impact any of these resources.

C.4.3.2.8 Socioeconomic Environment

Napoleonville Storage Site

Land Use There would be no additional impacts on land use during operation. The land at the site would already have been converted to developed use during construction. Some of the land disturbed during construction would be allowed to revegetate.

Transportation Less traffic related to the project would be generated during operation than during construction. A considerably smaller crew (25 to 60 employees) would be necessary to carry out fill and storage activities; however, their movements would be significant in comparison to current traffic volumes on county roads. The total traffic volume on these roads is expected to remain far below capacity, however, thereby minimizing this impact.

Population The operation of the storage site would have some effect on population in the surrounding area. The project would have a total of 60 employees on site in three shifts during fill and withdrawal operations. During standby operations, only about 25 employees would work at the site. Most of these workers may come from the existing labor pool in the parishes surrounding the site. If all the employees were to migrate to the area with their families, the impact on the local population (Grand Bayou) would be significant; however, lack of housing is likely to spread any in-migration over several towns in the area. As an example, Thibodaux has grown rapidly recently; the population increase associated with the Napoleonville project would constitute only a minor increment compared to this recent growth.

Housing Project operation would have a minimal impact on housing. Many of the workers employed are expected to come from nearby communities within commuting distance.

Economy The operation of the SPR project would have a significant positive effect on the economy of the region. Supplies for some operations may be purchased from existing petrochemical and service industries. In some local areas such as Grand Bayou, a large beneficial effect would result from the increased purchases by employees. Maintenance and operation of the project would require a small work force relative to construction. Most of the workers are expected to come from the local labor pool, although some may relocate in the area for the duration of filling (approximately two years).

During standby operations, only about 25 employees would work at the site. This would decrease the employment opportunities available at the site compared to construction or fill/withdrawal operations.

Employment income from the project would average $105,000 per month during the filling and withdrawal phase. Most of this income is not expected to stay in Assumption Parish for the two years of filling.

During standby operations, income would average approximately $43,750 a month for the 25 employees. This income is not expected to be sufficient to stimulate the local economy due to the wide area over which the employees would spend the wages.

Purchases in the region during operations could provide an economic stimulus. To the extent these purchases are made in Assumption Parish, they would provide a minor stimulant to the local economy.

Urban Services The operation phase of the SPR project would have a impact on police and fire services similar to that of the construction phase. Except in case of a major accident, no use of such services is anticipated. Fire fighting equipment would be available on site.

No adverse impact on health services are expected during normal operations. Large scale accidents could easily overwhelm available services in the area, however.

The small number of workers and their families with children that may relocate in the area would have no significant impact on schools.

Operation of the storage facility would continue the loss of tax revenues begun during construction.

Oil Distribution, Raw Water Supply, and Brine Disposal Systems

Land Use The operation of the oil, water, and brine systems would have no additional impact on land use. In some areas 58 acres of natural vegetation or crops may be allowed to be re-established. Large trees would not be allowed within the system maintenance right-of-way, however (Table A.4-1).

Transportation During normal operations the oil, water and brine systems would not affect any transportation systems in the region. In case of pipeline breaks, leaks, or other unexpected accidents, some temporary effects on transportation could occur; but these would be so temporary, they should be considered insignificant.

Population Operational impacts of the oil, water, and brine systems is anticipated to be negligible. The few workers required for maintenance are expected to come from the local labor pool.

Housing Because no significant change in population size or location is expected, housing is unlikely to be impacted.

Economy Operation of the pipeline systems would have an insignificant effect on the local or regional economy. The few workers required would generate slight additional income for the economy, but this would be minor compared to current economic activity.

Urban Services Except in the case of a pipeline accident, no urban services would be required by the pipeline facilities. If an accident occurred, some use of local hospitals could be necessary.

Alternatives

No significantly different type or degree of socioeconomic impact is expected to result from operational use of alternative facilities. Use of water supply and brine disposal pipelines to the Gulf would require removal of significantly more land from local tax rolls; also, a few more employees would be needed for routine maintenance and system repairs.

C.4.4 Impact Due to Termination and Abandonment

No specific plan for termination and abandonment of the Napoleonville oil storage site has been established. However, the DOE will be required to develop such a plan near the termination of the action. To date, no specific experience with the abandonment of an oil storage cavern facility has been developed in the United States. However, various feasible plans are available. Environmental hazards that must be considered include surface subsidence and release of residual oils squeezed from the workings by possible long-term plastic closure.

At present, it is intended to put the facility to some beneficial use, rather than abandon it. Beneficial uses might include disposal of wastes, such as dredge spoil, slurried fly ash, radioactive waste, or other polluted or toxic materials. Another possibility is to develop a compressed air storage facility for peak power use. The final selection of an abandonment plan will likely depend on the economic and environmental trade-offs and regulations that are in effect at the time of termination.

Use of the facility in the manner described above would assure continued surveillance of the cavern. The inherent integrity of the cavern would prevent any leakage of material into the environment. Certain activities associated with the specific use, such as waste transport, would impose some potential for environmental damage resulting from traffic, spillage and noise.

Should no beneficial use be found for the facility, the wells could be sealed and the caverns left filled with brine. No adverse environmental effects are likely to result from such action.

C.4.5 The Relationship of the Proposed Actions to Land-Use Plans, Policies and the Controls for the Affected Areas

There are presently no official plans, policies, or controls established by Federal, state, or local government agencies in Assumption Parish. Further-more, lands under consideration for use in developing the Strategic Petroleum Reserve Facility at Napoleonville are presently devoted to industrial uses.

Although a Coastal Zone Management Plan is in preparation in Louisiana, there is no apparent project conflict with the basic concepts established by the Louisiana Advisory Commission on Coastal and Marine Resources (1973) which are expected to be an important part of the ultimate plan. Thus, development would occur at a previously established industrial site and oil transportation would follow established corridors. It is not anticipated that any land use policies or plans would be in conflict with the proposed Napoleonville Strategic Petroleum Reserve Facility.

C.4.6 Summary of Adverse and Beneficial Impacts

Development of the Napoleonville salt dome as an oil storage facility is not likely to generate significant regional environmental impacts except for the remote possiblility of a major oil spill and the uncontrolled release of hydrocarbon vapors during oil transportation.

Table C.4-11 provides a summary tabulation of the findings of the various discipline analyses of impacts of project development. Impacts of project operation are summarized in Table C.4-12. The data are in both qualitative and quantitative form, as appropriate.

TABLE C.4-11 Summary of environmental impacts caused by development of the Napoleonville SPR facilities - proposed Capline Group development.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT PROPOSED PHYSICAL FACILITY	ALTERNATIVE PHYSICAL FACILITY
Geology and Land Features	Napoleonville dome and immediate vicinity	Site Preparation 144,000 cy of excavation of 261,000 cy of fill for pipelines, access roads, and other onsite surface facilities. Direct impacts on 63 acres. Cavern Leaching Up to 25 x 10^6 cy of salt removed from the dome by leaching. Brine Disposal Pressurization of brine disposal aquifers.	
	Terminal Facilities	Site Preparation (see Table C.3-2)	
	Pipeline Corridors between Napoleonville and Terminal Facilities	Crude Oil Distribution Temporary excavation of 300,000 cy of earth and clearing of vegetation from 61 acres in the pipeline ROW.	
	Bayou LaFourche	Raw Water Supply 74,000 cy of excavation (mostly temporary) from 12 acres in pipeline ROW.	
	Grand Bayou		Raw Water Supply 2100 cy of temporary excavation from 4 acres in pipeline ROW.
	Mississippi River		Raw Water Supply Temporary excavation of 300,000 cy of earth and clearing of vegetation from 61 acres in the pipeline ROW
	Gulf of Mexico		Raw Water Supply 653,000 cy of excavation (mostly temporary) and clearing of vegetation from 92 acres in pipeline ROW. Brine Disposal 1,129,000 cy of excavation (mostly temporary) and clearing of 92 acres of vegetation in pipeline ROW.
	Ground Water		Raw Water Supply 78,000 cy of excavation (mostly temporary), 110,000 cy of fill and clearing of vegetation from 26 acres in pipeline ROW. Possible surface subsidence over well field.
Water Resources	Grand Bayou, Lake Verret, and wetlands adjacent to the storage site	Site Preparation Significant volumes of sediment and construction pollutants carried into water bodies by rainfall runoff. Oil and Brine Spills Very small possibility of some release reaching water bodies; maximum credible brine spill could have significant impact.	
			Raw Water Supply Withdrawal from Grand Bayou could significantly affect water levels in local streams and wetlands during periods of low flow; pipeline construction impacts very minor.

TABLE C.4-11 continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT PROPOSED PHYSICAL FACILITY	ALTERNATIVE PHYSICAL FACILITY
	Water bodies and wetlands crossed by pipeline ROW, including Bayou Lafourche	Site Preparation and Pipeline Construction Locally significant volumes of sediment and construction pollutants carried into water bodies by rainfall runoff.	
	Bayou Lafourche	Raw Water Supply 885,000 BPD pumped from Mississippi River would increase turbidity and bank erosion from Donaldsonville to Klotzville (12 miles) and occasionally downstream; minimal effect on water quality/quantity expected.	
	Mississippi River	Raw Water Supply Diversion of 885,000 BPD to Bayou Lafourche would not significantly affect river quality or flow rate. Terminal Construction (see Table C.3-2)	Raw Water Supply Withdrawal of 885,000 BPD would not significantly affect river quality or flow rate.
	Gulf of Mexico		Raw Water Supply Withdrawal from Gulf (West Cote Blanche Bay) no significant effect on water quality; construction of supply pipeline would have significant local affects for most of its 42 mile length. Brine Disposal Disposal of brine in Gulf could cause local salinity excesses of 12 percent or less over several hundred acres; pipeline construction could alter surface water quality on-land and in the Gulf.
	Subsurface aquifers	Brine Disposal Pressurization of deep disposal aquifers could possibly displace saline water to potable aquifer directly or by migration up old wells.	
			Raw Water Supply Withdrawal from subsurface aquifers could affect water table and induce surface subsidence, though considered unlikely; construction effect locally significant.
Air Quality	All construction sites	Site Preparation Minor quantities of particulates, SO_2, CO, HC, and NO_2 released from construction equipment; minimal effect.	
	Napoleonville Dome	Site Preparation and Painting Short term HC concentrations of up to 104 $\mu g/m^3$ at 1 km downwind during painting of tanks; possible exceedance of ambient air quality standards due to high background levels during 3 day period at Napoleonville.	
			Raw Water Supply Development of a well field for raw water supply may reduce emission at Napoleonville (except HC from painting) by 50 percent. Construction of raw water supply lines to Grand Bayou or the Gulf of Mexico would alter the direction and location of construction emission but not the degree of impact.

TABLE C.4-11 continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT	
		PROPOSED PHYSICAL FACILITY	ALTERNATIVE PHYSICAL FACILITY
			<u>Brine Disposal</u> Construction of a brine disposal pipeline to the Gulf eliminates locally continuous emissions at Napoleonville and adds dispersed pipeline emissions.
	Terminal Facilities	<u>Site Preparation and Painting</u> (see Table C.3-2)	
<u>Noise Level</u>	Storage Site	<u>Site Preparation and Cavern Well Drilling</u> Maximum radius of noise impact (3 dB increase over ambient), 5000 feet; as many as 75 residences may be affected.	
	Pipeline Routes	<u>Pipeline Construction</u> Maximum zone of noise impact, 1800 feet; 50 to 75 structures may be affected.	
			<u>Raw Water Supply</u> Grand Bayou Water supply would not affect noise sensitive areas. Ground water supply well field would raise noise levels for 100 or more residences near Klotzville.
			<u>Brine Disposal</u> Brine disposal pipeline and raw water supply pipeline would affect noise levels for over one hundred residences, especially at Franklin.
	Terminal Facilities	<u>Site Preparation</u> Maximum zone of noise impact, 1600 feet; 10 to 15 residences may be affected.	
<u>Species and Ecosystem</u>	<u>Terrestrial</u>		
	Agricultural Land	<u>Site Preparation and Pipelines</u> Temporary loss of 66 acres due to facility construction. Minimal impact importance.	
		<u>Raw Water Supply</u> Loss of 11 acres (mostly temporary) due to construction of pipeline and pump station.	<u>Raw Water Supply</u> Loss of 26 acres due to raw water well field. Loss of 39 acres due to pipeline to Mississippi River. Loss of 17 acres due to pipeline to Gulf.
		<u>Terminal Construction</u> (see Table C.3-2)	
	Bottomland and Swamp Forest	<u>Site Preparation</u> Loss of 147 acres due to facility construction. Revegegation of 94 acres likely. Minimal impact importance.	
		<u>Brine Spills</u> Large brine spill could destroy several acres near Napoleonville dome.	
			<u>Brine Disposal</u> Loss of 50 acres of mostly swamp forest habitat due to construction of brine disposal or raw water lines to Gulf.
			<u>Raw Water Supply</u> Loss of 4 acres of swamp forest due to use of Grand Bayou as water source. Loss of 22 acres of swamp forest due to use of Mississippi River as source.

TABLE C.4-11 continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT ALTERNATIVE PHYSICAL FACILITY
	Aquatic		
	Bayou Lafourche	Raw Water Supply Destruction of phytoplankton and zooplankton during the three year leaching period. Impact on regional biotic resources considered insignificant.	
	Grand Bayou and local water bodies near construction sites	Site Preparation Minimal local impacts due to erosion and runoff. Brine Spills Major brine spill remotely possible near Grand Bayou; significant loss of biota would follow.	
	Mississippi River	Raw Water Supply Minor additional displacement of plankton to Bayou Lafourche through lift pumps.	Raw Water Supply Small number of organisms destroyed as a result of them being entrained.
	Gulf of Mexico		Brine Disposal Brine effluent could affect benthos community structures over several hundred acres. Should not be significant to plankton and nekton except possibly adjacent to brine diffuser. Dredging could destroy benthic habitats and reduce productivity.
Natural and Scenic Resources	All Pipeline Construction	ROW Clearing Locally significant impact due to clearing along pipeline right-of-way.	
Socioeconomic Conditions		All Sites	
	Cultural Resources	Possibly loss or disruption of significant cultural resources.	
	Land Use	Alteration of land use on total of 589 acres in Assumption and St. James Parishes.	
	Transportation	Total construction wages, $14.2 million, much of which would be spent outside the local area; loss of Dow Company jobs at Napoleonville brining operations.	
	Government	Possibly significant loss of property and severance tax revenues.	

TABLE C.4-12 Summary of environmental impacts caused by operation of the Napoleonville SPR facilities - proposed Capline Group.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT ALTERNATIVE PHYSICAL FACILITY
Geology and Land Features	Land Surface	Cavern Collapse Remote possibility of roof collapse causing surface subsidence and formation of a lake onsite.	
Water Resources	Grand Bayou and small water bodies near Napoleonville dome	Oil and Brine Spills Impacts from expected oil and brine spills negligible. Possible very large spill could seriously degrade water quality for several weeks or months.	
			Raw Water Supply Withdrawal from Grand Bayou could significantly lower water level and increase drainage rates from adjacent wetlands; inflow to Lake Verret increased.
	Bayou Lafourche	Raw Water Supply Pumping of up to 1,000,000 BPD through Bayou Lafourche would increase stage, erosion, and turbidity; 26 percent increase over average flow rate. Oil Spills Small potential for oil spills	
	Mississippi River	Raw Water Supply Withdrawal of up to 1,000,000 BPD for oil displacement over 183-day period expected to have no measurable effect on water quality or quantity. Oil Spills Could have significant local impacts. Terminal Facilities (see Table C.3-3)	Raw Water Supply Withdrawal of up to 1,000,000 BPD for oil displacement over 183-day period expected to have no measurable effect on water quality or quantity.
	Gulf of Mexico		Raw Water Supply or Brine Disposal No effect on Gulf of Mexico water quality and quantity due to withdrawal; local alteration of salinity and water quality near brine diffuser; increased brine spill exposure.
	Ground Water	Brine Disposal Brine injection should have no adverse impact. Oil and Brine Spills Very slight chance of local ground water pollution due to surface or brine oil spill; collapse or cavity roof could seriously degrade ground water supplies for Napoleonville area but such an occurrence is highly unlikely.	
			Raw Water Supply Surface subsidence potential expected to be small due to ground water withdrawal of up to 1,000,000 BPD.
Air Quality	Oil Handling and Storage	Total Emissions Emissions from 330 MMB oil storage facility for 5 fill and withdrawal cycles equal 67,300 to 66,700 tons 46 percent due to the expansion, 410 tons at Napoleonville. Storage in Surge Tanks (see Table C.3-3) Dock Transfers (see Table C.3-3)	

TABLE C.4-12 continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT: PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT: ALTERNATIVE PHYSICAL FACILITY
Noise		Storage Site Operation No significant increase in ambient sound levels on or adjacent to the site with either proposed or alternative facilities.	
Speices and Ecosystems	Terrestrial Agricultural Land	Oil and Brine Spills Possible oil or brine spills would have local, short-term adverse effect on agricultural productivity.	
			Raw Water Supply Withdrawal of water from wells would add 9 acres of pipeline ROW maintenance but eliminate possibility of adverse effects on Bayou Lafourche or Grand Bayou. Use of the Mississippi River as a source would require maintenance of a larger number of acres.
		Purchase of Commercial Power Would require maintenance of a 4-mile transmission line ROW.	
	Bottomland and Swamp Forest	Oil and Brine Spills Possible oil or brine spill from pipelines could have locally significant adverse impacts.	
		Storage Site Maintenance Clearing Continued maintenance of 41 acres would reduce available habitat in region by an insignificant amount.	
	Aquatic Grand Bayou and local water bodies near Napoleonville dome	Oil and Brine Spills Possibility of major spill of brine or oil from pipeline considered remote. Would cause locally significant impacts on aquatic life.	
			Raw Water Supply Withdrawal of water from Grand Bayou could significantly reduce habitat and standing crop of plankton and other small organisms.
	Bayou Lafourche	Raw Water Supply Average flow rate increased by about 30 percent from Donaldsonville to Klotzville during oil withdrawal (180 day period, expected five times in project life); increased turbidity; impact on aquatic biota not expected to be of regional significance.	
	Mississippi River	Oil Spills Potential oil spill impacts could be locally significant, especially at dock site and in lower delta.	
		Raw Water Supply No measurable impact on aquatic life due to water withdrawal.	Raw Water Supply No measurable impact on aquatic life due to water withdrawal.
	Gulf of Mexico	Oil Spills Expected oil spill volumes could significantly affect marine biota. Estimated total 5,230 barrels of oil from all SPR operations in the Gulf during project lifetime. Possible very large or maximum credible oil spill could have significant impacts to several thousand acres of shallow water or marsh if spill reaches shore before cleanup.	

TABLE C.4-12 continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT PROPOSED PHYSICAL FACILITY	ALTERNATIVE PHYSICAL FACILITY
			Raw Water Supply Use of Gulf of Mexico for water supply would increase maintenance acreage required along pipelines. Brine Disposal Brine could destroy benthic habitats and reduce productivity. Small impact on nekton and plankton. Possible alteration of migration route.
Natural and Scenic Resources		Oil Spills Adverse impacts associated with possible large oil spill which could foul swamp forest and marshes and contaminate water with oil. Operation and Maintenance Pipeline ROW maintenance would have adverse aesthetic impacts.	
		Purchase of Commercial Power 4-mile transmission corridor alignment would have adverse impact.	Raw Water Supply or Brine Disposal Pipelines to Gulf Coast would have additional adverse resource impact.
Socioeconomic Environment	Economy	Storage Site Employment Total wages expected to be approximately $113,000 during each month of oil fill and withdrawal; $18,000 during standby.	

C.5 ALTERNATIVE GROUPING NO. 1 (EARLY STORAGE SITES PLUS EXPANSION OF WEEKS ISLAND)

C.5.1 Introduction

The following sections detail the expected and potential environmental impacts associated with the development of this alternative for the Capline Group. Sections C.5.1.1 and C.5.1.2 very briefly summarize the types of impacts associated with the development and use of the Bayou Choctaw and Weeks Island early storage sites, which are treated in detail in previously published EIS's. Section C.5.1.3 briefly describes the activities related to the expansion of Weeks Island. Section C.5.2 considers impacts associated specifically with the expansion of the Weeks Island storage site. This section also describes significant cumulative impacts associated with full development of the Capline Group.

C.5.1.1 Bayou Choctaw Dome Early Storage Site

Environmental impacts related to the development of Bayou Choctaw dome as an early storage site having a capacity of up to 94 MMB are discussed in FES 76-5 (Section 3.0) and its supplements. Construction impacts include those associated with the following activities:

- onsite grading and construction of surface facilities;
- construction of a 39 mile pipeline to the Mississippi River near St. James;
- construction of a tanker dock, 4-200,000 barrel oil storage tanks, and associated terminal facilities at St. James.

Significant operational impacts would include:

- Possible oil and brine withdrawal;
- Withdrawal of surface water for oil displacement;
- Disposal of brine during oil fill;
- Hydrocarbon emissions during oil transport and handling;
- Maintenance clearing on project lands.

C.5.1.2 Weeks Island Dome Early Storage Site

Development of Weeks Island dome as an early storage site having a capacity of 89 MMB will have anticipated environmental impacts as detailed in Section 4.0 of FES 76/77-8 and its supplements. Construction of proposed facilities would have impacts associated with the following activities:

- temporary shutdown of Morton Salt Mine and loss of employment for local workers;
- onsite grading and construction of surface facilities;
- construction of a 64.4-mile pipeline to the Mississippi River near St. James;
- construction of a tanker dock, 4-200,000 barrel oil storage tanks, and associated terminal facilities at St. James.

Significant operational impacts would include:

- Possible oil spills;
- Hydrocarbon emissions during oil transport and handling;
- Maintenance clearing on project lands.

C.5.1.3 Weeks Island Expansion

As an alternative to development of a 150 MMB storage site at Napoleonville, newly leached storage cavities with a capacity of 91 MMB can be provided on the east flank of Weeks Island. With this expansion the Capline Group would consist of up to 94 MMB at Bayou Choctaw and 180 MMB at Weeks Island, for a total capacity of approximately 274 MMB.

New facilities required for site expansion at Weeks Island include the following: 10 leached storage cavities with a total capacity of 91 MMB: expansion of the early storage development pump station/control house; a brine settling pond, a 37.6 mile brine disposal pipeline to the Gulf of Mexico, and three backup brine disposal wells; onsite oil, water and brine pipelines, acces roads, and well-head containment dikes; a raw water pipeline to the Intracoastal Waterway, intake structure, and surge pond; and manifold connections to the 65-mile oil pipeline to the terminal. Power would be supplied commercially through a substation to be built for the early storage phase.

Section C.5.2 considers impacts associated with construction and operation of these new facilities and with expanded use of the early storage development facilities (primarily the oil pipeline and St. James Terminal). Particular attention is given to analysis of cumulative oil spill and air quality impacts which would be caused by the full 274 MMB Capline group development.

System alternatives at Weeks Island include: construction of an 7.5-mile raw water supply pipeline to the Gulf (following the proposed brine pipeline right-of-way); an alternative brine diffuser site in the Gulf of Mexico; a 24-well brine injection system located on the Bayou Cypremort levee ridge; and onsite power generation. Impacts of construction and use of these alternatives are also considered in the following subsections. (Impacts associated with the early storage phase development are given in FES 76-5 and FES 76/77-8 and supplements.)

C.5.2 Impacts of Weeks Island Expansion Alternative

C.5.2.1 Impacts of Site Preparation and Construction

The following section describes construction impacts for storage site facilities and related pipelines. Construction impacts of terminal facilities are described in Section C.3.

C.5.2.1.1 Land Features

Proposed Facilities

Quantities of material to be excavated or filled and acreages of land to be affected by grading and other construction activities at the Weeks Island salt dome, and along pipeline routes are listed in Table A.5-1.

Grading at the Weeks Island site would be confined to about 32 acres, of which 23 acres would occur in areas already cleared (primarily for sugar cane). The plant area, cavern wellheads and containment dikes, brine and raw water surge ponds, roadways, and other site construction would require 137,000 cubic yards (cy) of fill and 35,000 cy of excavation.

Construction of a brine disposal system to the Gulf of Mexico diffuser would require a 5.5-mile on-land pipeline over which 28 acres of cleared land, 13 acres of deciduous swamp, and 13 acres of marshes would be altered. Approximately 66,300 cy of soil would be displaced and the excavated material reused for backfill. Approximately 54 acres would finally be affected along the pipeline right-of-way on land. Alteration of existing land features would only be temporarily affected providing recontouring and revegetation is carried out. Three back-up brine disposal wells would be located along a 2.3-mile pipeline parallel to the brine and oil right-of-way. An estimated 12,000 cy of excavation for the pipeline, 13,300 cy of fill for the well pads, and 5 acres of construction disturbance would be required.

The raw water supply line from the Intracoastal Waterway just west of the site would require 5000 cy of excavation, a like amount of fill, and 9 acres of construction right-of-way.

Leaching of 10 storage cavities in the Weeks Island salt dome would involve removal of about 91 MMB of salt by leaching for disposal in deep saline water bearing sands. This is equivalent to 19×10^6 cy of salt. Sufficient wall thickness would be maintained between cavities to maintain cavern structural integrity (Section A.3.2.1.2).

Excavation impacts at the terminal sites are considered to be long-term or permanent. Excavation along the pipeline routes, except where canals are necessary through the marsh, is primarily short-term.

Alternative Facilities

Physical impacts of alternative facilities for Weeks Island development are listed in Table A.5-2. A 7.5-mile raw water supply pipeline to the Gulf would require 98,500 cy of excavation and 5000 cy of fill. Construction right-of-way requirements would be 62 acres if the raw water line is installed parallel to the planned brine disposal pipeline (20 foot additional right-of-way onshore) or 106 acres if a brine disposal well field is used (80-foot right-of-way).

A 25-well brine injection field would require 8.8 miles of pipeline, 151,000 cy of excavation, and 125 acres of construction area.

An alternative brine diffuser site, located 28.5 miles south of South Point, Marsh Island, would have the same impact on land features as the proposed diffuser pipeline since the on-land ROW would be the same.

Construction of an onsite gas or oil-fired turbine power plant may require a few acres of cleared land near the pump station. Additional land disturbance would be relatively minor.

C.5.2.1.2 Water Resources

Site preparation and development of proposed facilities at Weeks Island would affect several water bodies, including: the Intracoastal Waterway; the Gulf of Mexico (including West and East Cote Blanche Bays); small ponds, canals, and tidal creeks on and adjacent to the dome (e.g., Plantation Lake, Warehouse Bayou); Bayou Cypremort; and deep saline ground water aquifers. Potential impacts are treated according to specific aspects of storage facility development.

Construction of Storage Site Surface Facilities

Construction at Weeks Island storage site would require 35,000 cy of excavation, 137,000 cy of fill, and 32 acres of direct land disturbance (Table A.5-1).

Sediment represents the majornonpoint source of water pollution on most construction sites, especially on those which require extensive grading. Sediment includes solids and organic materials detached from the ground surface by erosion and carried into the drainage system principally by runoff. The introduction of sediment into various natural bodies of water and the associated turbidity and deposition of solids results in numerous adverse physical, chemical, and biological effects. Suspended sediment ultimately reduces the storage capacity of waterways, increases flooding hazards, fouls and destroys aquatic habitats, diminishes recreational and property values, and enhances the transport of other harmful pollutants such as human and animal sanitary wastes, pesticides, and petrochemicals.

The site preparation and construction activity at Weeks Island would involve a significant amount of earth movement. Approximately 172,000 cubic yards of earth would be displaced during this process and approximately 32 acres of land would be disturbed. The land overyling the dome is a mixture of cropland, forest, and cleared industrial land with elevations of 5 to 170 feet above sea level. Because of the high level of annual precipitation encountered in the region, a significant amount of sediment may be transported from the disturbed surface areas into the surrounding surface water system. This sediment should pass initially into the swamps and marshes in the vicinity of the dome. A small amount of the sediments could move into Plantation Lake (Figure A.5-3) which is located just north of the onsite oil, water and brine pipelines. Sediments could also be transported west to the Intracoastal Waterways and eventually to the coastal bays and Gulf of Mexico. Standard engineering practices such as interceptor ditches, dikes, and sedimentation ponds would be utilized where necessary to prevent any significant degradation of water quality due to plant site runoff.

Numerous solid and liquid products, both organic and inorganic, used in construction are a source of water pollution. Potential impacts on surrounding waters are described in Section C.4.3.1.2.

Prediction of the impact of such chemical and biological contaminants is quite difficult because of the human element involved. Assuming that effective waste management procedures are utilized and that personnel are properly instructed, impacts on water resources sould be minimal.

Impact of Raw Water Supply System Construction

Effects of Water Withdrawal

The proposed raw water source for leaching the Weeks Island facilities during the mining cycle is from the Intracoastal Waterway. Water would be obtained through a 0.9-mile pipeline terminating at an intake structure to the west of the site. The maximum water withdrawal rate during the mining cycle is 672,000 B/D.

As may be seen in Figure A.4-2, the Intracoastal Waterway is interconnected to Weeks and Vermilion Bays in the site vicinity. Water withdrawn during the mining cycle from the Intracoastal Waterway would be resupplied by those bays via the Gulf of Mexico and by drainage from adjoining marshlands.

Since a free interchange of water takes place between the waters of Weeks Bay and the Intracoastal Waterway under natural conditions, no changes in water quality or quantity within the Intracoastal Waterway are expected to occur as a result of withdrawal for leaching.

Pipeline Construction Effects

Construction of the proposed raw water supply system would include the installation of approximately 0.9 mile of buried pipeline between the plant area and the intake structure on the Intracoastal Waterway, using dry land installation techniques as described in Section A.3.4.1, and would involve excavating 5000 cubic yards of material. Potential water quality impacts resulting from pipeline installation are discussed in Section C.4.3.1.2.

The pipeline would pass through cleared land along the south flank of the elevated "island" formed by the salt dome (part of the route follows the Southern Pacific Railroad (SPRR) right-of-way; no water bodies would be crossed along the right-of-way. Erosion caused by runoff from spoil piled temporarily along the pipeline trench would enter the marsh south of the dome, however. Soil excavated from the pipeline trench would not normally be high in moisture content, so that extensive drainage to the marsh, which could cause low pH, low oxygen levels, and high nutrient concentrations, would not be expected to occur.

Impact of Brine Disposal System Construction

Effects on Receiving Waters

The proposed brine diffuser for the Weeks Island site is located in the coastal waters of the Gulf of Mexico, approximately 11.5 miles south of South Point, Marsh Island, at a depth of about 20 feet (Figure A.5-6). During the construction (cavity leaching), a maximum of approximately 672,000 B/D of brine with a salinity 200 parts per thousand (ppt) greater than ambient (about 30 to 35 ppt) would be discharged. In order to gain quantitative indications of the possible impacts of brine disposal to the Gulf of Mexico, computer simulation analyses were performed using a time-dependent model (NOAA, 1977). Model inputs included estimated current fields that closely approximate actual conditions and observed current patterns obtained from baseline monitoring at the Gulf diffuser site. A summary of the study results is presented in Appendix G.

Using estimated current fields of approximating actual conditions, results of the analyses indicate that the current sequence has only a moderate effect on the maximum predicted concentration in the far field, but it has a substantial influence on the shape of the calculated concentration distribution. Periods of strong ambient current produce long, narrow plumes. Concentrations near the diffuser are relatively low due to the positive dependence of near field dilution on current speed. During periods of stagnation, the plumes remain close to the diffuser. Concentrations near the diffuser are generally higher during stagnant conditions than for the strong net current cases due to concentration build-up (NOAA, 1977).

The sensitivity of the calculated concentration distributions due to a reduction in the horizontal and vertical turbulent diffusion coefficients was also tested. Reducing the vertical diffusion coefficient by a factor of 3.3 increases bottom concentrations by about .5 ppt over much of the plume. Reducing the horizontal diffusion coefficient by a factor of 3 decreases the lateral spreading of the plume and thereby increases the bottom concentrations predicted for the centerline of the plume. The effect on bottom salinity concentrations of reducing vertical diffusion is greater than the effect of reducing horizontal diffusion because the former process transports mass away from the bottom while the latter process merely redistributes mass along the bottom (NOAA, 1977).

For the case of moderate current conditions (estimated), an increase of less than 5 ppt above ambient could be expected within a boundary of 10^6 square feet (23 acres). After an 8-day stagnation period, salinities in the near field would remain similar but would increase by a factor of 4 or 5 over the base case outside the near field (NOAA, 1977).

Using 13 days of actual current meter data collected at the Weeks Island site to allow the model to become stabilized, outputs were taken at 0, 3, 9, and 18 hours. The average area of the 4 outputs contained in the 3 ppt isohaline was 40 acres. No major variations were noted between the actual observed and simulated current outputs.

A comprehensive discussion of the brine disposal simulation analysis and presentation of results is contained in Appendix G.

Due to geothermal heating, the brine in the cavern may increase to a temperature from 120 to 150^{o}F. The temperature of the brine at the diffuser would not be reduced greatly. However, due to turbulent mixing, temperature elevation would be less than 1^{o}F within the 25 acre brine mixing zone, even during stagnation periods.

The main impact of the brine plume on water quality would be elevated salinity levels, up to 230 ppt. Associated with this increase would be an alteration in the normal ion ratios. Ca/Mg and K/Na ratios would be altered to a large extent; the balance of these ions have been shown to be an important ecological factor in the physiological function of several organisms. Increases in the concentrations of precipitates would parallel increased salinity. Possible settling of these particulates could influence sessile marine life in the disposal area.

Heavy metals are not expected to impact the discharge area since the concentrations of the trace metals are low in both the leachwater source and the brine. The elevated salinity and temperature of the brine water would result in its deoxygenation. However, jet dilution at the diffuser site would cause a rapid increase in oxygen levels to near ambient concentrations.

The oil in brine analysis and experience gained during several years of operation of a similar facility in Manosque, France has shown that concentration of oil in the discharged brine should be well below the EPA recommended guidelines (see Appendix D).

Pipeline Construction Effects

The brine disposal pipeline would extend from Weeks Island in a southeasterly direction, crossing Bayou Cypremort and the Intracoastal Waterway (Figure A.5-2). South of the Intracoastal Waterway, the brine pipeline would traverse approximately 1.5 miles of coastal marsh containing numerous small tidal creeks and ponds which drain to West Cote Blanche Bay. The pipeline then would proceed offshore along a southeast bearing to the vicinity of Rabbit Island in East Cote Blanche Bay. From this location, the pipeline proceeds south-southwesterly into the Gulf of Mexico and terminates 32.1

miles offshore at a multiport brine diffuser in 20 feet of water. The location of the offshore brine disposal facilities is shown on Figure A.5-6.

Onshore construction of the proposed brine disposal system would require the installation of approximately 5.5 miles of buried pipeline between the site and the coast. Onshore pipeline installation would require approximately 66,300 cubic yards of excavation, potentially releasing 1.5 acre-feet of interstitial water to the surrounding water bodies and wetlands. Impacts on the water quality of the Intracoastal Waterway and Bayou Cypremort would include decreased pH and dissolved oxygen, and increased nutrient concentrations. These effects would be localized, and would dissipate within a week after pipeline installation due to reaeration of water and uptake of nutrient by aquatic vegetation and sediments.

Potential water quality impacts related to construction of the offshore portion of the brine disposal line are primarily a result of bottom sediment disruption during pipeline burial. An area 200 feet wide along the pipeline route may be assumed to be disturbed by the jetting process used to bury the pipe. The area disturbed would total about 778 acres for the 32.1 mile offshore portion of the pipeline. The volume of disturbed sediments would be 16,000 cubic yards per mile, or a total of 6×10^5 cubic yards.

Effects that could occur in surrounding waters are increases in turbidity BOD (biochemical oxygen demand) and lowering of dissolved oxygen (DO), lowering of pH, increase in nutrients, and possible increases in concentration of heavy metals, hydrocarbons, and pesticides released from the sediments. Field studies conducted for the nearby Louisiana Offshore Oil Port (LOOP) have indicated that the BOD of the Coastal Louisiana sediments is high (on the order of 400 ppm). Under worst-case conditions of low ambient dissolved oxygen levels, oxygen could be totally depleted in the water column in the near vicinity of construction.

Using a conservatively low assumption of 2 ppm dissolved oxygen in the nearshore waters, a cubic yard of disturbed sediments released along the pipeline route could conceivably deplete 100 to 1000 cubic yards of the surrounding waters of oxygen. It is likely, however, that the above analysis overestimates the effect on water quality for the following reason: (1) Oxygen is injected into the water during the dredging operation (at an average rate of between 800 and 1000 ft^3/min), and (2) it is unlikely that all of the BOD would be satisfied during the period of time sediments are exposed to oxygenated water. BOD values are calculated on a five-day basis over controlled laboratory conditions. It is probable that most sediments would settle out within a day or two, and thereafter only a fraction of the disturbed sediment would exert a significant oxygen demand.

Because of these uncertainties, the area likely to be affected by a significant lowering of oxygen cannot be precisely predicted. However, an estimate based on the above considerations is that 10 percent of the sediment BOD would be satisfied by dissolved oxygen in the water columns. Conclusions are that the disturbed sediments could have a significant effect on the dissolved oxygen content of the water in the immediate project area but would not affect oxygen levels on a regional scale. The duration of effect is likely to be relatively short (several days) though possible poor mixing between surface waters and bottom waters could increase this period.

Effects of Backup Brine Injection Wells

The three back up brine disposal wells would require 2.3 miles of pipelines from Weeks Island along the oil and brine pipeline ROW. Construction would release sediments to adjacent marsh and swamp forest wetlands with effects similar to those described for the brine line.

The backup brine disposal system would inject brine at rates of up to 100,000 BPD into deep sands which contain saline water. These injection sands are relatively permeable; thus, it is expected that the dense brine would flow downdip with a relatively slow movement that would not induce extensive mixing with the formation water. The high permeability of the sands would minimize the likelihood of migration of brine or saline water displaced from the injection sands up along faults or improperly cased wells. No impact to water supply is anticipated.

Accidental Brine Release

The estimated quantity of brine spilled during leaching of the Weeks Island expansion cavities is 45 barrels onto land and water bodies between the storage site and West Cote Blanche Bay (Table C.2-9). Maximum credible spills of up to 30,000 barrels are considered possible, though highly unlikely.

In offshore waters, spill frequencies would be six to seven times higher than onshore because of the greater pipeline length. However, average spill sizes used to calculate volume expectation onshore would not apply because spills offshore would be isolated and would tend to flow by gravity out of a ruptured pipeline. The maximum credible spill size would be the total volume of 32.1 miles of offshore pipeline length (approximately 300,000 barrels).

Effects of spills on surface water quality on shore would be locally significant and may last several weeks if natural circulation mechanisms do not effectively flush the area impacted. The expected number of brine spills is only 0.024, however, so that there is only 1 chance in about 42 of a spill occurring during leaching.

Spills which occur from the offshore portion of the pipeline are much less likely to have significant effects on water quality. However, it is possibe that brine released in nearshore shallow, poorly flushed waters of West Cote Blanche Bay could tend to form a high salinity stratification until mixed by wind-induced turbulence or high rates of fresh water runoff.

A brine spill at the site or along the disposal pipeline could locally impact the water quality in the upper unit of the Chicot aquifer or in the various perched water tables over the dome. The brine would tend to migrate downward within the formation and downdip along the formation due to density differences. A massive spill, although highly unlikely, could possibly impact the quality of water in those aquifers by causing increased salinities. As local recharge of the Chicot aquifer has been found to be minimal, potential seepage from the membrane-lined brine pit or from pipeline spills are likely to have negligible impact on regional ground water quality.

Hurricane surge studies conducted by the U.S. Army Corps of Engineers indicate that the 100-year flood elevation, excluding wave runup, at Weeks Island is +11.6 feet MSL. Maximum wave runup on the west site of the island is about +20 feet MSL. Most surface facilities at Weeks Island dome (including the brine surge pond) are located well above any conceivable storm water level. (The shallow waters of the bay prevent the propagation of major tidal waves along the coast). Portions of the raw water supply system and several well heads on the eastern flank of the dome are within the influence of storm waters, however. Also, the buried pipelines and backup brine disposal well field south of the dome would be subject to inundation. During construction, possible spills resulting from storm damage would be limited to relatively minor quantities of brine as a result of pipeline rupture. Effects on water quality would not be measureable under those conditions.

Construction of Alternative Facilities

An alternative system to provide raw water for cavern leaching is withdrawal from the Gulf of Mexico. An alternative brine disposal method is injection into deep saline water-bearing sands and an alternative brine disposal site in the Gulf of Mexico.

Alternative Raw Water Source - Gulf of Mexico

The Gulf of Mexico would be reached via a 7.5 mile pipeline to an intake structure southeast of the storage plant area (Figure A.5-2). Withdrawal of the required 672,000 cfs of water would have no significant effect on Gulf water quality or quantity.

The pipeline connecting the intake structure to the plant would be installed along the right-of-way previously described for the brine disposal line. Construction impacts resulting from installation and burial of the water supply pipeline would be similar to those previously discussed for the 5.5-mile onshore portion of the brine disposal line and, to a much smaller degree, to the offshore brine pipeline construction impacts.

Alternative Brine Disposal System - Well Injection

An alternate system for brine disposal is by emplacement in sands containing saline water. This can impact water supplies in various ways including increasing the salinity of the injection sands, displacement of moderately saline water from one portion of the injection sands into fresh water portions of the same sands, or inducing migration of brine or moderately saline water from the injection sands into a fresh water aquifer via such avenues as faults or abandoned wells. In certain geologic provinces where the rock is under stress it may be possible to generate earthquakes or activate faults by high pressure injection of waste water.

The proposed receiving formations for injection of brine at Weeks Island range in depth from 3,000 feet to 8,000 feet, well below any aquifers containing fresh or slightly saline water available in the region. Generally the only wells extending to the depth of the injection zone are oil wells which are generally well documented. The formations are not in a state of stress and are relatively permeable thus providing a path of least resistance in preference to faults. Standard operating procedures and routine monitoring of injection pressures should preclude hydrofracturing. In addition, the extremely dense brine could tend to move down dip in the receiving formation and the relatively slow movement could not induce mixing with the formation fluids. It may thus be concluded that no adverse impact on water supplies would be foreseen should injection be selected for brine disposal.

Alternative Brine Disposal Site - Gulf of Mexico

An alternative brine disposal site, located 28.5 miles south of South Point, Marsh Island, would have similar brine disposal and pipeline laying impacts as described above. However the pipeline would extend 47.6 miles underwater, 15.5 miles further than the proposed site. The impacts of pipelaying would thus extend over a greater distance.

C.5.2.1.3 Air Quality

During site preparation and construction, the air quality impacts for site expansion at Weeks Island would be very similar to the air quality impacts for Napoleonville as described in C.4.3.1.3. Construction impacts associated with development of early storage capacity at Bayou Choctaw and Weeks Island are given in FES 76-5 and 76/77-8.

All downwind concentrations due to construction would be well below state and national air quality standards. However, since background HC levels often exceed the 3-hour standard in southern Louisiana infrequent additional exceedances may be expected. All construction impacts would be short-term in nature and confined to a relatively small area.

Alternative

Construction of a raw water supply well field or a brine injection field would involve a significant amount of drilling activity. Air quality impacts associated with these activities may be similar to those expected from cavity drilling operations. Construction of pipelines to the Gulf of Mexico would constitute a relatively insignificant source of pollutants along the pipeline corridor.

C.5.2.1.4 Noise

The following section describes the anlaysis of possible construction impacts on noise levels at locations and residences near the Weeks Island SPR site. Noise levels of the major construction equipment are specified. Using hemispherical sound radiation assumptions, the noise levels are extrapolated to nearby locations off the site to determine the effect on ambient sound levels. Terminology used in this section is defined in Appendix B.2.4.

Noise Sources

Drilling New Cavity Entrance and Brine Disposal Wells Conventional oil well drilling rigs would be used for drilling 10 new cavern entry and 3 standby brine disposal wells. Noise levels associated with this activity have been discussed for the Napoleonville site (Section C.4.3.1.4) and would be similar for Weeks Island SPR development.

Leaching of Cavities Noise levels for this activity are identical to those described for SPR development at Napoleonville (Section C.4.3.1.3).

Construction of Support Facilities Many of the facilities necessary for operation of the SPR will have been constructed at the Weeks Island site as part of the Early Storage Phase (FES 76/77-8). Additional pumps and controls would be installed to handle the water and brine systems. A brine surge pond and a raw water surge pond would also be constructed. The associated activity would be of short duration and would not contribute significantly to the ambient noise.

Pipeline Construction A raw water pipeline to the Intracoastal Waterway (ICW), and a brine disposal pipeline to the Gulf of Mexico would be constructed. A crude oil distribution pipeline constructed under the Weeks Island Early Storage program would handle oil fills and withdrawals. Increased pumping capacities will be needed.

Pipeline and access road construction has been discussed in Section C.4.3.1.4 and is applicable to the Weeks Island site. An additional 32.1 miles of underwater pipe for brine disposal in the Gulf of Mexico would be necessary. Since this pipeline is distant from inhabited areas, the noise contributed by its construction is not considered.

Summary of Construction Noise

Sound levels from construction activities presented above are summarized in Table C.5-1.

Ambient Sound Levels During Construction

Major construction activities would occur near the Weeks Island and along the pipeline routes. In order to estimate the ambient sound levels during construction, the sound level contributions discussed in the previous sections are extrapolated, using hemispherical sound radiation and combined with background ambient sound levels. The assumption of hemispherical radiation does not include attenuation due to vegetation and is therefore conservative. The results of this computation for the drilling activity are summarized in Table C.5-2.

The U.S. Environmental Protection Agency has identified that annual day/night average ambient sound levels below an L_{dn} of about 55 dB do not degrade the public health and welfare (Appendix B.2.4). A review of data presented in the previous section indicates that at nearby residences (noise sensitive land uses) such as the town of Boudreaux, construction activity (well drilling) would have little effect on the day/night (L_{dn}) ambient sound levels; these levels would remain at 56 dB. There are no

TABLE C.5-1 Summary of construction activity noise level contributions at 500 feet.

Activity	Sound Level (dB) L_{eq}	L_d	L_n	Impact Zone Radius (feet)[a]
Drilling Shafts	67	67	67	4500
Support Facilities Construction	68	66	--	1400
Pipeline Construction	69	67	--	1800
Access Road Construction	68	66	--	1400

TABLE C.5-2 Ambient Sound Levels during Construction (dB) Weeks Island SPR Site

	Background Ambient			Construction Ambient		
	Ld	Ln	Ldn	Ld	Ln	Ldn
Center of site	70	67	74	72	70	76.5
Weeks Island away from site	49	46	53	49	49.5	56
Along Intracoastal Waterway[a]	59	54	61	59	54	61
Undeveloped Areas[b]	55	39	53	55	43	54
Nearby Noise Sensitive Land Uses[c]	58	39	56	58	39	56

[a] Estimated at point nearest Weeks Island

[b] Estimated two miles from center of site

[c] Estimated at town of Bouedreaux

residences on Weeks Island to be affected by noise from on site construction activities. The noise impact radii (distances for which noise levels are usually 3 dB or more) for drilling, road construction, and support facility construction are estimated to be 4500 feet, 1400 feet, and 1400 feet respectively (Table C.5-1).

Pipeline construction and access road construction progresses at approximately 1/2 mile a day. Areas within a distance of 1800 feet would be impacted for only a short duration. Day/night sound levels would be raised at least 3 dB. Since most of the pipelines run through uninhabited marshlands or industrial use areas, the impact would be negligible (about 19 structures located at Cypremort would be affected).

The state of Louisiana has no noise regulation limiting the proposed activity.

Alternative Facilities

Construction of either the raw water supply or oil distribution pipelines to the Gulf would affect noise levels at scattered residences (about 19 structures) along Bayou Cypremort for a very brief period. Offshore there would be no noise impact. Construction of a brine disposal well field Cypremort ridge would expose nearby residents (about 49 structures) to elevated noise levels for a period of several months. Offshore pipeline construction would only temporarily affect noise levels in any sensitive areas.

C.5.2.1.5 Impact on Ecosystems and Species

Salt Dome Development (expansion)

The expansion of the Weeks Island site would involve several impacts on the biota of the area. These impacts include loss of terrestrial habitat and indirect effects on the wildlife due to forced migration, noise and human disturbance. The total area involved for each habitat is presented in Table B.4-2.

Approximately 7 acres of forest would be cleared and removed. In addition, about 23 acres of cropland would be removed from production. Grading a total of 32 acres to a depth of up to one foot (Section A.5) would also severely impact any small invertebrates in the surface vegetation and topsoil. Populations of nematodes, mites, collembola (springtails), insect larvae, spiders, and oligochaetes (worms) would be destroyed. Secondary productivity by these groups, while unknown exactly for the site, is probably moderate due to the characteristic of gradual nutrient turnover in the habitat. Loss of primary and secondary terrestrial production would be localized but permanent.

If construction is completed relatively early in the growing season a plant community would become established on the banks and cleared areas within several months. This vegetation would help retard runoff, thereby reducing soil erosion and associated turbidity. It would also serve as cover and a source of food for some species of birds, small mammals, and other wildlife which frequent areas of human activity.

Approximately 32 acres of wildlife habitat would be lost due to on-site development. Habitat types to be affected include cleared land, upland forest, and intermediate marsh. Since about 100 acres at the site would be enclosed by fencing, it can be assumed that, except in the case of avifauna, the available resources provided by the habitat would be permanently lost to many other wildlife groups. Species likely to be affected by construction are mentioned in Section B.4.1.5.

Wildlife species to be directly affected by construction include non-mobile species of small rodents, amphibians, and reptiles. Direct effects on resident wildlife (mammals, birds, amphibians, and reptiles) would vary depending on whether or not construction can be avoided during the nesting and young-bearing season. Direct effects of the construction (other than death resulting directly from construction activities) include permanent habitat loss (loss of food, cover, nesting and breeding areas), forced migration of resident wildlife, and animal loss resulting from increased activity and road traffic.

Indirect effects on contruction include impacts on wildlife of forced migration, increased noise, and human disturbance. The effects of migration would be dependent on the availability of resources in an adjacent habitat. Critical factors to be considered include availability of space, protective cover, food, and the status of existing animal populations. Noise and human disturbance during construction would discourage wildlife within the area such as species noted in Table B.2-15 under the appropriate habitat types to be affected. Upon completion of construction activities, some wildlife species are likely to return to the impacted area. However, due to the extensive fencing planned for the site, many wildlife species other than birds would be permanently displaced.

The expansion of the site should not have any significant effects on the aquatic environment. Some minor amounts of sediment may be carried into Plantation Lake, the Intracoastal Waterway, and nearby marshes. Effects should be minor and of short duration.

Brine Disposal

The proposed brine disposal system to the Gulf of Mexico would include 5.5 miles of pipeline on shore, associated roads, and three disposal well pads, covering a total of 59 acres (see Section A.5 and Figure A.5-6). In addition, there would be about 32.1 miles of offshore pipeline involving about 778 acres of bottom disturbance. Impacts from this system include loss of terrestrial and aquatic habitat, increases in turbidity, brine discharge effects, and indirect effects on fish and wildlife due to forced migration noise, and human disturbance. The total area involved for each habitat is presented in Table B.4-2 (Section B.4.2.5).

Pipeline construction impacts in West Cote Blanche Bay, East Cote Blanche Bay, and nearshore Gulf waters include direct destruction of benthic-habitat within the pipeline ROW, indirect stress on adjacent benthic habitat and portions of the water column due to increased turbidity and siltation, and possible reduction in dissolved oxygen levels. Increased turbidity would reduce plankton productivity and cause nekton to avoid the region. As the nearshore bays are naturally turbid, it is unlikely that indirect effects on benthos would be significant. Released oxygen levels should be temporary. Also, benthos should repopulate the construction ROW within one to two years. There are no reported oyster beds in the vicinity of the proposed pipeline ROW. Some increased uptake of resuspended trace metals and other pollutants may also occur.

Brine injection into subsurface saline water bearing sands on Cypremort ridge would have no impact on species or ecosystems.

Brine discharged into the Gulf of Mexico may impact the marine biota in and around the point of discharge. The distribution of the brine plume, as analyzed by NOAA (1977), is described in Section C.5.2.1.2 and in Appendix G.

The high temperature-salinity sector for the proposed diffuser site is anticipated to have excess salinity values of approximately 3 to 200 ppt, excess temperatures of 1 to 70^{o}F, excess turbulence and particulates, low dissolved oxygen levels, and atypical concentrations of chemical constituents. The above factors would directly affect plankton, benthos, and nekton within a predicted average area of 40 acres around the diffuser site. Outside of this area, no one chemical component may be in high enough concentrations to be toxic, but a number of compounds may act synergistically to impact the regions near the diffuser sites.

Plankton would be entrained in the brine plume for several hours. During that time phyto- and zooplankton would experience physiological stress, inhibition of growth, or death. Primary production would be reduced as a result of increased turbidity and decreased dissolved oxygen. Approximately 23.7×10^{6} phytoplankton cells and 350 zooplankton would be destroyed for each cubic meter of water entrained in the brine plume. Benthic organisms in the near field would be destroyed at the rate of 2.1×10^{6} organisms per acre.

Adult nekton would be minimally affected due to their ability to avoid the high salinity-temperature areas. Decreases in local nekton productivity may result from avoidance and reduced benthic and planktonic populations. However, within the 40 acres around the diffuser, the brine plume may impact developmental stages, eggs and larvae, by inhibiting metabolic functions, growth, and development.

Construction of the diffuser pipeline and discharge of cavern leachwater is not expected to impact any unique habitats or endangered species. A more detailed discussion of the impacts of brine diffusion on the local marine biota is presented in Appendix G.

Raw Water Supply

The proposed raw water supply system from the Intracoastal Waterway is located almost entirely on cleared land (Table B.4-2); therefore, there would be very little terrestrial impact related to the construction of this system. The primary aquatic impact would be the entrainment and impingement of aquatic orgamisms from the Intracoastal Waterway (plankton, drifting invertebrates, and larvae and juvenile fish). The effects of entrainment and impingement were discussed under the heading Raw Water Supply in Section C.4.3.1.5. The relative loss of aquatic organisms due to entrainment and impingement is expected to be relatively small since the volume of water to be removed from the Intracoastal Waterway is only a small percent of the total volume of water present.

Accidental Brine Release

The expected quantity of brine accidentally spilled from the retention pond onsite or from the brine disposal pipeline to the Gulf are very small (Appendix E and Section C.2). These spills would not be anticipated to have significant adverse impacts on more than an acre or two of terrestrial or aquatic habitat in the vicinity of the site. A maximum credible spill of up to 30,000 barrels of brine could have significant local impacts on both the vegetation and animals in the spill area; however, the probability of such a spill is extremely small.

The most likely location for a major brine spill would be in offshore gulf waters along the pipeline (excluding the possibility of hurricane induced brine reservoir failures which would have devastating effects on terrestrial vegetation even without a brine release). It may be expected that a release of 30,000 barrels of brine in nearshore waters would destroy mostly bottom organisms, and possibly other organisms in the upper water column. This biological impact would be locally significant but recolonization would begin almost immediately after the spill had mixed with the coastal water.

Should a maximum credible brine spill occur on the salt dome or along the brine disposal pipeline the brine could spread across the swamp and bottomland forest possibly reaching the Intracoastal Waterway or one of the coastal estuaries. Impacts on vegetation and on animal life which could not avoid the brine in these areas would be locally devastating. Tens of acres of habitat could be destroyed and the resulting salt concentrations in the soil could remain above levels tolerated by growth of new vegetation for several years. However, it must be emphasized that such a spill is statistically very unlikely to occur especially from so short a section of pipeline.

Construction of Alternative Facilities

Alternative Raw Water Source - Gulf of Mexico

Withdrawal of water from the Gulf of Mexico for leaching would have both direct pipeline construction and entrainment and impingement effects on biota. Construction effects would be short term and of local consequence only, similar to those described for the brine disposal pipeline.

Entrainment and impingement of small marine organisms in the 672,000 BPD raw water supply stream would destroy a large number of plankton, drifting invertebrates, larvae, and juvenile fish. The effects would continue over a period of two years. As a very small function of the total water in the West Cote Blanche Bay is affected, it is unlikely that there would be a significant regional effect on biotic resources or on any particularly important species.

Alternative Brine Disposal System - Well Injection

Construction of the alternative brine disposal well field would directly affect 125 acres of land; 19 acres would be in swamp forest adjacent to the oil pipeline ROW and the remainder would be in cleared land on Weeks Island and on the Cypremort levee ridge (primarily sugar cane fields). Biological impacts to terrestrial and aquatic systems should not be significant. Discharge of the brine would not have any direct biological impacts. The overall environmental impact of this alternative brine disposal system would be less than that for the proposed disposal system to the Gulf of Mexico.

Alternative Brine Disposal System-Alternative Diffuser Location

Use of the alternate brine diffuser location would require a 47.6-mile offshore pipeline instead of the proposed 32.1-mile pipeline, thus increasing bottom disturbance by 376 acres.

C.5.2.1.6 Natural and Scenic Resources

Storage Site

Construction at the storage site would require removal of natural wooded vegetation and some cultivated crops on 32 acres of land. The conversion of natural wooded areas and cultivated crops to industrial usage would have a permanent and significantly adverse impact on the natural and scenic resources of Weeks Island.

Noise, dust, and fumes from constructional activity would further degrade the natural and scenic resources of the dome. These impacts would be temporary in nature and would be most evident during the first 9-16 months of construction. Some of the natural vegetation disturbed during construction may return to its previous condition during the next growing season.

Approximately half of the construction acreage would be visible from Route 83 on the east edge of the dome.

Raw Water Supply System

Most of the pipeline and pumping facilities necessary for water supply would be constructed in areas of low natural and scenic resource value which have already been converted to industrial uses for early storage. Only about nine additional acres of land would be required for a pipeline from the water intake structure to the pumping facilities. Construction of this pipeline would require the removal of some natural vegetation, but is not expected to have significant impact on the natural and scenic resource of the storage site. This portion of the dome is not accessible to the general public.

Some temporary disturbances caused by construction activities (e.g., dust, noise) would be confined primarily to areas which are currently in use for early storage and which are not accessible to or easily seen by the general public.

Brine Disposal System

The first 2 miles of the brine disposal pipeline to the Gulf of Mexico would pass through swamp forest and cultivated land. This portion of the pipeline right-of-way and the associated temporary disturbances due to construction activities would be visible from Route 83, but should have a minimal impact on agricultural resources. The remainder of the onshore portion of the pipeline would pass through marsh areas and would cross the Intracoastal Waterway south of the community of Cypremort, causing both temporary and some permanent disruption of natural and scenic resources.

Construction of the offshore portion of the pipeline would cause disruption of estuarine and marine ecosystems along its 32.1-mile length. The presence of the pipeline and especially the related construction activities would have a temporary adverse impact on the natural resources of these Gulf waters.

The offshore segment of the pipeline route would pass close to the Marsh Island and Shell Keys Wildlife Refuge areas and two camping spots on the east shore of East Cote Blanche Bay. Depending upon the exact route of the pipeline, construction activities could occur within 5 miles or less of these specially designated natural resource areas. Impacts should be negligible, however.

Additional acreage would be required for the construction of a backup brine disposal system consisting of three deep injection wells and a 2.3 mile pipeline to the disposal field. The removal of crops and swamp forest vegetation on this acreage would have minimal additional adverse impact on natural and scenic resources.

Alternative Facilities

Raw Water Supply Construction of a 7.5 mile water supply pipeline to the Gulf of Mexico would occur within the right-of-way necessary for the proposed brine disposal pipeline. Use of the same pipeline right-of-way for water supply would minimize the impact on scenic and natural resources.

If brine disposal is not in the Gulf of Mexico, construction of a water supply pipeline to the Gulf would require disruption of cropland and relatively undisturbed marsh areas and would have a significantly greater impact on natural and scenic resources than the primary alternative of utilizing the Intracoastal Waterway.

Brine Disposal System Use of deep injection wells would require removal of crops and natural marsh vegetation on approximately 125 acres of land. In some cases, vegetation may be allowed to revert to its natural state following the cessation of construction activities. The onshore adverse impacts on natural and scenic resources may be slightly greater under this alternative as compared to disposal in the Gulf of Mexico; however, there would be no offshore destruction of marine resources.

Alternative Brine Diffuser Site Construction of the 47.6-mile pipeline would follow the same on-land right-of-way as the proposed diffuser pipeline. Impacts would therefore be similar, with a larger area of impact offshore.

C.5.2.1.7 Archaeological, Historical, and Cultural Resources

Weeks Island has two known archaeological sites and excellent potential for others (Section B.4.2.7). A cultural resources survey would be conducted prior to final selection of pipeline and surface facility locations.

C.5.2.1.8 Socioeconomic Environment

Storage Site

Land Use The addition of ten new caverns and associated oil, brine and raw water facilities on 32 acres of land within the 100-acre fenced area would result in a significant change in land use over the dome. This area, currently a mixture of cultivated land, woodlands, and marsh, would be converted to industrial use. Revegetation would be allowed on approximately 25 acres of this land (Table A.5-1). Development of the brine diffuser system to the Gulf would disrupt 59 acres of coastal area. The impacts of construction in this area would be significant but temporary, with land returning to its previous use within a few months.

Transportation The impact of storage facility construction on local traffic would depend on the amount of material that must be transported to the site by surface routes and on the scheduling of construction. Most heavy equipment and materials would probably be transported by barge rather than by rail or highway. Some construction materials may be brought in by rail via a Southern Pacific Railroad spur that extends into the site.

Surface road access to the storage site is limited to a single two-lane highway, State Highway 83. This medium duty road currently carries 1280 vehicle trips in an average day and would experience a significant increase in traffic during construction. During peak contruction activities, slightly over 500 workers would travel to and from the site each day and truck traffic related to construction would rise. This traffic is not expected to cause excessive congestion however, due to the very light traffic conditions currently experienced in the area. Traffic impacts would also be mitigated to the extent that construction workers commute during off peak hours. (Construction workdays often coincide with available daylight hours).

Shipping and other boat traffic would experience temporary minor adverse effects in the Intrecoastal Waterway and the Gulf of Mexico during pipeline construction. The diffuser area and construction vessels would be carefully marked with approved navigational devices. Anti-snag diffuser ports would be utilized to avoid damage to fishing gear.

Population Construction of the SPR storage facilities may have a minor, temporary impact on population in the surrounding urban areas. Many construction workers may come from nearby communities; into the area from Baton Rouge or more distant labor pools. Because most of the construction would be completed within one year, few of the construction workers are likely to relocate their families into the area near the project. Availability of temporary housing could determine the location of population increases caused by immigrant workers. Should these workers all locate in one of the smaller communities in the area, such as Jeanerette, a noticeable increase in transient population would result. If, as expected, the workers locate in several of the larger surrounding urban areas, such as New Iberia or Lafayette, the impact would be reduced to minimal levels in each town. The general lack of available transient housing may require workers to commute from these larger, more distant urban centers, thus minimizing any local temporary population impact.

Housing There is little transient housing in Iberia Parish where some of the storage site workers may seek temporary housing. In addition, there is a general shortage of permanent housing in the area because of rapid economic and population growth in New Iberia. Presumably the greatest portion of the imported work force would want temporary housing in apartments, motels, rooming houses, and trailer parks. Because little is available in close proximity to Weeks Island, it is likely that they would have to go as far as Lafayette, about 45 miles northwest on U.S. 90, or to Morgan City, roughly the same distance to the east. The commuting distance to Baton Rouge, Thibodaux, or Houma is probably too great, even though construction workers typically are used to long distance commuting. These workers would have a minimal impact on housing in the larger urban areas such as Lafayette and Morgan City, but could have a significant impact on smaller nearby urban areas.

Economy The largest percentage of the total labor force employed for the Weeks Island project would be involved with construction of the 10 new caverns at the storage site. The major local benefit of storage site construction would be to termporarily relieve unemployment (4.4 percent in Iberia and 4.6 percent in St. Mary). Over half of the workers are expected to come from within commuting distance of Weeks Island. Employment levels would vary significantly during project construction, from a peak of 512 in the third month down to 60 in the twenty-fifth through fifty-second month (see Table C.5-3).

The availability of construction workers in the area would be affected by concurrent construction projects in the area.

Local contractors could be expected to provide some of the supplies and labor necessary for storage site construction; however, no new business is expected to open in the area as a result of this activity alone, due to its short duration. Most of the goods and services required for the project would be brought in from larger market areas, such as Lafayette, Morgan City, or Baton Rouge. Storage site construction would increase local income through employment and purchases of local goods and services. The exact size of the stimulus to the local economy cannot be estimated at this time.

The gross income from total project employment can be estimated using the information in Table C.5-3, which assumes an average monthly income of $1750 per employee. Total construction wages would be approximately $8.2 million.

Local workers (those who reside permanently within commuting distance) may be expected to spend more of their disposable income in the local area while immigrant workers who move into temporary quarters for the duration of their employment are apt to send part of their checks home to their families and/or to save larger parts of their salary. If the disposable income of the construction workers (that portion available for spending after payment of taxes, and Social Security payments) is estimated as 80 percent of total earnings, about $ 6.5 million would be added to the regional economy during construction.

TABLE C.5-3 Estimated Monthly Employment and Wages - Weeks Island

Month	Monthly Employment	Monthly Wages
0-1	79	$ 138,250
1-2	438	766,500
2-3	512	896,000
3-4	333	582,750
4-5	84	147,000
5-6	119	208,250
6-7	111	194,250
7-8	61	106,750
8-11	64	336,000 (x 3)
11-25	83	2,033,500 (x 14)
25-52	60	2,835,000 (x 27)
	TOTAL	$8,244,250

[1] begin construction = month 0

Secondary effects would occur in the local economy as a result of the project because money spent locally by construction workers becomes income to others in the nonbasic employment (service) sectors. The effect would be minimal, as the construction phase would be relatively short.

Government Construction of the storage facilities is expected to have an insignigicant impact on the ability of local police and fire forces to provide normal services. The project would provide security forces and onsite firefighting equipment and would coordinate these activities with appropriate local officials.

Health services are available in the major urban areas near the site. Normal contruction activities would have no direct impact on these services. In the case of an accident, facilities in New Iberia, Morgan City, and Lafayette could be impacted. Some increased use of medical facilities may occur temporarily, associated with the population of immigrant workers.

There would be minimal impact on school attendance in nearby urban areas related to construction of the storage facilities. Most employees already live in the area and few of the workers who move to the area would bring their families for such a short period. Existing revenue to local and state government from property and severance taxes would be minimally affected by construction. Some very slight increase in revenue from sales taxes may be expected as a result of local purchases of supplies and materials, and also from purchases by employees. In addition, income taxes levied on construction salaries would increase. This increase is expected to be minimal although the exact magnitude would depend upon the number of employees who would come into the area from out-of-state and the resulting increase in the incomes of workers now residing in Louisiana.

Raw Water Supply System

Land Use The raw water pumping facilities and most of the intake pipeline would be constructed in an area that is already in industrial use as the early storage plant site and pipeline right-of-way. One additional water pipeline from the point of water intake to the plant would require that nine acres of marsh and woodlands be converted to industrial use. Construction of the water supply system is not anticipated to have a major impact on land use.

Transportation Construction of the water supply system would have impacts on transportation that are smaller but similar to those described for construction of the main storage site. The number of workers associated with construction of the water supply system would be relatively small and their commuting patterns are unlikely to greatly increase traffic on local highways. However, when this increment of commuters is combined with the total labor force for other project facilities some local highways, especially State Highway 83, could experience significant increases in traffic. Overcrowded conditions are not expected to result due to the uncongested traffic conditions currently experienced on local roads and to the off-peak commuting schedules of construction workers. Construction of the water intake structure on the Intracoastal Waterway could have brief effects on traffic in this waterway.

Population Construction of the water supply system would involve a relatively small number of workers for a limited period of time. Most of these workers are expected to commute from the larger urban centers of New Iberia and Lafayette, and few are expected to relocate themselves or their families to the smaller communities close to Weeks Island. As such, local population increases would be small and significant impacts minimal.

Housing Housing in the local area, like population, is not expected to experience significant impacts due to the small construction force associated with the water supply facilities and the temporary duration of employment.

Economy Construction of the water supply system would employ a relatively small percentage of the total labor force required for the project at Weeks Island (Table C.5-3). The economic effects of increased employment and personal incomes would be proportionately less than those described for the main storage site facilities.

Government Normal construction activities for the water supply system should not significantly affect the ability of police and fire departments to provide normal services. Similarly, health facilities would be significantly impacted only in the case of a large-scale emergency or accident. Since increases in local population due to construction of the water supply system would be minimal, no significant impacts on local educational services are anticipated.

Brine Disposal System

Land Use Construction of the overland portion of the brine pipeline and backup system to the Gulf of Mexico would require the conversion of 59 acres of land from agricultural use, swamp forest, and natural marsh to industrial use. Approximately 37 acres along the pipeline right-of-way would be allowed to revert to previous usage once construction activities have ended. Complete rejuvenation of wetland areas, however, may take a considerable amount of time and may not occur in some areas.

Construction of the offshore pipeline into the Gulf would have no land use impacts in the usual sense, but may temporarily limit access to certain offshore areas in which construction was taking place.

Transportation The number of workers employed for brine pipeline construction would be perhaps 25 percent of the project total and their commuting patterns would not significantly increase or congest local traffic. For offshore work, staging areas would probably be set up in Morgan City.

The pipeline would cross the Intracoastal Waterway south of Cypremort and could temporarily disrupt barge traffic at this point. Ship traffic in the Gulf of Mexico might also be slightly disrupted by construction of the 32.1-mile offshore pipeline.

Populations Local population impacts associated with pipeline construction would be minimal due to the small labor force required and the temporary nature of the employment.

Housing Since local population increases are not anticipated, no significant impact on housing in the surrounding communities is likely to occur.

Economy Pipeline construction would have an impact on the local and regional economy proportional to the work force.

If construction of the 32.1-mile offshore portion of the brine pipeline has a significantly detrimental impact on commercial fish species, then some impact on the local fishing industry would result.

Government No significant impacts on local police and fire services are expected to result form normal construction activities. Only in the case of a large-scale emergency, would local health facilities be significantly impacted. Increases in local school enrollment would be minimal since little increase in local population is anticipated.

Alternative Systems

Water Supply from the Gulf of Mexico The impact of this water supply alternative would not differ to any large extent from those of the proposed system if the brine disposal system to the Gulf of Mexico is adopted as well.

Construction of a water supply pipeline to the Gulf would share the construction right-of-way and labor force required for the proposed brine disposal system. As such, additional socioeconomic impacts would be minimal.

Deep Well Brine Disposal A total land area of 125 acres would be required for construction of this alternative in an area that is partly agricultural and partly wooded swamp. In absolute terms, the land requirements of this alternative would be slightly greater than those of the proposed system. Adoption of this alternative, however, would not impact any barge or ship traffic and would pose no threat to the local commercial fishing industry. Other socioeconomic effects such as population, housing, and government service impacts would be essentially the same under both this alternative and the proposed system.

Alternative Brine Diffuser Site Socioeconomic impacts of the alternative site would be similar to those described above for the construction of the proposed system. The adverse economic and transportation impacts would be similar to the proposed system but would increase due to the increase in pipeline length and the amount of area affected offshore.

C.5.2.2 Impacts from Operation and Standby Storage

The following section describes operational impacts for storage site facilities and for related pipelines. Operational impacts of terminal facilities are described in Section C.3.

Should an oil supply interruption occur while oil is stored at the expanded Weeks Island site, a total of up to 274 MMB would be available for distribution, either by tanker or by the CAPLINE Pipeline. Oil would be pumped from both the early storage sites at Weeks Island and Bayou Choctaw and the expanded SPR storage caverns at Weeks Island using separate 36-inch diameter pipelines. Oil would also be injected into the storage cavities via the same facilities. Until an oil supply interruption occurs these facilities would be maintained in readiness by monitoring storage cavity systems, leak-checking pipelines, activating valves, and other standard procedures.

Thus, SPR expansion at Weeks Island would not introduce any new or unique operational impacts to the program but would require extended use of existing systems at the terminal and Weeks Island to accommodate a capacity increase from approximately 183 MMB to 274 MMB (50 percent increase). Principal impacts of the Weeks Island SPR operation are associated with hydrocarbon emissions and oil or brine spills. Impacts expected to accompany early storage facility operation and expanded SPR facility operation at Weeks are both given where appropriate to providing a perspective on program expansion impact significance.

C.5.2.2.1 Land Features and Geologic Impacts

Effects of operation and standby storage of the Weeks Island storage site on land features are expected to be minimal. Compared to the 946 acres required during construction offsite and within the 100-area fenced area, only 143 acres would be maintained during operation. No significant disturbance of site soils is expected after construction is completed. Soils would stabilize soon after they were revegetated.

Weeks Island is located in an area identified as Seismic Zone 1, that is with an expectation of minor earthquake damage (Figure B.2-8). Underground storage caverns are much less susceptible to damage from seismic events than surface tanks.

It is conceivable, though extremely unlikely, that the salt roof over one of the caverns could collapse. Appendix F considers the possible mechanism by which such an event could occur. A possible result would be the formation of a deep surface depression, probably resulting in a lake over the dome. Should such an event take place, significant quantities of oil or brine could be released to the surface or to shallow ground water aquifers. Impact on surface storage equipment would be potentially significant. The structural integrity of the storage cavities would be monitored and every available measure would be taken to preserve this integrity (Appendix E).

Alternatives

Use of alternative raw water, brine or oil transportation systems would have minimal impact on land features during project operation and standby storage through required maintenance of pipeline right-of-way (Table A.4-2).

C.5.2.2.2 Water Resources

Impacts to water resources during facility operation may occur as a result of raw water withdrawal for oil displacement, brine disposal during oil filling, and possible oil or brine spills.

Operation of Storage Site

During construction of the Napoleonville storage site, measures would be incorporated into the design to minimize sediment transport and erosion at the site. These measures would include grading, diking, and reseeding. Runoff from precipitation would therefore have minimal impact on water systems.

All sanitary wastes from the storage facility would be conveyed to a treatment plant sized to conform to Louisiana Health Department Standards, then routed to a receiving stream. As the numbers of operational employees would be small, no adverse impact on stream water quality would be expected.

Impact of Raw Water Supply System Operation

The proposed source of raw water for the Weeks Island facilities is the Intracoastal Waterway. The maximum water withdrawal rate during the oil extraction cycle is 1,000,000 B/D, as compared to 672,000 B/D during the mining cycle. Accordingly, the impacts as a result of displacement water withdrawal would be similar in kind, but greater than those described in Section C.5.2.1.2. The supply and quality of water in the Intracoastal Waterway should not be adversely affected by this withdrawal.

Zinc anodic protection would be used along the raw water supply pipeline at intervals of approximately 1000 feet. This may result in the release of 0.6 grams of zinc per square meter of pipe surface area per year (the exact mechanisms of the release are not clearly understood). Since the pipeline would be buried under several feet of sediment, little of the zinc would be expected to enter the water column unless sediments were disturbed for pipeline repairs. Operation of the pipeline would have no significant effect on hydrology.

Operation of Brine Disposal System

When oil is pumped into the storage caverns, brine would be displaced intermittently to the Gulf of Mexico through the diffuser at an average rate of 250 or 500 MBCD over 2 or 1 years, respectively. Generally, the impacts of operational brine disposal would be similar to those of the leaching operation (Section C.5.2.1.2). However, discharge volumes would be less and would occur over a shorter period of time, lessening the impact. Maximum oil concentrations at the diffuser are expected to be less than 15 ppm and to average 6 ppm over the life of the project, based on theoretical oil in brine analysis and the experience of operation of a similar facility in France (Appendix D).

Because the compensaton water would remain in the cavern for a longer period of time than during leaching, the salinity of the brine would be close to saturation, 264 ppt. The oil-brine interaction that would occur only during the operational phase would result in a brine hydrocarbon concentration gradient of from 0 to 31.4 ppm during the initial oil fill. During subsequent refills, after a refractory layer had formed, the hydrocarbon content of the brine would vary from 4 to 15 ppm, depending on cavern geometry. However, reduction of oil content during brine discharge due to vaporization of light hydrocarbons and the mitigative oil skimming process would result in an estimated oil concentration in the discharged brine of approximately 6 ppm; this level is an order of magnitude greater than the ambient hydrocarbon concentration at the proposed diffuser site.

Oil or Brine Spills

During project operation, oil spills could occur from pipelines connecting the storage site with the surge tanks, and from the wellheads at Weeks Island (releases from the underground storage caverns are not quantified, see Appendix E). Brine spills could occur from the brine disposal pipeline and from the brine reservoir. A thorough description of possible modes of spills, methodologies of spill calculations, quantification of expected spill volumes and frequencies, spill dispersion characteristics, and spill prevention and control measures is provided in Appendix E. A summary of oil and brine spill expectations is also given in Section C.2 and in Tables C.2-3, C.2-4 and C.2-9. Possible effects on water resources are considered in this section.

Spills of oil or brine which occur on Weeks Island would generally flow to the south or east toward adjoining marsh land. Depending on the exact location of the pipelines, oil or brine could possibly reach Plantation Lake. Spills from the wellheads piping would flow toward Warehouse Bayou to the east, eventually reaching the Intracoastal Waterway and Weeks Bay northwest of the dome. Spills from the vicinity of the pump station would flow south to the marsh and an extensive system of canals which connect an oil and gas field to the Intracoastal Waterway.

Spills from the segment of oil and brine disposal lines between Weeks Island and the Bayou Cypremort levee ridge would enter wetlands drained by the Intracoastal Waterway to the southwest. Spills occurring south of the ridge would enter the Intracoastal Waterway or marshlands adjoining West Cote Blanche Bay.

Spills from the oil pipeline connecting the site with the terminal are considered in the Supplement to the Final EIS, Weeks Island Mine (DOE, 1977). In general: spills which occur west of Franklin would enter either swamp forest or marshland which drain to West Cote Blanche Bay; spills between the East and West Protection Levees of the Atchafalaya Basin would reach extensive swamp forests which eventually drain to the

Atchafalaya River and the Gulf; spills occurring between the West Protection Levee and the Bayou Lafourche ridge would impact swamp forest drained by Lake Verret; east of the Lafourche ridge, oil would enter swamp forest in the Barataria-Salvador-Des Allemands drainage basin.

Oil spills would enter major water bodies such as Bayou Teche and Bayou Lafourche only if they occur within the short pipeline segment between the banks. Containment of spills in these bayous would be relatively easy. Oil reaching the Intracoastal Waterway may also be contained because of the extensive bank levees. Oil entering marsh or swamp forest would tend to spread slowly but access for containment and recovery may be very difficult.

Quantities of oil and brine expected to be released from the early storage and Weeks Island expansion facilities are listed by source and location in Tables C.2-3, C.2-4 and C.2-9. Total oil spillage from pipelines and at the storage site for five fill/withdrawal cycles is projected to be 849 barrels for the early storage facilities and an additional 541 barrels for the Weeks Island expansion facilities. The distribution of spills is projected to include 823 barrels at the storage sites and 567 barrels from the connecting pipelines. The maximum credible spill events are estimated to be 10,000 barrels from a pipeline rupture and 6000 barrels from the storage site.

Oil is expected to be left in distribution pipelines during standby storage; spill risk exposure is the same as during pumping. Therefore, there is no additional pipeline spill risk exposure between Weeks Island and the terminal as a result of expansion of Weeks Island facilities. Spills from this pipeline are considered in the Supplement to the Weeks Island Mine EIS (DOE, 1977).

Brine spills could occur from the pipeling system at Weeks Island and south along the disposal pipeline to the Gulf. Total spillage is estimated to be 86 barrels from Weeks Island (onshore), and 49 barrels from Bayou Choctaw (Weeks Island early storage facilities do not use brine to displace oil from storage) (Table C.2-9). The maximum credible (onshore) spill event is estimated to be 30,000 barrels.

As indicated in Section C.2.2.1.2, offshore pipeline spill frequencies for the Weeks Island expansion would be 6 to 7 times as great as onshore because of the greater pipeline length. Also, the maximum credible spill would be in excess of 100,000 barrels, since spills could be shut off and would flow out of the line by gravity.

A description of weathering processes which occur to oil released into the environment is provided in Section C.4.3.2.2. Evaporation, dissolution, emulsification, sedimentation, biological degradation, and chemical oxidation all tend to change the physical and chemical form of crude oil.

The broad geographical distribution of possible spill sites creates a wide range of oil spill situations. Many of these may be mitigated by oil spill response efforts (example in the Mississippi River, or Gulf of Mexico). Spills occurring in swamp sorests or marshland would be difficult to control, however.

Two potentially significant impacts of oil spills on water resources would be the potential for buildup of toxic fractions and depletion of oxygen levels in shallow, poorly flushed water bodies. The most likely locations of such impacts would be in swamp forests along the pipeline route to the terminal and in marshes located along the lower Mississippi River Delta (including the vicinity of Pass a Loutre and Delta Wildlife Refuges).

Oil spills reaching the Mississippi River or the open gulf should not have significant impacts on water quality because of the potential for dilution and for oil recovery. Oil which sinks to the bottom or is deposited on the riverbank or shoreline may provide a local source of petroleum hydrocarbons to the water column for several weeks or even months, however.

Oil spills occurring anywhere outside diked areas could affect human use of water (industrial, domestic or recreational).

The Chicot and Plaquemine aquifer are overlain by about 100 feet of clay and silt in the vicinity of Weeks Island. Oil spilled from the pipeline should not reach potable ground water supplies, except possibly some perched water table aquifers at Weeks Island.

Should a subsurface spill occur, either from a defective well casing or collapse of a storage cavity, then oil would tend to collect at the water table and migrate laterally along the water surface. Crude oil tends to migrate very slowly through subsurface formations, and then only under pressure. However, some components of the oil, particularly the lighter aromatic hydrocarbons might be sufficiently soluble to impart an objectionable taste and odor to the water. There is very little ground water use in the vicinity of Weeks Island, however.

Spills of brine or saline water have less potential for adverse effects on water quality than do oil spills because of the limited on-shore spill volume potential. Except for a very large brine spill, normal flushing of local water bodies (i.e., ICW, Warehouse Bayou) would quickly dilute salt concentrations to normal levels, resulting in very temporary water quality degradation. Flushing is not as effective in shallow water bodies or in the swamp forest, however; salinity excesses would continue for several days or weeks and may remain in the substrate.

The potential exists for relatively frequent and possibly large crude oil spills from the Capline Group of SPR sites. Calculations of spill probability and the nature of local water bodies indicates that significant impacts on local water resources should be very infrequent.

Hazards Due to Flooding

Most surface facilities at Weeks Island would not be subject to flooding caused by hurricanes or tropical storms. Surface elevations over the dome vary from +5 feet MSL to 170 feet MSL. Data supplied by the U.S. Army Corps of Engineers indicates that the 100-year flood level at Weeks Island (including wave runup) is +20 feet MSL. Excluding wave runup (i.e., vicinity of wellheads) the flood level is +11.6 feet MSL.

Most SPR facilities on Weeks Island would be above the 100-year storm flood level. However, buried pipelines at the edge of the dome and to the south would be under water in such an event.

Storm floods greater than the 100-year event could occur and could damage some surface facilities. In the event of an oncoming storm, oil would be removed from surface tanks, thus eliminating the largest spill potential. If surface piping is ruptured, a few barrels of oil could escape but would be retained within the storage area. Damage to wellhead piping could result in the loss of a few barrels from the cavern. Brine from the settling pond would be quickly diluted by flood waters. As only limited quantities of oil could be released in the event of a damaging storm flood, environmental effects due to the flood waters and winds are expected to be much greater than due to loss of oil or brine.

Alternative Facilities

Operation of a brine injection system on Cypremort ridge would have approximately 20 percent of the potential for brine spill occurrence as the offshore pipeline. Also, average spill sizes are expected to be smaller (perhaps 50 percent) because the system is under pressure and can be easily monitored and shut down. Discharge of up to 240,000 B/D to brine injection wells should not affect the injection sands. Disposal of the brine through an offshore diffuser pipeline 47.6 miles long would have operational impacts similar to the proposed system. Offshore pipeline spill frequencies for the alternative brine diffuser pipeline would be 8 to 9 times as great as onshore because fo the greater pipeline length.

Use of the Gulf of Mexico for a raw water supply system for oil displacement would have impacts on water supply similar to those described for leaching (Section C.5.2.1.1). Water withdrawal rates would be 50 percent higher for oil displacement, however (1,000,000 B/D).

C.5.2.2.3 Air Quality

The largest potential effects on air quality associated with the operation of the proposed oil distribution system would result from hydrocarbon emissions during fill and withdrawal cycles. Data presented in Section B.2.3.3.2 indicate that non-methane hydrocarbon concentrations in the area frequently exceed the national and state standard of 160 $\mu g/m^3$ (3-hour average, 69 a.m.). Hydrogen sulfide losses are expected to be minimal since most of the crude oil that is expected to be stored in the Capline system would have weathered sufficiently during overseas transit to essentially eliminate the H_2S component.

Generally, the air quality impacts during operation for site expansion at Weeks Island would be similar to those described for Napoleonville (Section C.4.3.2.3). The total hydrocarbon emissions at the Weeks Island dome storage site over the life of the project are estimated to be 228 tons from the brine pond and 35 tons from the small oil surge tank on-site. These emissions should have no significant impact n air quality near the dome. Operational impacts associated with develcpment of early storage capacity at Bayou Choctaw and Weeks Island are given in FES 76-5 and 76/77-80.

C.5.2.2.4 Noise

Operation Sound Sources

Principal sound sources during the operation of the storage facility would be material handling equipment such as pumps for filling and emptying the storage facility. These electric motor driven pumps would be mounted in a pump house with corrugated steel sides and roof.

Operation sound levels from the facilities described above are estimated from measurements at a similar facility in New York State. The facility is a liquified propane gas storage plant with similar material handling and processing equipment. The major differences are that the pumps are located outdoors and dehydrators and trucks are used at the New York State facility.

From these measurements, it is estimated that unenclosed pumps at Weeks Island would produce sound levels of 75dB(A) at 50 feet. Typical wall attenuation for a corrugated steel building is 20-25dB. Therefore, the equivalent sound level contribution for the proposed facility at Weeks Island to the ambient sound level is estimated to be 30-35 dB at 500 feet. This contribution is negligible compared to existing ambient sound levels of 53dB.

Fill Cycles

No significant noise impact is expected for this activity.

Withdrawal Cycle

No significant impact is foreseen.

Gas Turbines

The power requirements of the facility would be supplied by commercial power through an onsite electrical substation. There would be no noticeable noise contribution associated with the substation.

Alternatives

None of the alternative systems proposed for the Weeks Island storage site would contribute significant sound levels at nearby noise-sensitive areas.

C.5.2.2.5 Species and Ecosystems

Operational impacts of the proposed SPR facilities on biological resources in the area are principally related to brine discharge and the potential for oil or brine spills. Also, raw water must be withdrawn from the ICW to displace oil from the caverns and brine must be discharged to the Gulf of Mexico during oil filling. Normal surface activities at the 100-acre storage site would exclude wildlife from the immediate project vicinity as well as 43 acres offsite for pipeline maintenance. This is an expansion of the existing industrial use of the project lands but is not a new or significantly adverse impact.

Surface Operations

Operations of the storage facilities at Weeks Island should have little additional effect on the ecological aspects of the site. Minor adverse impacts such as weed control, periodic brush removal, increased noise and air quality changes should have little impact on the plants and wildlife. Human activity associated with fill, withdrawal, and standby operations would result in increased site activity but these activities would have only minor effects on area wildlife. The greatest impacts from normal operations and standby activities at the Weeks Island site would be from possible oil spills (considered in a succeeding subsection).

Approximately 40.8 miles of offsite pipeline and 6.6 miles onsite (oil, water, and brine) right-of-way must be maintained clear of woody vegetation to allow immediate access in case of system malfunction. Normally, up to a 50-foot wide right-of-way is required; however, as the brine disposal line and onsite pipelines are to be installed in common ROWs very little additional maintenance right-of-way acreages for the proposed (and alternative) facilities is given in Tables A.5-1 and A.5-2.

The most significant adverse impact associated with ROW maintenance is the long term loss of vegetation productivity and wildlife habitat in the marsh, swamp, and bottomland forest. Though grasses, shrubs and shallow water may provide some utility for forage and nesting, there is expected to be a net loss in wildlife carrying capacity. On cleared lands normal agricultural practices can be continued so that no additional biological impacts are expected.

During the operational phase of the proposed pipeline, right-of-way maintenance would cause a disruption in the soil and vegetation brought on by vehicular movement and chemical spraying for weed control. Spraying and mowing operations could increase the fire hazard potential unless proper procedures are utilized. The overall impact of pipeline maintenance can be minimized if care is taken to ensure that minimum vehicular movement in the right-of-way occurs, and * weed control spraying is selective, localized, and performed only with biodegradable herbicides having short half-lives and minimum toxicity to animals and man.

Noise from operation may have an adverse effect upon wildlife, however, very limited noise increases would be associated with the brine disposal system.

Maintenance of the pipeline and the elimination of cover may have adverse effects on some wildlife species. Continued clearing of brush would prevent small rodents and other wildlife from becoming established on the pipeline corridor. The brush clearing would maintain the "edge" effect and would encourage new growth of established plant species, thus providing a continued food source for herbivorous wildlife.

Human intrusion during operation and maintenance of the pipeline would have minimal short-term effects on wildlife. These brief periods of human activity along the pipeline may cause wildlife to leave the immediate area, but only for a short period of time (in most instances, a matter of hours).

Brine Disposal

Impacts of brine disposal on marine organisms during operation would be similar to those during construction (Secton C.5.2.1.5) although disposal during operation would occur at lower rates over shorter periods of time. The predicted area of major impact would be within 40 acres surrounding the diffuser. Additional impacts during operation resulting from elevated hydrocarbon concentrations in the brine (6 ppm) could cause depression of growth and photosynthesis in phytoplankton and decreased feeding and metabolic activity in zooplankton and nekton. Decreased growth, delayed hatching, and abnormal behavior and development may occur in fish and macroinvertebrate eggs and larvae. Incorporation of petroleum hydrocarbons may result in tainting of edible species. These effects would probably only be seen within a small area around the diffuser.

Raw Water Supply

The predominant impact on vegetation and wildlife of normal operation of the raw water supply system would also result from the periodic maintenance required for the pipeline route and was included in the discussion at surface operations.

Impacts to the aquatic environment would be primarily related to entrainment and impingement of aquatic organisms. The impacts due to entrainment and impingement are discussed in Section C.5.2.1.5 with respect to leaching of the storage caverns. However, the magnitude of the impacts during operation would be 50 percent greater than during construction because the raw water requirements would be increased.

Oil Delivery System

The predominant impact on vegetation and wildlife of normal operation of the oil delivery system would result from periodic maintenance required for the pipeline route and would be the same as those disccused for the surface operations. As no new ROW would be required for Weeks Island expansion, no impact is attributable to this alternative.

In the event of a major pipeline oil spill extensive and significant impacts to the environment are probable. The extent of these impacts would be directly related to the magnitude, location and duration of the spill. Oil spill risk, size frequency, and a discussion of the rate of oil spillage are discussed in Section C.2; potential environmental effects on terrestrial and aquatic environments are addressed in a later subsection. The most sensitive areas with respect to oil spills for the oil delivery system are the marshes near Cote Blanche Island and the swamps in the Basin and west of St. James. As oil would be retained in the pipeline during early storage facility standby pipeline spill risks are not increased by expansion of Weeks Island capacity.

Accidental Oil or Brine Release

The potential for oil or brine spills during project operation is described in Appendix E; expected annual spill volumes by mode of operation and by geographical location are summarized in Section C.2, particularly Tables C.2-1 through C.2-9. In the event of an oil or brine spill, the expected movement from various spill locations, the weathering processes likely to occur, and the potential for water quality degradation are described in Sections C.4.3.2.2 and C.5.2.2.2. This section treats some of the biological effects which can occur as a result. A more complete treatment is given in Appendix D.

The information on frequency and volume of expected oil and brine spills for Weeks Island expansion and early storage development of Weeks Island and Bayou Choctaw are summarized in Section C.6.2.2.2.

Brine spills could occur from the piping system at Weeks Island and south along the disposal pipeline to the Gulf. Total spillage is estimated to be 86 barrels from Weeks Island expansion and 49 barrels from Bayou Choctaw (Weeks Island early storage facilities do not use brine to displace oil from storage) (Table C.2-9). The maximum credible spill event is estimated to be 30,000 barrels of brine (excluding possible release of up to 100,000 barrels of brine due to possible breaching of the brine reservoir).

Frequencies of spills are also given in the summary tables. Except for transfer spills, all modes of spills are expected to be fairly infrequent. For brine spills, there is a 97.6 percent chance of having no spills during the project lifetime for Weeks Island expansion.

Because of the design safeguards provided in the storage system and the relatively infrequent spill expectation, the potential biological impact from small, chronic oil spills at the Weeks Island storage site is expected to be small. The wellheads at Weeks Island would be diked to contain minor spills.

Descriptions of typical oil spill impacts to biota are provided in Section C.4.3.2.5. Additional oil spill exposures resulting from expansion of storage capacity at Weeks Island include bottomland hardwood forests near the wellheads and marsh east of the dome. No additional exposure occurs along the pipeline route. Additional brine spill exposures include shallow land on Weeks Island and marsh, agricultural land, and shallow bay waters south of Weeks Island.

The impacts to biota due to normal operations of the Weeks Island storage site are expected to be rather small. Even in the case of occasional small oil spills, impacts are not expected to be widespread or serious. However, depending on the specific conditions, including location, season, volume, and spill control effectiveness, a large oil spill may have a serious impact on the biota in the local environment. Furthermore, cumulative spill effects due to development of the full 274 MMB Capline Group capacity may be locally significant, especially at inshore transfer sites.

A pipeline spill would likely have the most intensive, localized biological impact. The recurrence interval of an oil spill greater than 1000 gallons, even with oil left in the line during standby storage, is 47 years so that it is likely that no large spills would occur during the lifetime of the SPR project.

The small spills accompanying oil transfer operations constitute the vast majority of all spills expected from the SPR program. With appropriate deployment of booms and other oil recovery equipment, effects should be very localized.

Several scenarios were described in Section C.4.3.2.5 to evaluate potential effects of maximum credible spills for various oil spill modes. These scenarios apply to spill exposures caused by expansion of the Weeks Island site.

In summary, it may be concluded that the very low frequency of oil and brine spills indicates that chronic biological impacts should generally not be experienced. Very large spills are fairly improbable and represent a small likelihood of regionally significant adverse impact, but the impact potential is fairly large depending on spill location. Except for the case of a large spill in the gulf or lower Mississippi River being transported to near shore waters and coastal bays prior to recovery, adverse impacts should not be of regional significance.

Alternatives

Construction of a pipeline for deep well brine injection would have little effect on the potential for brine spills. Development of the alternative offshore diffuser site would result in impacts similar to those described for the proposed site.

C.5.2.2.6 Natural and Scenic Resources

Normal operation of the Weeks Island site and associated facilities is not anticipated to bring additional impacts on scenic, recreational, or natural resources. In some cases the impacts would be reduced during this stage as some areas at the storage site and along the pipelines would be allowed to revegetate.

The potential exists for oil spills in the process of transporting oil to and from storage. Spills from the oil pipeline between the terminal and Weeks Island could degrade the scenic and recreational potential of sections of swamp forest or waterways crossed by the right-of-way.

Brine spills could degrade scenic and natural resources along the five-mile brine disposal pipeline leading from Weeks Island to West Cote Blanche Bay.

C.5.2.2.7 Archaeological, Historical, and Cultural Resources

Following construction none of the operational characteristics of any of the facilities are expected to negatively impact any of these resources.

C.5.2.2.8 Socioeconomic Environment

Land Use There would be no additional impacts on land use during operation. The land at the site would already have been coverted to developed use during construction. Some of the land disturbed during construction would be allowed to revegetate.

Transportation Less traffic related to the project would be generated during operation than during construction. A considerably smaller crew (25 to 65 employees) would be necessary to carry out fill and storage activities; their movements would not be significant in comparison to current traffic volumes on county roads. The total traffic volume on these roads is expected to remain far below capacity.

Population The operation of the storage site would have some effect on population in the surrounding area. The project would have a total of 60 employees on-site in three shifts during fill and withdrawal operations. During standby operations, only about 25 employees would work at the site. Most of these workers may come from the existing labor pool in the parishes surrounding the site. Even if all the employees were to migrate to the area with their families, the impact on the local population would not be significant; however, lack of housing is likely to spread any immigration over several towns in the area.

Housing Project operation would have a minimal impact on housing. Many of the workers employed are expected to come from nearby communities within commuting distance.

Economy The operation of the SPR project would have a positive effect on the economy of the region. Supplies for some operations may be purchases from existing petrochemical and service industries. In some local areas such as Jeanerette, a minor beneficial effect would result from the increased purchases by employees. Maintenance and operation of the project would require a small work force relative to construction. Most of the workers are expected to come from the local labor pool, although some may relocate in the area for the duration of filling (approximately two years).

During standby operations, only about 25 employees would work at the site. This would decrease the employment opportunities available at the site compared to construction or fill/withdrawal operations.

Employment income from the project would average $114,000 per month during the filling and withdrawal phase. Much of this income would remain in Iberia, Lafayette and St. Mary Parishes for the two years of filling.

During standby operations, income would average approximately $43,750 a month for the 25 employees. This income is not expected to be sufficient to stimulate the local economy due to the wide area over which the employees would spend the wages.

Purchases in the region during operations could provide a small economic stimulus. To the extent these purchases are made in Iberia Parish, they would provide a minor stimulant to the local economy.

Urban Services The operation phase of the SPR project would have an impact on police and fire services similar to that of the construction phase. Except in case of a major accident, no use of such services is anticipated. Fire fighting equipment would be available on-site.

No adverse impacts on health services are expected during normal operations. Large scale accidents might extend available services in the area, however.

The small number of workers and their families with children that may relocate in the area would have no significant impact on schools.

Operation of the storage facility would continue the loss of tax revenues begun during construction.

Oil Distribution, Raw Water Supply, and Brine Disposal Systems

Land Use The operation of the oil, water, and brine systems would have no additional impact on land use. In some areas natural vegetation or crops may be allowed to be reestablished. Large trees would not be allowed within the system maintenance right-of-way, however (Table A.5-1).

Transportation During normal operations the oil, water and brine systems would not affect any transportation systems in the region. In case of pipeline breaks, leaks, or other unexpected accidents, some temporary effects on transportation could occur; but these would be so temporary, they should be considered insignificant.

Population Operational impacts of the oil, water, and brine systems is anticipated to be negligible. The few workers required for maintenance are expected to come from the local labor pool.

Housing Because no significant change in population size or location is expected, housing is unlikely to be impacted.

Economy Operation of the pipeline systems would have an insignificant effect on the local or regional economy. The few workers required would generate slight additional income for the economy, but this would be minor compared to current economic activity.

Urban Services Except in the case of a pipeline accident, no urban services would be required by the pipeline facilities. If an accident occurred, some use of local hospitals could be necessary.

Alternatives

No significantly different type or degree of socioeconomic impact is expected to result from operational use of alternative facilities.

C.5.3 Impact Due to Termination and Abandonment

No specific plan for termination and abandonment of the Weeks Island oil storage site has been established. However, the DOE will be required to develop such a plan near the termination of the action. To date, no specific experience with the abandonment of an oil storage cavern facility has been developed in the United States. However, various feasible plans are available. Environmental hazards that must be considered include surface subsidence and release of residual oils squeezed from the workings by possible long-term plastic closure.

At present, it is intended to put the facility to some beneficial use, rather than abandon it. Beneficial uses might include disposal of wastes, such as dredge spoil, slurried fly ash, radioactive waste, or other polluted or toxic materials. Another possibility is to develop a compressed air storage facility for peak power use. The final selection of an abandonment plan will likely depend on the economic and environmental trade-offs and regulations that are in effect at the time of termination.

Use of the facility in the manner described above would assure continued surveillance of the cavern. The inherent integrity of the cavern would prevent any leakage of material into the environment.

Certain activities associated with the specific use, such as waste transport, would impose some potential for environmental damage resulting from traffic, spillage and noise.

Should no beneficial use be found for the facility, the wells could be sealed and the caverns left filled with brine. No adverse environmental effects are likely to result from such action.

C.5.4 The Relationship of the Proposed Actions to Land-Use Plans, Policies and the Controls for the Affected Areas

There are presently no official plans, policies, or controls established by Federal, state, or local government agencies in Iberia Parish. Furthermore, lands under consideration for use in developing the Strategic Petroleum Reserve Facility at Weeks Island are presently devoted or adjacent, to industrial uses.

Although a Coastal Zone Management Plan is in preparation in Louisiana, there is no apparent project conflict with the basic concepts established by the Louisiana Advisory Commission on Coastal and Marine Resources (1973), which are expected to be an important part of the ultimate plan. Thus, development would occur at a previously established industrial site and oil transportation would follow established corridors. It is not anticipated that any land use policies or plans would be in conflict with the proposed Weeks Island Strategic Petroleum Reserve Facility.

C.5.5 Summary of Adverse and Beneficial Impacts

Development of the Weeks Island salt dome as an oil storage facility is not likely to generate significant regional environmental impacts except for the possibility of a major oil spill and the uncontrolled release of hydrocarbon vapors during oil transportation.

Table C.5-4 provides a summary tabulation of the findings of the various discipline analyses of impacts of project construction. Impacts of project operation are summarized in Table C.5-5. The data are in both qualitative and quantitative form, as appropriate.

TABLE C.5-4 Summary of environmental impacts caused by development of Weeks Island SPR facilities.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT: PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT: ALTERNATIVE PHYSICAL FACILITY
Geology and Land Features	Weeks Island dome and immediate vicinity	Site Preparation 35,000 cy of excavation and 137,000 cy of fill for on-site, pipelines, access roads, and other surface facilities. Direct impacts on 32 acres. Cavern Leaching Up to 12×10^6 cy of salt removed from the dome by leaching.	
	Terminal Facilities	Site Preparation (see Table C.3-2)	
	Pipeline Corridors - between Weeks Island and:		
	Intracoastal Waterway	Raw Water Supply 5000 cy of excavation (mostly temporary) and clearing of vegetation from 9 acres in pipeline ROW.	
	Gulf of Mexico	Brine Disposal 587,300 cy of excavation (mostly temporary) and clearing of 59 acres of vegetation in pipeline ROW onshore; disturbance to 788 acres offshore.	Brine Disposal 820,800 cy of excavation (mostly temporary) and clearing of 54 acres of vegetation in pipeline raw onshore Raw Water Supply 98,500 cy of excavation (mostly temporary) and clearing of vegetation from 17 acres in pipeline ROW.
	Brine Disposal Wells		Brine Disposal 151,000 cy of excavation (mostly temporary) and clearing of 125 acres of vegetation in pipeline ROW. Pressurizaiton of brine disposal aquifers.
	Terminal Facility		Terminal Facility (see Table C.3-2)
Water Resources	Plantation Lake, Warehouse Bayou, ICW, and wetlands adjacent to the storage site and along pipeline ROW.	Site Preparation Potentially large volumes of sediment and construction pollutants carried into water bodies by rainfall runoff. Oil and Brine Spills Very small possibility of some release reaching water bodies; maximum credible brine spill could have significant impact.	
	Intracoastal Waterway	Raw Water Supply Withdrawal of 650,000 BPD for cavern leaching would not significantly affect water quality or quantity.	
	Mississippi River	Terminal Construction (see Table C.3-2)	

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT PROPOSED PHYSICAL FACILITY	ALTERNATIVE PHYSICAL FACILITY
	Gulf of Mexico	Brine Disposal Disposal of 650,000 BPD of brine in Gulf could raise salinity by 5 ppt in immediate vicinity of diffuser, and by 1 ppt over as much as 2200 acres and could alter surface water quality. Pipeline construction would create locally significant levels of turbidity and possibly reduced oxygen levels. Resuspension of pollutants from sediments.	Brine Disposal Disposal of 650,000 BPD of brine in Gulf could raise salinity by 5 ppt in immediate vicinity of diffuser, and by 1 ppt over as much as 2200 acres and could alter surface water quality. Pipeline construction would create locally significant levels of turbidity and possibly reduced oxygen levels. Resuspension of pollutants from sediments.
			Raw Water Supply Withdrawal from Gulf (West Cote Blanche Bay) should have no significant effect on water quality.
	Subsurface Aquifers		Brine Disposal Pressurization of deep disposal aquifers could possibly displace saline water to potable aquifer directly or by migration up old wells.
Air Quality	All construction sites	Site Preparation Minor quantities of particulates, SO_2, CO, HC, and NO_2, released from construction equipment; minimal effect.	
	Weeks Island Dome	Site Preparation and Painting Short term HC concentrations of up to 104 $\mu g/m^3$ at 1 km downwind during painting of tanks; possible exceedance of ambient air quality standards due to high background levels during 3 day period at Weeks Island.	
			Brine Disposal Development of a well field for brine disposal may decrease emission at Weeks Island (except HC from painting) by 50 percent. Construction of raw water supply lines in the Gulf of Mexico would increase the direction and location of construction emission but not the degree of impact.
	Terminal Facilities	Site Preparation and Painting (see Table C.3-2)	
Noise Level	Storage Site	Site Preparation and Cavern Well Drilling Maximum radius of noise impact (3 dB increase over ambient), 4500 feet; no residences affected.	
	Pipeline Routes	Pipeline Construction Maximum zone of noise impact, 1800 feet; 19 structures may be affected.	
			Raw Water Supply Construction would affect noise-sensitive areas on Cypremort levee for less than 1 week.

TABLE C.5-4 continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT PROPOSED PHYSICAL FACILITY	ALTERNATIVE PHYSICAL FACILITY
			Brine Disposal Brine disposal well field construction would affect noise levels for several residences in Cypremort levee.
	Terminal Facilities	Site Preparation (see Table C.3-2)	
Species and Ecosystems	Terrestrial		
	Agricultural Land	Site Preparation and Pipelines Temporary loss of 63 acres due to facility construction. Minimal impact importance.	
			Brine Disposal Loss of 125 acres (mostly agricultural land) due to brine injection well field.
		Terminal Construction (see Table C.3-2)	
	Bottomland and Swamp Forest	Site Preparation and Pipelines Loss of 22 acres due to facility construction. Revegetation of 8 acres likely. Minimal impact importance.	
		Brine Spills Large brine spill could destroy several acres near Weeks Island dome.	
			Raw Water Supply Loss of 3 acres of swamp forest due to use of Gulf of Mexico as water source.
		Brine Disposal Loss of acres due to construction of brine disposal pipeline to Gulf	Brine Disposal Same as proposed.
	Aquatic		
	Plantation Lake, ICW, and local water bodies near construction sites	Site Preparation Minimal local impacts due to erosion and runoff.	
		Brine Spills Major brine spill remotely possible; significant loss of biota would follow.	
	Intracoastal Waterway	Raw Water Supply Destruction of phytoplankton and zooplankton during the 3-year leaching period. Impact on regional biotic resources considered insignificant.	
	Gulf of Mexico	Brine Disposal Temporary loss of 778 acres due to pipeline installation. Brine effluent could affect benthos community structures over several hundred acres. Should not be significant to plankton and nekton except possibly adjacent to brine diffuser. Dredging could destroy benthic habitats and reduce productivity.	Brine Disposal Same as proposed.
		Terminals (see Table C.3-2)	

TABLE C.5-4 continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT: PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT: ALTERNATIVE PHYSICAL FACILITY
Natural and Scenic Resources	All Pipeline Construction	ROW Clearing Locally significant impact due to clearing of forest land on Weeks Island and along pipeline right-of-way, especially through coastal marsh.	
Socioeconomic Conditions	Cultural Resources	All Sites Possible loss or disruption of significant cultural resources.	
	Land Use	All Sites Alteration of land use on total of 100 acres in Iberia, St. Mary and St. James Parishes.	
	Transportation	All Sites Potential for locally significant traffic increase at shift changes; overall, congestion should not be significant.	
	Economy	Total Construction Wages $8.2 million, much of which would be spent outside the local area.	Marine Terminal Significant increase in employment, both locally and regionally.
	Government	Taxes Minor loss of property tax revenues.	

TABLE C.5-5 Summary of environmental impacts caused by operation of Weeks Island SPR facilities.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT: PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT: ALTERNATIVE PHYSICAL FACILITY
Geology and Land Features	Land Surface	Cavern Collapse Remote possibility of roof collapse causing surface subsidence and formation of a lake onsite.	
Water Resources	Plantation Lake, Warehouse Bayou and small water bodies near Weeks Island dome.	Oil and Brine Spills Impacts from expected oil and brine spills negligible. Possible very large spill could seriously degrade water quality for several weeks or months.	
	Intracoastal Waterway	Raw Water Supply Withdrawal of up to 1,000,000 BPD for oil displacement over 180-day period expected to have no measureable effect on water quality or quantity. Oil Spills Could have significant local impacts.	
	Mississippi River	Terminal Facilities (see Table C.3-3)	Oil Spills Could have significant local impacts.
	Gulf of Mexico	Brine Disposal Local alteration in salinity and water quality near brine diffuser.	Brine Disposal Same as proposed.
	Ground Water	Brine Disposal Brine injection should have no adverse impact. Oil and Brine Spills Very slight chance of local ground water pollution due to surface or brine oil spill; collapse of cavity roof could seriously degrade ground water supplies for Weeks Island area but such an occurrence is highly unlikely.	
Air Quality	Oil Handling and Storage	Total Emissions Emissions from 274 MMB oil storage facility for 5 fill and withdrawal cycles equal approximately 54,700 tons, 32 percent due to expansion, 263 tons at Weeks Island. Terminal Facilities (see Table C.3-3)	Onsite Power Generation Would cause significant HC emissions at Weeks Island.
Noise		Storage Site Operation No significant increase in ambient sound levels on or adjacent to the site with either proposed or alternative facilities.	

TABLE C.5-5 continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT PROPOSED PHYSICAL FACILITY	ALTERNATIVE PHYSICAL FACILITY
Species and Ecosystems	Terrestrial		
	Agricultural Land	Oil and Brine Spills Possible oil or brine spills would have local, short-term adverse effect on agricultural productivity.	
			Brine Disposal Brine injection in wells would add 45 acres of pipeline ROW maintenance.
			Raw Water Supply Use of Gulf of Mexico would slightly increase pipeline ROW maintenance.
		Terminal Facilities (see Table C.3-3)	
	Bottom Land, Swamp Forest and Marsh	Brine Spills Possible brine spill from pipelines could have locally significant adverse impacts. No additional oil spill exposure off dome.	
		Storage Site Maintenance Clearing Continued maintenance of 7 acres would reduce available habitat in region by an insignificant amount.	
			Raw Water Supply Use of Gulf of Mexico for water supply would slightly increase pipeline ROW maintenance.
	Aquatic		
	Plantation Lake, Warehouse Bayou and local water bodies near Weeks Island dome	Oil and Brine Spills Possibility of major spill of brine or oil from pipeline considered remote. Would cause locally significant impacts on aquatic life.	
			Raw Water Supply Withdrawal of water from Grand Bayou could significantly reduce habitat and standing crop of plankton and other small organisms.
	Intracoastal Waterway	Raw Water Supply No measureable impact on aquatic life due to water withdrawal.	
	Mississippi River	Oil Spills Potential oil spill impacts could be locally significant, especially at dock site and in lower delta.	
	Gulf of Mexico	Oil Spills Expected oil spill volumes could significantly affect marine biota. Estimated total 4,306 barrels of oil from all SPR operations in the Gulf during project lifetime. Possible very large or maximum credible oil spill could have significant impacts to several thousand acres of shallow water or marsh if spill reaches shore before cleanup.	

TABLE C.5-5 continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT ALTERNATIVE PHYSICAL FACILITY
		Brine Disposal Brine could destroy benthic habitats and reduce productivity. Small impact on nekton and plankton. Possible alteration of migration routes.	Brine Disposal Same as proposed.
			Raw Water Supply Use of Gulf of Mexico for water supply should have little regional effect on standing crop of plankton and other small organisms.
Natural and Scenic Resources		Oil Soills Adverse impacts associated with possible large oil spill which could foul swamp forest and marshes and contaminate water with oil.	
		Operation and Maintenance Pipeline ROW maintenance would have some adverse aesthetic impacts.	
			Onsite Power Generation Would add a highly visible emissions stack to Weeks Island.
Socioeconomic Environment	Economy	Storage Site Employment Total wages expected to be approximately $113,000 during each month of oil fill and withdrawal; $44,000 during standby.	

C.6 ALTERNATIVE GROUPING NO. 2 - EARLY STORAGE SITES PLUS EXPANSION OF BAYOU CHOCTAW PLUS DEVELOPMENT OF IBERIA

C.6.1 Introduction

The following sections detail the expected and potential environmental impacts associated with the development of this alternative for the Capline Group. Sections C.6.1.1 and C.6.1.2 very briefly summarize the types of impacts associated with development and use of the Bayou and Weeks Island early storage sites, which are treated in detail in previously published EIS's. Section C.6.1.3 and C.6.1.4 briefly describe the activities related to the expansion of Bayou Choctaw and development of Iberia as storage sites. Sections C.6.2 and C.6.3 consider impacts associated specifically with the expansion of Bayou Choctaw and development of Iberia, respectively. These sections also describe significant cumulative impacts associated with full development of the Capline Group.

C.6.1.1 Bayou Choctaw Dome Early Storage Site

Environmental impacts related to the development of Bayou Choctaw dome as an early storage site having a capacity of up to 94 MMB are discussed in FES 76-5 (Section 3.0) and its supplements. Construction impacts include those associated with the following activities:

- onsite grading and construction of surface facilities;
- construction of a 39 mile pipeline to the Mississippi River near St. James;
- construction of a tanker dock, 4-200,000 barrel oil storage tanks, and associated terminal facilities at St. James.

Significant operational impacts would include:

- Possible oil and brine spills;
- Withdrawal of surface water for oil displacement;
- Disposal of brine during oil fill;
- Hydrocarbon emissions during oil transport handling;
- Maintenance clearing on project lands.

C.6.1.2 Weeks Island Dome Early Storage Site

Development of Weeks Island dome as an early storage site having a capacity of 89 MMB will have anticipated environmental impacts as detailed in Section 4.0 of FES 76/77-8 and its supplements. Construction of proposed facilities would have impacts associated with the following activities:

- o temporary shutdown of Morton Salt Mine and loss of employment for local workers;
- o onsite grading and construction of surface facilities;
- o construction of a 64.4-mile pipeline to the Mississippi River near St. James;
- o construction of a tanker dock, 4-200,000 barrel oil storage tanks, and associated terminal facilities at St. James.

Significant operational impacts would include:

- o possible oil spills;
- o hydrocarbon emissions during oil transport and handling;
- o maintenance clearing on project lands.

C.6.1.3 Bayou Choctaw Expansion

Expansion of Bayou Choctaw to a maximum 150 MMB storage facility would result in some additional impacts similar to those that are described for the early storage facilities in FES 76-5 and its supplements. Expansion of the Bayou Choctaw site for SPR storage would require the following new facilities: six leached storage cavities bringing the total site capacity to approximately 150 MMB; a raw water pipeline to the Mississippi River and construction of an intake structure on the River; 13 deep disposal wells; and access roads to the new cavities and new brine disposal wells. Additional raw water and brine injection pumps would also be required but would not involve any new areas to be disturbed. The crude oil would be distributed through the early storage phase pipeline from Bayou Choctaw (Figure A.6-1).

Section C.6.2 considers the impacts associated with construction and operation of these new facilities for expansion of Bayou Choctaw and the expanded use of early storage phase facilities at Bayou Choctaw. Particular attention is given to analysis of cumulative oil spill and air quality impacts which would be caused by the full 289 MMB Group development.

System alternatives for Bayou Choctaw expansion include: construction of a 119.9 mile brine disposal pipeline to a Gulf diffuser site; delivery of a portion of the brine to Allied Chemical Corporation; raw water taken from the Port Allen Canal, from the Gulf of Mexico, or from subsurface aquifers; and construction of an on-site power plant. Impacts of development and use of these alternatives are also considered in Section C.6.2.

C.6.1.4 Iberia Development

Development of Iberia dome to a 50 MMB storage facility would require construction of the following new facilities: six leached storage cavities to provide 50 MMB and bring the Group capacity to approximately 289 MMB (up to 150 MMB at Bayou Choctaw after expansion and 89 MMB at Weeks Island); a pump station/control house, a brine settling pond and 21 deep disposal wells; on-site oil, brine, and raw water pipelines and access roads, a raw water supply line from Bayou Teche; and an oil pipeline to the early storage phase pipeline at Weeks Island.

Section C.6.3 considers impacts associated with construction and operation of these new facilities at Iberia dome and with expanded use of the early storage development facilities at Weeks Island.

System alternatives at Iberia include: construction of a 52.2-mile brine disposal pipeline to a Gulf diffuser site: raw water taken from Lake Fausse Pointe, from the Gulf of Mexico, or from subsurface aquifers; and construction of on-site power plants. Impacts of development and use of these alternatives are also considered in Section C.6.3.

C.6.2 Impacts of Expansion of Bayou Choctaw

C.6.2.1 Impacts of Site Preparation and Construction

The following section describes construction impacts for the expanded storage site facilities at Bayou Choctaw and for related pipelines. Construction impacts of terminal facilities are described in Section C.3.

C.6.2.1.1 Land Features

Proposed Facilities

Quantities of material to be excavated or filled and acreages of land to be affected by grading and other construction activities for the Bayou

Choctaw expansion, along pipeline routes, and at the distribution terminal are listed in Table A.6-1.

Grading for the storage site expansion would be confined to about 27 fenced acres, of which only a small portion would occur in areas already disturbed. The new cavern wellheads, containment dikes, and cavern wellhead drill pads and other onsite construction would require 62,400 cubic yards (cy) of fill and 19,000 cy of excavation.

Offsite pipeline and wellhead pad construction would temporarily disturb 90 acres of land and require 99,000 cubic yards of earth excavation and 116,000 cy of fill. Before revegetation of disturbed areas is complete, some erosion of the soil may be expected.

Leaching of 6 additional cavities in the Bayou Choctaw salt dome would involve removal of about 50 MMB of salt by leaching for disposal in deep saline water bearing sands. This is equivalent to about 10×10^6 cy of salt. Sufficient wall thickness would be maintained between cavities to maintain cavern integrity (Appendix A).

Excavation impacts at the terminal sites are considered to be long term or permanent. Excavation along the pipeline routes, except where canals are necessary through the marsh, is primarily short term.

Alternative Facilities

Quantities of material to be excavated or filled and acreages of land to be affected by grading and other construction activities of alternative facilities at the Bayou Choctaw dome, along pipeline routes, and at the distribution terminals are listed in Table A.6-2. Obtaining water from Port Allen Canal (ICW) would reduce the amount of land and soil excavated. Use of the Gulf of Mexico for brine disposal or raw water supply would result in approximately 45 times as much excavation as the primary raw water supply system for the Mississippi River. Construction of a brine disposal system to the Gulf of Mexico diffuser would require 96.3-miles of pipeline onshore over which 133 acres of cleared land, 9 acres of bottomland forest, 232 acres of deciduous swamp, 298 acres of marsh, and 2 open water acres would be altered. Approximately 1,269,300 cy of soil would be displaced and the excavated material reused for backfill. Approximately 674 acres of land would finally be affected along the onshore pipeline ROW. Alteration of existing land features would only be temporarily affected providing recontrouing and revegetation is carried out. Construction of an on-site power plant would require about the same amount of grading as the purchase of commercial power.

C.6.2.1.2 Water Resources

Site preparation and construction of facilities at Bayou Choctaw may directly affect several water bodies, including: Bayou Bourbeaux, Bull Bay, Port Allen Canal/ICW, Bayou Choctaw; the on-site lake, the Mississippi River; and ground water aquifers. Potential impacts are treated according to specific aspects of facility development.

Construction of Storage Site Facilities

Construction at Bayou Choctaw would require 19,000 cy of excavation, 62,400 cy of fill and 27 acres of direct land disturbance (Table A.6-1).

Sediment represents the major nonpoint source of water pollution to most construction sites, especially on those which require extensive grading. Sediment includes solids and organic materials detached from the ground surface by erosion and carried into the drainage system principally by runoff. The introduction of sediment into various natural bodies of water and the associated turbidity and deposition of solids result in numerous adverse physical, chemical, and biological effects. Suspended sediment ultimately reduces the storage capacity of waterways, increases flooding hazards, fouls and destroys aquatic habitats, diminishes recreational and property values, and enhances the transport of other harmful pollutants such as human and animal sanitary wastes, pesticides, and petrochemicals.

The site preparation and construction activity at Bayou Choctaw would involve a significant amount of earth movement. Approximately 81,400 cubic yards of earth would be displaced during this process and approximately 27 acres of land would be disturbed. The land overlying the dome is primarily swamp forest with an elevation of from five to ten feet above sea level. Because of the high level of annual precipitation in the region, a significant amount of sediment may be transported from the disturbed surface areas into the surrounding surface water system. This sediment should pass initially into the swamps and canals on the dome.

Some of the sediments would move into Bayou Bourdeaux, the on-site lake or other canals that run through the site (Figure A.6-2). Most of the on-site construction would be on the southern portion of the site resulting in sediments reaching Port Allen Canal from some of the natural bayous. Standard engineering practices such as an interceptor ditches, dikes, and sedimentation ponds would be utilized where necessary to prevent any significant degradation of water quality due to plant site runoff.

Numerous solid and liquid products, both organic and inorganic, used in construction are a source of water pollution. The major sources of construction-related chemical pollution can be broadly grouped under the following headings:

- Petroleum products
- Herbicides and pesticides
- Fertilizers
- Metals
- Soil additives
- Construction chemicals
- Miscellaneous wastes

A description of the potential sources of these pollutants and how they may be introduced into the environment is included in Section C.4.3.1.2.

Prediction of the impacts of such chemical and biological contaminants is quite difficult because of the human element involved. Assuming that effective waste management procedures are observed and that personnel are properly indoctrinated, the impact on the water environment should be minimal.

Raw Water Supply System Construction

Effects on Water Source The proposed source of raw water for leaching the Bayou Choctaw expansion facilities during the mining cycle is the Mississippi River. Water would be obtained through a 5.4-mile pipeline terminating at an intake structure on the west bank of the river one mile southeast of Addis (Section A.6.2.4.1 and Figure A.6-3).

The water would be supplied from the Mississippi River. The average raw water supply rate during the mining cycle would be about 380,000 barrels per day (B/D), or approximately 30 cfs (maximum raw water withdrawal rate would be 710,000 B/D). In comparison, the average daily flow of the Mississippi River is on the order of 1,000,000 cfs, as discussed in Section B.2.2.1.2. Since the amount of water withdrawn would constitute a minor fraction of the Mississippi River flow, no significant impact on water supply would result.

Pipeline Construction Effects Construction of the proposed raw water supply system would include the installation of 5.4 miles of buried pipeline between the plant area and the intake structure on the Mississippi River (see Section A.6.2.4.1), using installation techniques as described in Section A.3.4. No major waterways would be crossed, though the headwater of Bayou Bourbeaux and other intermittent streams would cross the ROW. For the most part, this route is located on cropland or other developed land and would not impact much highly productive bottomland forest and deciduous swamp.

Water quality impacts of constructing pipelines can include changes in water-flow patterns, BOD, dissolved oxygen, pH, nutrients, heavy metal concentrations, salinity, and turbidity. The disturbance of bottom sediments has the potential of: (1) creating low oxygen conditions by exposing the BOD of sediments to dissolved oxygen in surface wates, (2) lowering the pH of waters by exposing sulfides to oxidation and creating sulphuric acid, (3) increasing heavy metal concentrations by exposing complexed metals to low pH conditions, (4) releasing trapped nutrients, thereby stimulating local eutrophication, and (5) creating highly turbid conditions from mixing of water with the sediments.

The amount of material released to interact with the air and water as a result of pipeline excavation depends upon (1) the excavation process, (2) the total amount of sediment excavated, (3) the amount of sediment excavated per unit time and distance, and (4) the physical-chemical characteristics of the sediment.

Construction of the raw water supply pipeline would involve the excavating of 29,000 cubic yards of material at the rate of about one-half mile or 3000 cubic yards per day. Based on the assumption that 50 percent of the excavated material is water (LSU, 1975) and that no more than 10 percent of the water in the sediments will drain into surrounding water in any short time period (less than one week), about 1 acre-foot of interstitial water could drain to surrounding lands. Depending on water depths and mixing conditions, the 54 acres of cleared land and shallow water could be affected by low pH, low dissolved oxygen and high nutrient concentrations. These effects should dissipate within a week of occurrence due to reaction of water and use of nutrients by biota.

In addition, construction of the proposed pipeline would continue the adverse trend of canalization. The overall incremental effect, even without restorative measures, would be minor, considering the small area disrupted by the proposed canal compared to the extent of existing canals. The flow of surface waters through canals produced during the construction phases of the pipelines will be impeded by bulkheads constructed where natural courses are crossed. This will minimize the impacts produced by canalization in the project region.

Impact of Brine Disposal System Construction

Effects on Receiving Aquifers The proposed method for the disposal of brine is by the addition of 13 disposal wells to inject brine in sands containing saline water. This can impact ground water supplies in various ways including increasing the salinity of the injection sands, displacing moderately saline water from one portion of the injection sands into fresh water portions of the same sands, or inducing migration of brine or moderately saline water from the injection sands into a fresh water aquifer via such avenues as abandoned wells or faults.

The proposed receiving formations for injection of brine at Bayou Choctaw range in depth from 5,000 feet to 7,000 feet, well below any aquifers containing fresh or slightly saline water. The increase in salinity, therefore, would be restricted to water that would not be economically competitive for desalination due to the large quantities of fresh and slightly saline water (1000 mg/l to 3000 mg/l) available in the region.

The likelihood of the occurrence of problems caused by abandoned wells is small because generally the only wells extending to the depth of the injection zone are oil wells whose locations are usually well documented.

In certain geologic provinces where the rock is under stress it may be possible to generate earthquakes or activate faults by high pressure injection of fluids. However, in southern Louisiana, the geologic formations are not in a state of stress and are relatively permeable; thus, they provide the path of least resistance to flow, in preference to flow along faults.

Standard operating procedures and routine monitoring of injection pressures should preclude hydrofracturing. In addition, the extremely dense brine would tend to move downdip in the receiving formation; the relatively slow movement would not induce mixing with the fluids already present in the formation.

It may thus be concluded that no adverse impact on water quality would occur from the use of deep well injection as the method of brine disposal. Additional site-specific studies would need to be conducted to confirm the technical feasibility of injecting brine in the proposed quantities, however.

Pipeline Construction Effects Construction of the proposed brine disposal injection well system would require installation of 3.9 miles of buried pipeline to expand the brine disposal field southeast of the dome (Figure A.6-2). Permanent roadways would be constructed to each wellhead; therefore, the 70,000 cubic yards of required excavation would be performed using conventional techniques. Releases of interstitial water resulting from construction could be 2.2 acre-feet. Only minor water bodies or other sediment transporting waterways would be crossed by the system. Minimal impact on water quality due to sediment release and drainage from spoil would be anticipated.

Impact of Oil Distribution System Pipeline Construction

No new pipeline construction would be required for crude oil distribution. The 36-inch diameter pipeline for the early storage phase would provide adequate capacity for expansion of Bayou Choctaw to 150 MMB.

Accidental Brine Release

The estimated quantity of brine spilled during leaching of the Bayou Choctaw expansion is about 20 barrels onto lands crossed by the pipelines leading to the disposal wells. Water quality impacts should be negligible. Maximum credible spills of up to 30,000 barrels are considered possible, though highly unlikely (see Appendix E). Such spills could have very serious effects on local water quality, vegetation, and wildlife.

A brine spill at the site or along the disposal pipeline would locally impact the water quality in the upper unit of the Plaquemine aquifer. The brine would tend to migrate downward within the formation and downdip along the formation due to density differences. A massive spill, although highly unlikely, could possibly impact the quality of municipal water supplies pumped from aquifers in the area by causing increased salinities in those aquifers. However, as the Plaquemine aquifer is contained by a 100-foot layer of clay and silt, potential spills from the membrane-lined brine pit or from the pipeline are likely to have negligible impact on water quality.

Storm studies conducted by the U.S. Army Corps of Engineers indicate that the 100-year flood elevation, at Bayou Choctaw is 8.1 feet MSL (Roy, personal communication). As the brine pond would be protected by a levee there is little likelihood of a catastrophic failure resulting in release of brine.

Construction of Alternative Facilities

Alternative systems to provide raw water for cavern leaching include use of ICW, withdrawal from the Gulf of Mexico, and pumping of moderately saline ground water. An alternative brine disposal method is disposal in the Gulf of Mexico through a diffuser.

Alternative Raw Water Source - ICW The ICW would be reached via a 1.0 mile pipeline to an intake structure west of the storage plant area (Figure A.6-2). Withdrawal of the required 42 cfs of water could be offset by additional flow from the Mississippi River through the Port Allen Locks but would probably require the installation of a major pumping station at the lock to assure a water supply. The decrease in stage of the ICW would be small. The ICW, Choctaw Bayou, Bayou Bourbeaux and other interconnecting waterways drains a substantial area of swamp and bottomland forest in Iberville and West Baton Rouge parishes. During low flow periods, withdrawal of 42 cfs would lower the water level in surrounding wetlands and could substantially reduce the flow of water to the south.

The pipeline connecting the intake structure to the plant would require about 5,300 cubic yards of material to be excavated with up to 0.16 acre-feet (54,000 gallons) of interstitial water being released to drain to surrounding waters. The area affected by the action is estimated to be about 8 acres.

Alternative Raw Water Source - Gulf of Mexico A pipeline to a raw water intake on the coast of the Gulf of Mexico could supply the raw water requirements of the Bayou Choctaw site with insignificant effects on the quantity or quality of water in the Gulf of Mexico. Pipeline construction effects would be more significant than for other alternatives. A 98.3-mile long pipeline including the 2 mile extension into the Gulf would be constructed using conventional, push-ditch and flotation canal methods. Installation could have an estimated total on-land excavation of about 1,301,000 cubic yards. Releases of interstitial water could total 41 acre-feet, affecting as much as 600 acres of nearby wetlands.

The pipeline would be installed adjacent to the oil pipeline right-of-way between Bayou Choctaw and St. James then follow Shell No. 258 pipeline to the coast. The intake would be located as near shore as possible and still minimize intake impacts.

Alternative Raw Water Source - Ground Water Ground water from aquifers in the site vicinity is an alternative source for leaching water. In the event constraints were placed on use of surface water it would be possible to install large capacity wells in the lower unit of the Plaquemine aquifer and pump the required quantities of moderately saline water (3,000 to 10,000 milligrams per liter dissolved solids) for leaching of the storage cavities and for displacement of oil from storage. Leaching operations would require water over a three year period at a rate of about 18,700 gpm.

Impacts that might result from withdrawal of such large quantities of water include lowering of the piezometric level in the pumped zone, land subsidence, and intrusion of the pumped zone by waters of different salinities. Land subsidence and salt water intrusion result directly from drawdown or reduction of the piezometric level in the aquifer. This in turn depends upon such factors as pumping rate, well spacing and completion, and aquifer thickness. With due consideration to well spacing and completion methods and given the great thickness and high permeability of sands containing moderately saline water in the site vicinity, it should be possible to provide the required quantities of water with less than 100 feet of drawdown in the vicinity of the well field. Data provided in publications by Pettit and Windslow (1957), Hammond (1969) and Sandeen and Wesselman (1973) indicate that about one foot of subsidence results from 100 feet of drawdown in the Texas coastal area. However, there is apparently no documented evidence of subsidence associated with ground water withdrawal in the Capline project area. This may be partly due to the relative lack of development of ground water resources in the area. The impact of those ground water withdrawals on water quality would be primarily an increase in salinity of the water in the production zone. This would be due to a decrease in pressure inducing migration from underlying more saline zones. The increase in salinity can be minimized by proper spacing and completion of wells. In addition, the proposed production zone contains moderately saline water (3,000 to 10,000 milligrams per liter dissolved solids) which is not economically attractive for desalination because of the large quantities of slightly saline water (1,000 to 3,000 milligrams per liter dissolved solids) available in the site region.

Construction of the well field would require a total of 4.7 miles of pipeline with 25,000 cubic yards of excavation. Approximately .77 acre-feet of interstitial water could be released to nearby water bodies as a result of construction.

Alternative Brine Disposal System - Gulf of Mexico On-land construction of a brine disposal pipeline would affect stream, bayou, and marsh water quality, since there would be approximately 49 water crossings of the pipeline. Runoff from the spoils could affect adjacent surface waters by causing eutrophication from nutrient runoff, high turbidity, lowered pH and dissolved oxygen, and increased heavy metal and pesticide concentrations. In the sluggish streams and bayous, sedimentation and altered water might occur. Surface drainage patterns and rates may also be changed. After backfilling, appropriate measures to prevent erosion would be required. In addition, a 23.6-mile offshore pipeline would be constructed through the shallow waters of the Gulf of Mexico, terminating in 30 feet of water 26 miles south of Pointe au Fer. Potential impacts to offshore water quality due to construction would include dredging for laying pipe and disposal of brine used in leaching. The same brine diffuser as planned for the Chacahoula dome development would be used, thus, impacts would be similar to those described in Section C.7.2.1.2.

C.6.2.1.3 Air Quality

During site preparation and construction, the air quality impacts for site expansion at Bayou Choctaw would be very similar to the air quality impacts for Napoleonville as described in C.4.3.1.3. Construction impacts associated with development of early storage capacity at Bayou Choctaw and Weeks Island are given in FES 76-5 and 76/77-8.

All downwind concentrations due to construction would be well below state and national air quality standards. However, since background HC levels often exceed the 3-hour standard in southern Louisiana infrequent additional exceedances may be expected. All construction impacts would be short-term in nature and confined to a relatively small area.

Alternatives

Use of alternative sources of raw water would have some effect on construction emissions. Development of a ground water well field east of the site would increase drill rig emissions by an estimated 50 percent. Construction of a 1.0 mile pipeline to the ICW would reduce pipeline emissions by roughly a factor of 5 compared to use of the Mississippi River. Construction of a 98.3 mile pipeline to the Gulf would increase total emissions, though they would not be concentrated in any one area for more than a few days.

Construction of a 119.9-mile pipeline for brine disposal in the Gulf would replace a significant source of continuous emissions at Bayou Choctaw (well field drill rig emissions) with emissions associated with pipeline construction dispensed over a wide geographical area.

C.6.2.1.4 Noise

The following sections describe the analysis of possible construction impacts on noise levels near the Bayou Choctaw site associated with SPR development. Noise levels associated with the major construction equipment are specified. Using hemispherical sound radiation assumptions, the noise levels are extrapolated to nearby locations off the site to determine the effect on ambient sound levels. Terminology used in this section is defined in Appendix B.2.4.

Noise Sources

Drilling New Cavity Entrance and Brine Disposal Wells Conventional oil well drilling rigs would be used for drilling the new cavern entry wells. It is estimated that two large drill rigs may be operating simultaneously on the site. The equivalent sound level, L_{eq}, contribution of this activity is estimated to be 67 decibels (dB) at 500 feet. Assuming that drilling activity is continuous throughout a 24-hour day, the daytime and nighttime equivalent sound level L_d and L_n contribution to ambient noise levels are both estimated to be 67 dB at 500 feet. Development of each storage cavern would require 60 to 90 days of rig time, brine disposal wells would require 30 days of rig time. Assuming 6 new cavern wells and 13 disposal wells, drilling operations would last 360 to 540 days.

Activities associated with conversion of existing caverns to storage facilities would contribute negligibly to ambient sound levels.

Leaching of Cavities Leaching is accomplished by pumping raw water into the drill holes and displacing the resulting brine. The major noise sources associated with leaching are pumps. These pumps would be housed within a sheet metal pumphouse. Outdoor pump sound levels add negligibly to the ambient sound at 500 feet, due to wall attenuation at the pumphouse.

Construction of Support Facilities Support facilities to be constructed on the site include access roads and on-site piping. The sound levels associated with equipment used for construction of these facilities are summarized in Table C.4-3. The equivalent sound level, L_{eq}, contribution at 500 feet is estimated to be 68 dB. Since construction would take place for 10 hours per day, a daytime equivalent sound level contribution of 66 dB at 500 feet is estimated.

Pipeline Construction Raw water supply and brine disposal would require construction of pipelines. Two basic techniques would be used for pipeline construction: 1) push-ditch method; and 2) conventional dry method. Typical equipment and the sound levels associated with each of these methods are presented in Table C.4-4. Since various methods would be employed for specific sections of the pipeline, a conservative estimate is made. An L_{eq} of 69 dB at 500 feet and a L_d of 67 dB at 500 feet is estimated for pipeline construction.

Roadways would be constructed along the pipeline rights-of-way and landfill would be required. It is assumed that two dump trucks and one bulldozer would be used for this road construction. Table C.4-5 presents sound levels and usage factors for this equipment. The L_{eq} is estimated to be 68 dB at 500 feet; the daytime equivalent sound level, L_d, assuming construction activity takes place 10 hours per day is 66 dB at 500 feet.

Summary of Construction Noise Sound levels from construction activities presented above are summarized in Table C.6-1.

Ambient Sound Levels During Construction of Proposed Facilities

Major construction activities would occur at the Bayou Choctaw site and along the pipeline route to the brine disposal well field and the Mississippi raw water supply source. Since no site-specific prefacility ambient noise levels are available, the estimates discussed in Section B.2.4 are used. It is assumed that within the site area, the prefacility ambient day/night sound level, L_{dn}, is on the order of 53 dB. This is a conservatively low estimate. Construction activity noise levels are extrapolated using hemipherical sound radiation to determine the distance to which construction activity would contribute significantly to the ambient sound levels. Within a circle defined by this radius, with its center at the center of the activity, (or in the case of pipeline construction, within a corridor width along the pipeline defined by this distance), average day/night sound levels would be increased by at least 3 dB, a discernible amount. These distances are presented in Table C.6-1. The assumption of hemispherical radiation does not account for attenuation due to foliage, air, or ground effects, and is therefore conservative. Furthermore, populated areas would probably have prefacility day/night sound levels higher than 53 and therefore the impact zones at these locations would be appreciably smaller.

Since pipe laying and access road construction progresses along the pipeline route at approximately one-half mile a day, areas would be impacted for only a short duration. Since most of the pipelines run through uninhabited marshlands, the impact would be negligible.

TABLE C.6-1 Summary of Construction Noise Impact - Bayou Choctaw SPR Development

Area	Activity	Impact Zone Radius (ft)[a]
Bayou Choctaw	Drilling new wells	5000
Pipeline Routes	Laying of pipe	2800
	Access road construction	2500

[a] This is the distance within which sound levels are raised 3 decibels or more by activity described. For pipeline construction activity the radius describes a corridor along the pipeline. A baseline ambient day/night sound level of 70 dB and 50 dB is assumed at Bayou Choctaw and along the pipeline route respectively.

The state of Louisiana has no regulation limiting the proposed activity.

The U.S. Environmental Protection Agency has identified that annual day/night average ambient sound levels below an L_{dn} of about 55 dB do not degrade the public health and welfare. Within the impact zone, the L_{dn} would be above 55 dB during construction activity. Since there are no residents within the impact zone defined for drilling activities, there will be no significant noise impact from on-site activities.

Noise impacts due to pipeline construction would be most significant where the raw water supply pipeline approaches the Mississippi River. Less than 50 residences would be exposed to sound level increases of more than 3 dB for periods of up to 1 week.

Ambient Sound Levels During Construction of Alternate Facilities

Construction of either the brine disposal or raw water supply pipeline to the Gulf would produce elevated noise levels for more than 100 residences, particularly in the vicinity of Plaquemine and White Castle, and along Bayou Lafourche levee. Duration of impacts would be less than one week.

Construction of the 1.0 mile raw water pipeline to the ICW should have no effect on noise sensitive areas.

Construction of the raw water supply wells along the pipeline route between the site and the Mississippi River may elevate noise levels at 10 or more residences over a period of 3 weeks to one month. As some of the wells would be drilled on agricultural land, noise attenuation due to vegetation would be negligible.

C.6.2.1.5 Impact on Ecosystems and Species

Salt Dome Development

Expansion of the Bayou Choctaw site would involve several impacts on the biota of the area. These impacts include loss of terrestrial and aquatic habitats, increases in turbidity, and indirect effects on fish and wildlife due to forced migration, noise, and human disturbance. The total area involved for each habitat is presented in Table B.5-2.

Approximately 18 acres of deciduous swamp would be cleared and filled. Grading an additional 9 acres to a depth of up to one foot would also severely impact any small invertebrates in the surface vegetation and topsoil. Populations of nematodes, mites, collembola (springtails), insect larvae, spiders, and oligochaetes (worms) would be destroyed. Secondary productivity by these groups, while unknown exactly for the site, is probably moderate due to the characteristic of gradual nutrient turnover in the habitat. Loss of primary and secondary terrestrial production would be localized but permanent.

If construction is completed relatively early in the growing season, a plant community would become established on the banks and cleared areas within several months. This vegetation would help retard runoff, thereby reducing soil erosion and associated turbidity. It would also serve as cover and a source of food for some species of birds, small mammals, and other wildlife which frequent areas of human activity.

Approximately 27 acres of wildlife habitat would be affected within the site. Habitat types to be affected include cleared industrial land associated with brining operations, existing oil field development, small water bodies, and deciduous swamp. Since about 27 acres at the site will be enclosed by fencing, it can be assumed that, except in the case of avifauna, the available resources provided by the habitat would be permanently lost to many other wildlife groups. Species likely to be affected by construction are mentioned in Section B.3.3.5.

Wildlife species to be directly affected by construction include non-mobile species of small rodents, amphibians, and reptiles. Direct effects on resident wildlife (mammals, birds, amphibians, and reptiles) would vary depending on whether or not construction can be avoided during the nesting and young-bearing season. Direct effects of the construction (other than death resulting directly from construction activities) include permanent habitat loss (loss of food, cover, nesting and breeding areas), forced migration of resident wildlife, and animal loss resulting from increased activity and road traffic.

Indirect effects of construction include impacts on wildlife of forced migration, increased noise, and human disturbance. The effects of migration would be dependent upon the availability of resources in an adjacent habitat. Critical factors include availability of space, protective cover, food, and the status of existing animal populations. Noise and human disturbance during construction would discourage wildlife within the area by the species as noted in Table B.2-15 under the appropriate habitat types to be affected. Upon completion of construction activities, some wildlife species are likely to return to the impacted area. However, due to the extensive fencing planned for the area, some wildlife species would be permanently displaced.

Earth moving activities for leach pad construction, roads, and other construction operations, would increase turbidity and add nutrients to swamps and other surface water systems in the area. Increases in turbidity from construction would affect most of the surface water onsite by decreasing light penetration and hence possibly reducing plankton production. However, an influx of nutrients from the sediments and fill could increase phytoplankton, periphyton, and macrophyte production in areas not buried by fill, thus mitigating the effects of reduced light levels on plant productivity. Community composition also could be affected since different species have different physiological tolerances and ecological dependencies.

Siltation caused by construction might eliminate a small number of benthic invertebrates in the unfilled parts of the site or might affect their feeding, respiration, or reproduction. This reduction of invertebrate numbers in the aquatic system and food web would be of only local significance and, for the most part, would be temporary. Many species of sunfish and other freshwater fish which feed mainly by sight would be forced to migrate from the area in order to find food. The invasion of surrounding, undisturbed areas by displaced fish could result in stressing these fish populations already present. The expanse of interconnected and continguous waters would cause the stress levels to be lower than they would be within a smaller or closed system. Fish should move back within a short time after turbidity settles and disturbances cease, if construction takes place in summer months. Mollusks (e.g., snails and bivalves) covered by siltation from rain runoff from the fill areas could suffocate or suffer gill abrasion. This could also occur with fish and crayfish. Crayfish can survive in water made turbid by its high content of detrital matter and presumably could tolerate high turbidity produced by other sources. Crayfish may temporarily decline in the areas affected by high turbidity at the dome because of a decline in food supply (decomposed organic matter) and disturbed habitats.

Brine Disposal

The proposed brine disposal system would include 3.9 miles of pipeline, associated roads, disposal well pads, and other construction operations, covering a total of 36 acres (see Section A.6 and Figure A.4-4). Biological impacts include loss of terrestrial and aquatic habitat, increases in turbidity, and indirect effects on fish and wildlife due to forced migration, noise, and human disturbance. The total area involved for each habitat is presented in Table B.5-2.

The elimination of the cover vegetation within the pipeline right-of-way is expected to have a significant though short-term adverse impact in areas of high precipitation and soil moisture. In efforts to reduce this impact, the felling of large trees and disturbance to natural plant communities adjacent to the proposed pipeline right-of-way would be avoided.

Clearing of the cover vegetation and removal of topsoil from the proposed pipeline right-of-way would cause several secondary impacts. Most important of these is a decrease in productivity of forage material within the right-of-way corridor. Another impact results from altering the composition of the vegetation community; an example is the "invasion" of the right-of-way by low-productivity "decreaser" plant species having little or no forage value. In addition, clearing and/or spraying the right-of-way would have the secondary effect of increasing the fire danger due to drying out the brush and increasing human activity. Restoring the topsoil and reseeding the right-of-way with native grasses would serve to minimize the impacts of construction.

Another direct impact of construction of the proposed pipeline is the compaction and random mixing of the soil by heavy equipment and vehicles within the right-of-way. This impact would be minimized by the methodology used to ditch and backfill. A majority of the topsoil would end up at or near the top of the ditch by reversing the ditching steps when backfilling.

Human activities, construction, and the release of dust, dirt, and fumes would most likely cause the migration of resident wildlife species from the direct impact areas due to loss of protective cover, and feeding, breeding, and nesting areas. Some animal losses are expected from the direct and indirect effects of pipeline construction. Animal losses are expected to be greatest among the small rodents and other less mobile wildlife species. The potential losses resulting from pipeline construction would be greatest during the major nesting and young-bearing season.

The effects of pipeline construction on wildlife in cleared land habitats are expected to be minor and short-term. Most of the wildlife species commonly found in cleared lands are able to survive despite fluctuating conditions and altered habitats. Some loss of the less mobile species is expected during construction. The temporary loss of habitat and resources provided by that habitat would probably last 6 months to 1 year in old field and pasture areas. Other areas (urban and industrial) would probably require less recovery time.

The effects of pipeline construction on wildlife at river crossings would be minimal and temporary. Construction activities would force most wildlife away from the crossings. Most mammals, birds, and herpetofauna would return to the area once human activities decrease.

Permanent loss of habitat is expected in the wooded bottomlands and swamps. Brush and trees would be completely removed within the right-of-way in these areas. This removal would result in a loss of habitat, feeding areas, protective cover, and nesting areas for woodland species. Arboreal species of wildlife and woodland perching and nesting avifauna would be adversely affected. Some species within these groupings include the squirrels, raccoon, opossum, broadheaded skink, eastern gray treefrog, red-tailed and red-shouldered hawks, other hawks (Buteo spp.), owls, and most passerines (Appendix B, Table B.2-18). The loss of feeding areas would be permanent for some species (i.e., squirrels); however, once recovery of grasses, shrubs, and emergent macrophytes takes place, the area may provide a food source for some wildlife species. Loss of protective cover and nesting areas in the pipeline right-of-way in bottomland woods and swamps would be permanent for most species of wildlife unless dense stands of tall, herbaceous vegetation are permitted to remain.

A positive factor derived from construction is the creation of an "edge effect", a transitional area where two major biotic communities meet and blend together. An edge includes organisms common to the communities on both sides of it, as well as other more versatile species. It allows a diversity of habitat that in turn provides resources for a more diverse fauna. The edge may serve as a food source for animals of the forest or travel lanes for large and medium-sized mammals. Many important game species are characterized as "edge" species, including quail, rabbits, and the white-tailed deer.

The effects of pipeline construction on wildlife that inhabit the swamps and wetland habitats would probably be significant because of the vast number of wildlife species that inhabit these areas. Habitat loss in the swamps and wetlands may be temporary; however, alteration of existing drainage patterns in the wetlands could force water-dependent herpetofauna species into marginal habitats where their chances of survival would be greatly reduced.

A large number of furbearers, waterfowl (winter), and marsh-inhabiting bird species would be adversely affected by pipeline construction in that some feeding and nesting areas would be lost. The mobility of avian species would reduce some of the anticipated impacts. Effects of construction on swamp and wetland areas may be evident for one to two years or more.

The primary impacts from pipeline construction on the aquatic environment are the destruction of benthic habitat where wetlands and streams (or other water bodies) are crossed, and the turbidity caused by instream construction and land runoff. The biological details of these impacts were discussed earlier in this section.

Water bodies that would be affected by pipeline construction include the swamp to the south of the site, Little Grand Bayou, and several smaller creeks and canals.

Raw Water Supply

The proposed raw water supply system from the Mississippi River has a 5.4 mile long pipeline which will use 53 acres of cleared terrestrial habitat and 1 acre in open water (Table B.5-2, Figure A.6-2). The terrestrial impacts would be minimal in the agriculatural area.

The primary aquatic impacts related to the raw water supply system would be the entrainment of plankton, drifting invertebrates, and larval fish from the Mississippi River and the impingement of juvenile fish on the intake screen. Entrained organisms would be lost since they would be unable to withstand the high salinity within the cavities. The required intake rate is only a small percent of the flow of the Mississippi River. Since the intake structure is in an area of relatively low productivity, and the area potentially impacted is a small portion of the Mississippi River, the aquatic impacts will be negligible.

The impingement of aquatic organisms on the intake screen would be primarily limited to juvenile fish (usually less than about 4 inches long). Since all of the impinged fish would be returned to the river, it is likely that many may survive. The actual survival rate would depend on flume design, and location and operating procedures used for the intake structure. Assuming that the intake structure is not located in the vicinity (or just downstream) of major fish spawning areas, the impact probably would be small.

Oil Pipeline Construction

No new oil pipeline construction would be required for expansion of Bayou Choctaw. The 36-inch diameter pipeline for the early storage phase would have adequate capacity for expansion of Bayou Choctaw to 150 MMB. The impacts of construction of the oil pipeline from Bayou Choctaw to St. James are assessed in the May 1977 supplement to FES 76-5.

Accidental Brine Release

The expected quantity of brine accidentally spilled from the retention pond on-site or from the brine injection system during leaching is 16 barrels (Appendices E and C.2). These spills would not be anticipated to have significant adverse impacts on more than one to two acres of terrestrial or aquatic habitat in the vicinity of the site. A maximum credible spill of up to 30,000 barrels of brine could have significant local impacts on both the vegetation and animals in the spill area; however, the probability of such a spill is extremely small.

Should a maximum credible brine spill occur on the salt dome or along the brine disposal pipeline, the brine could spread across the swamp and bottomland forest possibly reaching the ICW to the west. Impacts on vegetation and on animal life which could not avoid the brine in these areas would be locally devastating. Tens of acres of habitat could be destroyed and the resulting salt concentrations in the soil could remain above levels tolerated by growth of new vegetation for several years. However, it must be emphasized that such a spill is statistically very unlikely to occur, especially from so short a section of pipeline.

Construction of Alternative Facilities

Alternative Raw Water Source - ICW The alternative raw water supply system from ICW has a 1.0 mile long pipeline which would use 8 acres of terrestrial habitat (Table B.5-2, Figure A.6-2). The terrestrial impacts of this system would be minimal due to its short length, but they would be of the same kind as those discussed for the primary brine disposal system. The impacts related to the aquatic ecosystem would be similar to those discussed for the proposed raw water system. However, entrainment and impingement impacts would be greater, since a significant portion of the ICW flow would be used and because resident fish populations are expected to be more abundant.

Alternate Raw Water Source - Gulf of Mexico The alternative raw water supply system from the Gulf of Mexico would be constructed adjacent to the crude oil pipeline between Bayou Choctaw and St. James and then would follow Shell No. 258 pipeline to the coast. Acreages of various habitats directly affected are given in Table A.6-2. Entrainment and impingement of marine organisms would affect large numbers of individuals but a very small proportion of the existing Gulf of Mexico populations.

Alternative Raw Water Source - Ground Water The alternative raw water supply system from the well field east of the site would have a 4.7-mile long pipeline and would use 12 acres of terrestrial habitat (Table B.5-2, Figure A.6-2). The only adverse effects on biota would occur as a result of pipeline and well field construction.

Alternative Brine Disposal System - Gulf of Mexico Construction of the 119.9-mile brine disposal pipeline would traverse 96.3 miles of cleared land, bottomland forest, deciduous swamp, marsh, and streams. The impact on these habitats would be similar to those described previously in this section. In addition, the pipeline would underlie 23.6 miles of Gulf waters. Since the underwater pipeline would be the same as that proposed for Chacahoula development, the impacts would be similar to those described in Section C.7.2.1.5.

An additional impact which must be considered is the effect of brine disposal during cavern leaching on the aquatic biota of the Gulf of Mexico. A description of expected biological impacts of brine on organisms in the water column and on the ocean bottom near the diffuser is given in Section C.7.2.1.5. In summary, it is expected that brine disposal in the Gulf should not have a significant regional effect on plankton or nekton. Increases in salinity may affect species diversity and populations on the bottom near the diffuser. Also it is possible that altered salinity levels could slightly modify migration patterns of shrimp near the diffuser.

C.6.2.1.6 Natural and Scenic Resources

Storage Site

Expansion at the Bayou Choctaw site would slightly diminish the quality of the natural and scenic resources in the immediate vicinity of the dome. Effects at the site would be limited to loss of trees and other vegetation as a result of construction of well pads, pipelines and roads to the six new caverns. Dust, noise, fumes and siltation would have a slight adverse effect during construction. These impacts would not be visible from local highways or towns.

Oil Distribution Pipeline

The oil pipeline to St. James would be constructed as part of the early storage phase. Therefore there will be no new impacts on scenic or natural resources. A description of these impacts is in the May 1977 supplement to FES 76-5.

Brine Disposal System

The brine disposal system would impact natural swamp environments adjacent to the brine disposal well field that will be used by the early storage facility. This construction would significantly affect the natural qualities of this limited area (36 acres) by clearing vegetation and disrupting habitat. For the limited number of individuals passing the area during construction the scenic qualities of the area could be slightly diminished. However, this area does not offer any unique habitat types that could not be found elsewhere.

Raw Water Supply

The raw water supply system would not significantly diminish the scenic or natural qualities of the area long the pipeline route since the right-of-way would pass through 5.4 miles of mostly cleared land.

Alternative Systems

Raw Water The use of the ICW could have a significantly adverse effect on the natural and scenic resources along this waterway since the ability of the ICW to meet the water demands of the project is uncertain.

The use of ground water would require 12 acres of agricultural land. The impact to scenic and natural resources would be minor or insignificant.

Construction of a raw water pipeline to the Gulf of Mexico would cause a significant increase in the adverse impact of the project on natural and scenic resources. Although the pipeline would follow existing pipeline rights-of-way, the construction impacts would affect many miles of natural marshland, coastal swamps, agricultural land, and transportation corridors.

Brine Disposal The alternative brine disposal system to the Gulf of Mexico would have impacts similar to those described for the raw water supply from the Gulf.

C.6.2.1.7 Archaeological, Historical and Cultural Resources

Storage Site

There are numerous sites of historic, archaeological or cultural significance in the area immediately surrounding the storage site. While no direct impact on any of these resources is anticipated, new sites may be discovered during development. If any archaeological or historic material were found, it would be immediately reported to State officials so that appropriate action could be taken to preserve or protect the material.

Oil Distribution Pipelines

There are no known areas of historic, archaeological or cultural significance in the right-of-way.

Raw Water Supply System

There are no known areas of historic, archaeological or cultural significance in the right-of-way.

Brine Disposal System

The brine disposal field would be located just south of the dome. No impact on areas of historic, archaeological or cultural significance is expected due to construction.

Alternative Physical Facilities

No anticipated adverse impacts are expected as a result of developing a raw water supply at the ICW or a ground water well field along the pipeline route.

C.6.2.1.8 Socioeconomic Impact of Construction

Storage Site

Land Use - On site land use impacts on the expansion of the Bayou Choctaw storage facility from the early storage phase capacity of 94 MMB to a total of 150 MMB will be relatively minor. The area has been in industrial use for over 40 years, and, in addition, most of the alterations required for oil storage will have been completed. Most of the expansion can be accommodated within the plant area of the early storage phase. Only 27 acres of additional land will be required for the new caverns, pipelines and roads, etc.

Transportation - Increased commuting traffic to the storage site will occur on Route 1 especially between Baton Rouge and Plaquemine, and some minor increases in existing traffic problems may occur in localized areas. Traffic impacts would be longest during the first 21 months of project construction (when employment would be greatest) with the associated labor force dwindling appreciably after this time. More congestion may occur during periods when cane fields are being harvested. To the extent that traffic associated with the project does not coincide with existing peak hours, the impacts would be reduced. Construction workdays frequently coincide with the available daylight. The impacts would also be reduced to the use of three shifts per day for some tasks.

Much of the delivery of materials and equipment will utilize Bayou Plaquemine and the Port Allen Canal portions of the Intracoastal Waterway. This will add to existing traffic on those waterways but decrease potential surface road congestion.

Population - Little, if any, population impact is anticipated from construction at the storage site. There is a large available labor pool in nearby Baton Route and most of the construction workers are expected to commute from their current residences, leaving the permanent local population unchanged, for the most part.

Housing - Housing, like population, is not expected to be significantly impacted during the construction phase. There is a large pool of labor within commuting distance of the site and it is unlikely these workers would relocate their households for the short period during which most of the construction would take place. Any workers wishing to relocate closer to the storage site will find little housing available, especially rental units in nearby Plaquemine.

Economy - The construction project at the storage site will have no adverse impact upon the highly developed economic base of the Baton Rouge area. There will be a beneficial impact resulting from employment and purchases of materials and supplies, but it is not anticipated to be highly significant in relation to the magnitude of existing economic activity. Increased economic activity in Plaquemine is likely to be more significant though much smaller in absolute magnitude.

The project is not expected to significantly alter the employment picture in the project area. Due to the large construction labor force in the Baton Rouge area and the relatively small size of the project work force, the project is not expected to cause any manpower shortages, although it should have a slight beneficial effect on employment; the peak month employment for construction of storage facilities will be only about 230 employees. By the 21st month, only approximately 39 workers will be involved with the project and by the 51st month only approximately 15 employees will be working (see Table C.6-2).

Government - The project is unlikely to severely impact the sources or absolute levels of tax revenues in the surrounding parishes since the storage site is already owned by the Federal Government for use as an early storage facility. Since the employment associated with construction of the storage site is small and temporary, no significant increase in sales or property tax revenues associated with higher personal incomes is expected.

Due to the proximity of the storage site to many large communities in the Baton Route area, the project is not expected to significantly impact government services. The work force will be made of residents primarily from the Baton Route area and would not add to the demand for government services.

Increased traffic in the area could slightly increase police calls and, in case of large scale accidents, local police and fire services might be required.

Medical facilities in nearby Baton Rouge are not expected to be significantly impacted by normal construction operations. Should a large scale disaster occur, transport of the injured to Baton Rouge could tax facilities.

Because most employees are expected to commute from existing residential areas, no significant increase in school enrollment locally is anticipated.

Raw Water Supply System

Land Use - Construction of the water supply pipeline will have a significant impact on land use. The 5.4-mile pipeline would require an 80-foot right-of-way to the intake point at the Mississippi River and

TABLE C.6-2 Extimated Monthly Employment and Wages - Bayou Choctaw Expansion Alternative

Month[1]	Monthly Employment		Monthly Payroll
0-1	43		$ 75,250
1-2	231		404,250
2-3	151		264,250
3-4	126		220,500
4-5	134		234,500
5-6	104		182,000
6-8	128		448,000 (x 2)
8-21	108		2,457,000 (x 16)
21-51	39		2,047,500 (x 30)
51-56	15		131,250 (x 5)
		TOTAL	$6,464,500

[1]Beginning construction = month 0

one to two acres of land for the intake structure for a total of 54 acres. The major portion of this acreage would be in areas currently in agricultural use.

Transportation - Construction of the water supply system may have a minor impact on transportation. Pipeline construction would cross Route 1 as well as the Texas and Pacific Railroad. In addition, the pipeline would cross the Bayou Bourbeaux. In most cases, it would be possible to drill under the roads and railroads minimizing the effect on local traffic. Overall, the construction impacts in any single location should be of short duration.

Population - Construction of the water supply system, like storage site construction, is not expected to significantly affect population in Iberville Parish or the region.

Housing - No significant impacts on housing are expected to occur from construction of the water supply pipeline.

Economy - Only a small percentage of the construction workers necessary for the total project will be working on the water supply pipeline itself. Thus, little stimulus to the local or regional economy would be expected to occur from this construction activity. Any impacts that did occur, (e.g., employment, increase in personal income, use of local supplies) would be similar to those caused by construction of the storage site, only much smaller in magnitude.

Government - Since construction of the water supply system would require federal ownership of roughly 54 acres of land, a small reduction in property tax revenues would be expected to occur.

Impacts on local police, fire, medical, and educational services would be similar to, but on a much smaller scale than those for storage site construction. No significant adverse impacts would be expected.

Brine Disposal System

Land Use - No significant impact on land use is expected to occur from construction of 13 brine disposal wells. A total area of about 36 acres would be needed for construction of the wells and drill pads. This acreage would be converted from what is now forrested wetland. The area of construction, although mainly wooded, is already interspersed with early storage brine disposal facilities.

Transportation - The number of construction workers associated with the brine disposal wells will be small and the disposal field will not cross any roads or waterways. Thus, adverse impacts on transportation will be negligible. Local increases in traffic from construction workers from the brine disposal field, the main storage site, and the water supply pipeline system combined, may be significant as discussed in the section on impacts of the storage site.

Population - As discussed for the storage site, no significant changes in populaton are expected to occur from construction of 13 disposal wells.

Housing - Housing, like population, will not be significantly impacted by construction activities.

Economy - The economic effect of brine disposal construction activities would be similar to those discussed for the storage site, only much smaller in magnitude.

Government - The land needed for brine disposal facilities is currently owned by the federal government so no change in property tax revenues from the site would occur.

Demands on local services would be minimal and only in combination with those created by other construction activities (storage site, water supply) could they be of any significance. The most likely demand would be for police services related to additional traffic levels.

Alternative Facilities

Raw Water Construction of a one-mile pipeline to the Intracoastal Waterway southwest of the storage site would require eight acres of cleared land. Absolute land use requirements under this alternative would be significantly less than those associated with water supply from the Mississippi River.

Construction of this alternative might have a small temporary impact on transportation on a small segment of the Intracoastal Waterway. Otherwise, increases in traffic on local roads and highways will be essentially the same as for the project without this alternative.

The number of construction workers needed for this alternative would be equal to or less than the number needed for the primary alternative, and they would be expected to live in and commute primarily from Baton Rouge. Impacts on population, housing, economy and government services would not change significantly with use of the Intracoastal Waterway for raw water supply.

Raw Water Supply from Ground Water This alternative would require 12 acres of cleared land for construction of 15 new wells and well pads. The acres required would be in a wooded area already interspersed with brine disposal facilities. The absolute land requirement for this alternative would be less than that of the primary alternative, and the area of construction would not intersect any waterways or major roads.

In general, the number of workers associated with this alternative might increase slightly but would not differ significantly from the primary alternative. Adoption of the ground water alternatives as compared to the primary alternative would have similar (and essentially minimal) impacts on transportation, housing, population and government services.

Water Supply from the Gulf of Mexico Land use impacts under this alternative would be significantly larger than for the primary alternative. The 98.3-mile pipeline from the storage site to the Gulf of Mexico intake structure would require a total of 723 acres of which 133 acres of cleared land, 298 acres of marsh, 232 acres of swamp, and 51 acres of open water. Depending upon the exact route, the pipeline would cross Routes 77, 75, 70, 401, 20 and 90 plus numerous small canals and waterways. Temporary disruption of traffic on these transportation routes would be minimal if mitigating construction techniques were used; however, the potential for disruption would be significantly greater under this alternative than the primary alternative.

Adoption of the Gulf of Mexico alternative would significantly increase the total number of workers associated with the project, but the associated impacts on traffic, population, housing and government services would be dispersed over a much wider area. Most of the workers would still be drawn from existing labor pools in the larger cities and would most likely live in and commute from such centers as Baton Rouge, Plaquemine, Thibodaux, Houma, and Morgan City. Housing in smaller settlements along the pipeline route would not be readily available. In accordance with the larger number of workers required and the possibly longer commuting distances, the impacts on local traffic under this alternative would be greater than under the primary alternative. This increase in traffic and the presence of workers in a larger area would have a greater (albeit temporary) impact on local police and fire services in jurisdictions along the entire length of the pipeline route.

Brine Disposal in the Gulf of Mexico The impacts of this alternative are essentially the same as those described above for the raw water supply alternative, except for the 23.6 mile offshore portion of the pipeline. Adoption of this alternative would most likely occur in conjunction with adoption of the similar raw water supply alternative which would multiply the increased land requirements and other socio-economic impacts associated with the project as compared to the primary alternatives for water supply and brine disposal. Should brine disposal negatively impact any commercial fish in the Gulf, the fishing industries of Houma, Morgan City and other ports could be adversely impacted, in turn, affecting the local economy.

C.6.2.2 Impacts from Operation and Standby Storage

The following section describes operational impacts for storage site facilities and for related pipelines. Operational impacts of terminal facilities are described in Section C.3.

Should an oil supply interruption occur while oil is stored at the expanded Bayou Choctaw site, a total of as much as 289 MMB would be available for distribution, either by tanker or by the CAPLINE Pipeline. Oil would be pumped from the early storage sites at Weeks Island and Bayou Choctaw and from the expanded SPR storage caverns at Iberia and Bayou Choctaw using two 36-inch diameter pipelines. Oil would also be injected into the storage cavities via the same facilities. Until an oil supply interruption occurs these facilities would be maintained in readiness by monitoring storage cavity systems, leak-checking pipelines, activating valves, and other standard procedures.

Thus, SPR development at Bayou Choctaw would not introduce any new or unique operational impacts to the program but would require extended use of existing systems at the terminal and Bayou Choctaw to accommodate a capacity increase from approximately 183 MMB to 289 MMB (58 percent increase). Principal impacts of the Bayou Choctaw SPR operation are associated with hydrocarbon emissions and oil or brine spills. Impacts expected to accompany early storage facility operation and expanded SPR facility operation are both given where appropriate to provide a perspective on program expansion impact significance.

C.6.2.2.1 Land Features and Geologic Impacts

Effects of operation and standby of the Bayou Choctaw storage site expansion on land features are expected to be minimal. No significant disturbance of site soils is expected after construction is completed. Soils would stabilize soon after they are revegetated.

Compared to the 117 acres required during construction offsite and within the 27-acre fenced area, 85 acres would need to be maintained during operation.

Bayou Choctaw is located in an area identified as seismic Zone 1, with an expectation of minor earthquake damage (Figure B.2-8). Underground storage caverns are much less susceptible to damage from seismic events than surface tanks.

It is conceivable, though extremely unlikely, that the salt roof over one of the caverns could collapse. Appendix F considers the possible mechanism by which such an event could occur. A possible result would be the formation of a deep surface depression, probably resulting in a lake over the dome similar to the collapse which resulted in a 12-acre lake in 1955. Should such an event take place, significant quantities of oil or brine could be released to the surface or to shallow ground water aquifers. Impacts on surface storage equipment could be potentially significant. The structural integrity of the storage cavities would be monitored and every available measure would be taken to preserve cavern integrity (Appendix E).

Alternatives

Use of alternative raw water, brine, or oil transportation systems would impact land features during project operation and standby storage only through required maintenance of pipeline right-of-way (Table A.4-2). The brine disposal and raw water supply pipelines to the Gulf would have much greater maintenance requirements than the proposed system. Land required for maintenance of the brine disposal pipeline to the Gulf would be less than that required for construction (422 acres vs. 672 acres).

C.6.2.2.2 Water Resources

Impacts to water resources during facility operation may occur as a result of raw water withdrawal for oil displacement, brine disposal during oil filling, and possible oil or brine spills.

Operations of Storage Site

During construction of the Bayou Choctaw storage site expansion measures would be incorporated into the design to minimize sediment transport and erosion at the site. These measures would include grading, diking and reseeding. Runoff from precipitation would therefore have minimal impact on water systems.

All sanitary wastes from the storage facility would be conveyed to a treatment plant sized to conform to Louisiana Health Department Standards, then routed to a receiving stream. As the number of operational employees would be small, no adverse impact on stream water quality would be expected.

Operation of Raw Water Supply System

Operational water requirements for the storage site would be based on the 65 cfs (29,200 GPM) used for crude oil displacement (1 million BPD) during the 150-day withdrawal period. As expected for the 42 cfs withdrawal necessary for a period of about two years during the leaching cycle, the 55 percent higher rate during 5 anticipated withdrawals is expected to have insignificant impact on Mississippi River flow conditions.

Zinc anodic protection would be used along the raw water supply pipeline at intervals of approximately 1000 feet. This may result in the release of 0.6 grams of zinc per square meter of pipe surface area per year (the exact mechanisms of the release are not clearly understood). Since the pipeline would be buried under several feet of sediment, little of the zinc would be expected to enter the water column unless sediments were disturbed for pipeline repairs. Operation of the pipeline would have no significant effect on hydrology.

Operation of Brine Disposal System

When oil is pumped into the storage caverns, brine would be displaced to the injection wells at an average rate of 175,000 B/D and at a maximum rate of 240,000 B/D. Filling of the expansion capacity would take 320 days at the average rate. As even the maximum expected fill rate is only 34 percent of the planned maximum brine disposal rate during cavern leaching (Section C.4.3.1.2), there should be no adverse effect on the condition of ground water aquifers.

Oil or Brine Spills

During project operation, oil spills could occur from pipelines connecting the storage site with the terminal surge tanks, and from the well heads at Bayou Choctaw (releases from the underground storage caverns are not quantified, see Appendix E). Brine spills could occur from the brine disposal pipeline and from the brine reservoir. A thorough description of possible modes of spills, methodologies of spill calculations, quantification of expected spill volumes and frequencies, spill dispersion characteristics, and spill prevention and control measures are provided in Appendix E. A summary of oil and brine spill expectations is also given in Section C.2 and in Tables C.2-1 through C.2-9. Possible effects on water resources from the Bayou Choctaw site expansion are considered in this section.

Oil and brine spills associated with use of expansion facilities at Bayou Choctaw could occur at the storage site or from the brine disposal well field in swamp forest to the south. (Oil spill risks from pipeline transportation between Bayou Choctaw and terminal facilities would not be increased over those described in the early storage site Supplement to Final EIS, Bayou Choctaw (DOE, 1977) as oil would be retained in the brine even without site expansion). Spills occuring at the site would normally be contained within the dikes constructed at the site. However, it is possible that oil could get into the canal system which drains into Bull Bay and the Intracoastal Watersay to the west. From the brine disposal field brine could flow into the adjoining swamp forest and marsh and could also eventually reach the Intracoastal Waterway to the west.

Quantities of oil and brine expected to be released from the early storage, Iberia and Bayou Choctaw facilities are listed by source and location in Tables C.2-1 through C.2-9. Total oil spillage from pipelines and at the storage site for five fill/withdrawal cycles is projected to be 988 barrels for the early storage facilities and additional 355 barrels for the Iberia and Bayou Choctaw expansion facilities. (Spill estimates for terminal and tanker spills are discussed in Section C.3.) The distribution of spills is projected to include 723 barrels at the storage sites and $3620 barrels from the connecting pipelines. The maximum credible spill events are estimated to be 10,000 barrels from a pipeline rupture, and 6000 barrels from storage sites.

Brine spills could occur from the piping system at Bayou Choctaw and south along the disposal pipelint to the injection field. Total spillage is estimated to be 24 barrels from site expansion and 49 barrels from early storage facilities. The maximum credible spill event is estimated to be 30,000 barrels.

A description of weathering processes which occur to oil released into the environment is provided in Section C.4.3.2.2. Evaporating disolution, emulsification, sedimentation, biological degradation, and chemical oxidation all tend to change the physical and chemical form of crude oil.

The broad geographical distribution of possible spill sites creates a wide range of oil spill situations. Many of these may be mitigated by oil spill response efforts (for example, in the Mississippi River, or Gulf of Mexico). Spills ocurring in swamp forests or marsh land would be difficult to control, however.

Two potentially significant impacts of oil spills on water resources would be the potential for buildup of toxic fractions and depletion of oxygen levels in shallow, poorly flushed water bodies. The most likely location of such impacts would be in swamp forests along the pipeline route to the terminal and in marshes located along the lower Mississippi River Delta (including the vicinity of Pass a Loutre and Delta Wildlife Refuges). Most of the spills would occur in the Mississippi River or in diked areas at the terminal.

Oil spills occurring anywhere outside diked areas or in the Mississippi River could affect human use of water (industrial, domestic or recreational).

The Plaquemine aquifer is overlain by about 100 feet of clay and silt in the vicinity of Bayou Choctaw. Oil spilled from the pipeline should not reach potable ground water supplies.

Should a subsurface spill occur, either from a defective well casing or collapse of a storage cavity, then oil would tend to collect at the water table and migrate laterally along the water surface. Crude oil tends to migrate very slowly through subsurface formations, and then only under pressure. However, some components of the oil, particularly the lighter aromatic hydrocarbons might be sufficiently soluble to impart an objectionable taste and odor to the water. This taste and odor could potentially reach users in the Plaquemine area as most domestic water supplies are taken from the Plaquemine aquifer.

Spills of brine or saline water have less potential for adverse effects on water quality than do oil spills because of the limited spill potential. Except for a very large brine spill, normal flushing of local water bodies (i.e., canals or Bull Bay) would quickly dilute salt concentrations to normal levels, resulting in very temporary water quality degradation. Flushing is not as effective in shallow water bodies or in the swamp forest, however, salinity excesses would continue for several days or weeks and may remain in the substrate.

The potential exists for relatively frequent and possibly large crude oil spills from the Capline Group of SPR sites. Calculations of spill probability and the nature of local water bodies indicates that significant impacts on local water resources should be very infrequent.

Hazards Due to Flooding

Surface facilities at Bayou Choctaw would not be subject to flooding caused by hurricanes or tropical storms. Surface elevations over the dome are approximately +5 to +10 feet, MSL. Data supplied by the U.S. Army Corps of Engineers indicate that the 100-year flood level at Bayou Choctaw +8.1 feet MSL. There should not be any destructive currents or waves to threaten surface facilities, however.

Storm floods greater than the 100 year event could occur and could damage surface facilities. In the event of an oncoming storm, oil would be removed from the surface tanks, thus eliminating the largest spill potential. If surface piping is ruptured, a few barrels of oil could escape but would likely be retained within the storage area. Damage to well head piping could result in loss of a few barrels from the cavern. Brine from the settling pond would be quickly diluted by flood waters.

As only limited quantities of oil could be released in the event of a damaging storm flood,environmental effects due to the flood waters and winds are expected to be much greater than due to loss of oil or brine.

Alternative Facilities

Operation of the brine disposal pipeline to the Gulf of Mexico would increase the potential for brine spills by a factor of about 28. Nearly 20 percent of this exposure would occur in the Gulf, but due to dilution would have less potential for adverse impacts on water quality.

Discharge of up to 240,000 BPD to the Gulf would occur at the brine diffuser during operation. The water quality impacts would diffuse slightly from the leaching procedure but would be similar to the Chacahoula operational brine discharge described in Section C.7.2.2.2.

Use of the alternative raw water supply system for oil displacement would have impacts on water supply similar to those described for leaching (Section C.6.2.1.2). However, water withdrawal rates are about 60 percent greater. Consequently, the potential for surface subsidence (with well supply) or increased turbidity and local drawdown (with ICW supply) are somewhat greater.

C.6.2.2.3 Air Quality

The largest potential effects on air quality associated with the operation of the proposed oil distribution system would result from hydrocarbon emissions during fill and withdrawal cycles. Data presented in Section B.2.3.3.2 indicate that non-methane hydrocarbon concentrations in the area frequently exceed the national and state standard of 160 $\mu g/m^3$ (3-hour average, 6-9 a.m.). Hydrogen sulfide losses are expected to be minimal since most of the crude oil that is expected to be stored in the Capline system would have weathered sufficiently during overseas transit to essentially eliminate the H_2S component.

Generally, the air quality impacts during operation for site expansion at Bayou Choctaw would be similar to those described for Napoleonville (Section C.4.3.2.3). The total hydrocarbon emissions at the Bayou Choctaw storage site over the life of the project are estimated to be 140 tons due to expansion and 270 tons due to early storage phase capacity from the brine pond and small oil surge tank onsite. These emissions should have no significant impact on air quality near the dome. Operational impacts associated with development of early storage capacity at Bayou Choctaw and Weeks Island are given in FES 76-5 and 76/77-80. Operational impacts at Iberia dome are discussed in Section C.6.3.2.3.

C.6.2.2.4 Noise

Operation Sound Sources

Principal sound sources during the operation of the storage facility would be material handling equipment such as pumps for filling and emptying the storage facility. These electric motor driven pumps would be mounted in a pump house with corrugated steel sides and roof.

Operation sound levels from the facilities described above are estimated from measurements at a similar facility in New York State. The facility is a liquefied propane gas storage plant with similar material handling and processing equipment. The major differences are that the pumps are located outdoors and dehydrators and trucks are used at the New York State facility.

From these measurements, it is estimated that unenclosed pumps at Bayou Choctaw would produce sound levels of 75 dB(A) at 50 feet. Typical wall attenuation for a corrugated steel building is 20-25dB. Therefore, the equivalent sound level contribution for the proposed facility at Bayou Choctaw to the ambient sound level is estimated to be 30-35 dB at 500 feet. This contribution is negligible compared to existing ambient sound levels of 53 dB.

Fill Cycle

No significant noise impact is expected for this activity.

Withdrawal Cycle

No significant impact is foreseen.

Gas Turbines

The power requirements of the facility would be supplied by commercial power through an onsite electrical substation. There would be no noticeable noise contribution associated with the substation.

Alternatives

None of the alternative systems proposed for the Bayou Choctaw storage site would contribute significant sound levels at nearby noise-sensitive areas.

C.6.2.2.5 Species and Ecosystems

Operational impacts of the proposed SPR facilities on biological resources in the area are principally related to the potential for oil or brine spills. Also, raw water must be withdrawn from the Mississippi River to displace oil from the caverns; brine is discharged to deep salt water bearing sands during oil filling, with no resulting effects on aquatic resources. Normal surface activities at the 27-acre storage site would exclude wildlife from the immediate project vicinity as well as 58 acres offsite for pipeline maintenance. This is an expansion of the existing industrial use of the project lands but is not a new or significantly adverse impact.

Surface Operations

Operations of the storage facilities at Bayou Choctaw should have little additional effect on the ecological aspects of the site. Minor adverse impacts such as weed control, periodic brush removal, increased noise and air quality changes should have little impact on the plants and wildlife. Human activity associated with fill, withdrawal, and standby operations would result in increased site activity but these activities would have only minor effects on area wildlife. The greatest impacts from normal operations and standby activities at the Bayou Choctaw site would be from possible oil spills (considered in a succeeding sub-section).

Approximately 2 miles of onsite pipeline and 9.3 miles offsite (oil, water, and brine) right-of-way must be maintained clear of woody vegetation to allow immediate access in case of system malfunction. Normally, up to a 50-foot wide right-of-way is required; however, as the onsite pipelines generally would be installed in common ROW's, very little additional maintenance right-of-way is expected for each. A summary of construction and maintenance right-of-way acreages for the proposed (and alternative) facilities is given in Tables A.6-1, A.6-2, and B.5-2.

The most significant adverse impact associated with ROW maintenance is the long term loss of vegetation productivity and wildlife habitat in the swamp and bottomland forest. Though grasses, shrubs and shallow water may provide some utility for forage and nesting, there is expected to be a net loss in wildlife carrying capacity. On cleared lands, normal agricultural practices can be continued so that no additional biological impacts are expected.

Typical impacts on wildlife associated with ROW maintenance activities are described in Section C.4.3.2.5.

Brine Disposal

Operational impacts of the brine disposal system would be limited to ROW maintenance of 3.9 miles of brine pipeline associated with the injection well field. Possible effects on wildlife were described previously. Injection of brine would not affect biological systems in the absence of brine spills.

Raw Water Supply

The predominant impact on vegetation and wildlife of normal operation of the raw water supply system (or one of the alternatives) would also result from the periodic maintenance required for the 5.4 mile pipeline route and would be the same as those described previously. However, most of the water supply line crosses agricultural land, requiring much less disturbance to natural vegetation and wildlife.

Impacts to the aquatic environment of the Mississippi River would be primarily related to entrainment and impingment of aquatic organisms. The impacts due to entrainment and impingment are discussed in Section

C.6.2.1.5 with respect to construction of the raw water supply system. However, the magnitude of the impacts during operation would be 50 percent greater than during construction because of increased raw water requirements during oil withdrawal.

Oil Delivery System

The predominant impact on vegetation and wildlife of normal operation of the oil delivery system would result from periodic maintenance required for the pipeline route and would be the same as those discussed previously. Oil spills would also occur from the pipeline system as described in Section C.2. However, since the oil distribution pipeline to be used for Bayou Choctaw expansion is the same as for the early storage development, no additional pipeline maintenance activities or spill risks are attributable to site expansion.

Accidental Oil or Brine Release

The potential for oil or brine spills during project operation is described in Appendix E; expected annual spill volumes by mode of operation and by geographical location are summarized in Section C.2, particularly Tables C.2-1 through C.2-9. In the event of an oil or brine spill, the expected movement from various spill locations, the weathering processes likely to occur, and the potential for water quality degradation are described in Sections C.4.3.2.2 and C.6.2.2.2. This section treats some of the biological effects which can occur as a result. A more complete treatment is given in Appendix D.

The information on frequency and volume of expected oil and brine spills for Iberia dome, Bayou Choctaw expansion, and early storage development of Weeks Island and Bayou Choctaw was summarized in Section C.6.2.2.2.

Brine spills could occur only from the piping system at Bayou Choctaw and south along the disposal pipeline corridor. Total spillage is estimated to be 24 barrels from site expansion and 49 barrels from early storage facilities. The maximum credible spill event is estimated to be 30,000 barrels of brine.

Frequencies of spills are also given in the summary tables. Except for transfer spills, all modes of spills are expected to be fairly infrequent. The recurrence interval calculated (Appendix E) for pipelines is 41 years for spills greater than 1000 barrels. For brine spills, there is a 98.5 percent chance of having no spills during the project lifetime for Bayou Choctaw expansion.

Because of the design safeguards provided in the storage system and the relatively infrequent spill expectation, the potential biological impact from small, chronic oil spills at the Bayou Choctaw storage site is expected to be small. The wellheads at Bayou Choctaw would be diked to contain major spills.

Description of typical oil spill impacts to biota are provided in Section C.4.3.2.5. No additional oil spill exposure occurs along the oil pipeline corridor to St. James.

The impacts to biota due to normal operations of the Bayou Choctaw storage site are expected to be rather small. Even in the case of occasional small oil spills, impacts are not expected to be widespread or serious. However, depending on the specific conditions, including location, season, volume, and spill control effectiveness, a large oil spill may have a serious impact on the biota in the local environment. Furthermore, cumulative spill effects due to development of the full 289 MMB Capline Group capacity may be locally significant, especially at inshore transfer sites.

A pipeline spill would likely have the most intensive, localized biological impact. The recurrence interval of an oil spill greater for 1000 gallons, even with oil left in the line during standby storage is 41 years so that it is likely that no large spills would occur during the lifetime of the SPR project.

The small spills accompanying oil transfer operations constitute the vast majority of all spills expected from the SPR program. With appropriate deployment of booms and other oil recovery equipment, effects should be very localized.

Several scenarios were described in Section C.4.3.2.5 to evaluate potential effects of maximum credible spills for various oil spill modes. These scenarios apply to spill exposures caused by expansion of the Bayou Choctaw site.

In summary, it may be concluded that the very low frequency of oil and brine spills indicates that chronic biological impacts should generally not be experienced. Very large spills are fairly improbable and represent a small likelihood of regionally significant adverse impact, but the impact potential is fairly large depending on spill location. Except for the case of a large oil spill in the gulf or lower Mississippi River being transported to near shore waters and coastal bays prior to recovery, adverse impacts should not be of regional significance.

Alternatives

Construction of a pipeline for brine disposal in the Gulf of Mexico would increase the potential for brine spills due to the increased pipeline length and would expose additional areas of wetlands to possible brine spills. During operation, the discharged brine and its components would have similar impacts to organisms in the region of the Gulf diffuser sites as described for the Chacahoula site (C.7.2.3.5). Also, ROW maintenance impacts would be significant (approximately 422 acres, Table A.6-2). Construction of a brine disposal well field along the raw water supply pipeline ROW would reduce maintenance requirements and oil spill potential by about one third.

C.6.2.2.6 Natural and Scenic Resources

Normal operation of the Bayou Choctaw site and associated facilities is not anticipated to bring additional impacts on scenic, recreational, or natural resources. In some cases the impacts would be reduced during this stage as some areas at the storage site and along the pipelines would be allowed to revegetate.

The potential does exist for oil spills in the process of transporting oil to and from storage. Spills from the oil pipeline between the terminals and Bayou Choctaw are not attributable to Bayou Choctaw site expansion.

Brine spills could degrade scenic and natural resources along the 3.9-mile brine disposal pipeline leading from Bayou Choctaw to the south.

A decision to generate power onsite would cause substantial hydrocarbon emissions and possibly require a 200-foot stack on-site which would be visible from populated areas to the east.

C.6.2.2.7 Archaeological, Historical, and Cultural Resources

Following construction, none of the operational characteristics of any of the facilities are expected to negatively impact any of these resources.

C.6.2.2.8 Socioeconomic Environment

Land Use There would be no additional impacts on land use during operation. The land at the site would already have been converted to developed use during construction. Some of the land disturbed during construction would be allowed to revegetate.

Transportation Less traffic related to the project would be generated during operation than during construction. A considerably smaller crew (25 to 39 employees) would be necessary to carry out fill and storage activities; however, their movements would not be significant in comparison to current traffic volumes on county roads. The total traffic volume on these roads is expected to remain far below capacity.

Population The operation of the storage site would have some effect on population in the surrounding area. The project would have a total of 39 employees on-site in three shifts during fill and withdrawal operations. During standby operations, only about 25 employees would work at the site. Most of these workers may come from the existing labor pool in the parishes surrounding the site. Even if all the employees were to migrate to the area with their families, the impact on the local population would not be significant; however, lack of housing is likely to spread any immigration over several towns in the area (most likely Baton Rouge).

Housing Project operation would have a minimal impact on housing. Many of the workers employed are expected to come from Baton Rouge.

Economy The operation of the SPR project would have a significant positive effect on the economy of the region. Supplies for some operations may be purchased from existing petrochemical and service industries near Baton Rouge. In some local areas such as Plaquemine, small effect would result from the increased purchases by employees. Maintenance and operation of the project would require a small work force relative to construction. Most of the workers are expected to come from the nearby Baton Rouge labor pool, although a few may relocate in the Plaquemine area for the duration of filling (approximately three years).

During filling and withdrawal operations, only about 39 employees would work at the storage site. This would decrease the employment opportunities available at the site compared to construction. Employment income from the project would average $68,000 per month during the filling and withdrawal phase. Most of this income is not expected to stay in Iberville Parish for the three years of filling.

During standby operations, income would average approximately $44,000 a month for the 25 employees. This income is not expected to be sufficient to stimulate the local economy due to the wide area over which the employees would spend the wages.

Purchases in the region during operations could provide an insignificant economic stimulus. To the extent these purchases are made in Iberville Parish, they would provide a minor stimulant to the local economy.

Urban Services The operation phase of the SPR project would have an impact on police and fire services similar to that of the construction phase. Except in case of a major accident, no use of such services is anticipated. Fire fighting equipment would be available onsite.

No adverse impact on health services are expected during normal operations. Large scale accidents could easily overwhelm available services in the area, however.

The small number of workers and their families with children that may relocate in the area would have no significant impact on schools.

Operation of the storage facility would continue the loss of tax revenues begun during construction.

Oil Distribution, Raw Water Supply, and Brine Disposal Systems

Land Use The operation of the oil, water, and brine systems would have no additional impact on land use. In some areas natural vegetation or crops may be allowed to be re-established. Large trees would not be allowed within the system maintenance right-of-way, however (Table A.6-1).

Transportation During normal operations the oil, water and brine systems would not affect any transportation systems in the region. In case of pipeline breaks, leaks, or other unexpected accidents, some temporary effects on transportation could occur; but these would be so temporary, they should be considered insignificant.

Population Operational impacts of the oil, water, and brine systems is anticipated to be negligible. The few workers required for maintenance are expected to come from the local labor pool.

Housing Because no significant change in population size or location is expected, housing is unlikely to be impacted.

Economy Operation of the pipeline systems would have an insignificant effect on the local or regional economy. The few workers required would generate slight additional income for the economy, but this would be minor compared to current economic activity.

Urban Services Except in the case of a pipeline accident, no urban services would be required by the pipeline facilities. If an accident occurred, some use of local hospitals could be necessary.

Alternatives

No significantly different type or degree of socioeconomic impact is expected to result from operational use of alternative facilities. Use of water supply and brine disposal pipelines to the Gulf would require removal of significantly more land from local tax rolls; also, a few more employees would be needed for routine maintenance and system repairs.

C.6.3 Impacts of Development of Iberia

C.6.3.1 Impacts of Site Preparation and Construction

The following section describes construction impacts for storage site facilities at Iberia dome and for related pipelines. Construction impacts of terminal facilities are described in Section C.3.

C.6.3.1.1 Land Features

Proposed Facilities

Quantities of material to be excavated or filled and acreages of land to be affected by grading and other construction activities at the Iberia dome and along pipeline routes are listed in Table A.6-1.

Grading at the Iberia storage site would be confined to about 49 acres, of which a large portion would occur in areas used for agricultural purposes. Plant area, cavern wellheads and containment dikes, cavern wellhead roadways, and other site construction would require 79,500 cubic yards (cy) of fill and 16,000 cy of excavation.

Pipeline and wellhead pad construction would temporarily disturb 241 acres of land and require 355,000 cubic yards of earth excavation. Before revegetation of disturbed areas is complete, some erosion of the soil may be expected.

Leaching of 6 storage cavities in the Iberia salt dome would involve removal of about 50 MMB of salt by leaching for disposal in deep salt water bearing sands. This is equivalent to as much as 10×10^6 cy of salt. Sufficient wall thickness would be maintained between cavities to maintain cavern integrity (Section A.3.2.12).

Excavation along the pipeline routes, except where canals are necessary through the marsh, is primarily short term.

Alternative Facilities

Quantities of material to be excavated or filled and acreages of land to be affected by grading and other construction activities at the Iberia dome and along pipeline routes are listed in Table A.6-3. Obtaining water from Lake Fausse Pointe would substantially increase the amount of land and soil excavated. Use of the Gulf of Mexico for brine disposal or raw water supply would greatly increase excavation quantities above what is proposed. Construction of a brine disposal pipeline to the Gulf of Mexico diffuser would require a 20.1-mile on-land pipeline over which 117 acres of cleared land, 66 acres of deciduous swamps, and 13 acres of marsh would be altered. Approximately 233,000 cy of soil would be displaced for the onshore portion of the pipeline and the excavated material reused for backfill. Approximately 196 acres would finally be affected along the onshore portion of the pipeline right-of-way. Alteration of existing land features would only be temporarily affected providing recontouring and revegetation is carried out. Construction of an onsite power plant would moderately increase the amount of land disturbance. An alternative crude oil distribution pipeline would provide a more direct route to the terminal at St. James.

C.6.3.1.2 Water Resources

Site preparation and construction of the proposed facilities at Iberia may directly affect Bayou Tete, which passes over the dome, Lake Fausse Pointe, Weeks Bayou, Bayou Teche, the ICW near Weeks Island, and ground water aquifers. Potential impacts are treated according to specific aspects of facility development.

Construction of Storage Site Surface Facilities

Construction at Iberia would require 16,000 cy of excavation, 79,500 cy of fill and 49 acres of direct land disturbance (Table A.6-1).

Sediment represents the major nonpoint source of water pollution on most construction sites, especially on those which require extensive grading. Sediment includes solids and organic materials detached from the ground surface by erosion and carried into the drainage system principally by runoff. The introduction of sediment into various natural bodies of water and the associated turbidity and deposition of solids result in numerous adverse physical, chemical, and biological effects. Suspended sediment uitlimately reduces the storage capacity of waterways, increases flooding hazards, fouls and destroys aquatic habitats, diminishes recreational and property values, and enhances the transport of other harmful pollutants such as human and animal sanitary wastes, pesticides, and petrochemicals.

The site preparation and construction activity at Iberia dome would involve a significant amount of earth movement. Approximately 95,500 cubic yards of earth would be displaced during this process and approximately 49 acres of land would be disturbed. The land overlying the dome is a mixture of farmlands and woods. Because of the high level of annual precipitation encountered in the region, a significant amount of sediment may be transported from the disturbed surface areas into the surrounding surface water system. This sediment should pass into Bayou Tete adjacent to the dome. Some of the sediments might move into Lake Fausse Pointe (Figure A.6-7) which is located about 6 miles east of the site. Standard engineering practices such as interceptor ditches, dikes, and sedimentation ponds would be utilized where necessary to prevent any significant degradation of water quality due to plant site runoff.

Numerous solid and liquid products, both organic and inorganic, used in construction are a source of water pollution. The major sources of construction-related chemical pollution can be broadly grouped under the following headings:

- Petroleum products
- Herbicides and pesticides
- Fertilizers
- Metals
- Soil additives
- Construction chemicals
- Miscellaneous wastes

A description of the potential sources of these pollutants and how they may be introduced into the environment is included in Section C.4.3.1.2.

Prediction of the impact of such chemical and biological contaminants is quite difficult because of the human element involved. Assuming that effective waste management procedures are observed and that personnel are properly indoctrinated, the impact on the water environment should be minimal.

Raw Water Supply System Construction

Effects on Water Source The proposed source of raw water for leaching the Iberia SPR facilities during the mining cycle is Bayou Teche. Water would be obtained through a 1.5 mile pipeline terminating at an intake structure on the north bank of the channel about four miles upstream from Jeanerette and 1.5 miles downstream from Olivier (Figure A.6-7).

The water would be supplied from an intake structure on Bayou Teche through the 1.5 mile pipeline. The average water supply rate during the mining cycle would be 640,000 barrels per day (B/D), or approximately 42 cfs. The average daily flow of the bayou is about 500 cfs as discussed in Section 4.2.2.1.1. The amount of water withdrawn would constitute about 8 percent of the average flow of Bayou Teche. Therefore water supply (and water quality) impacts would be slight under typical flow conditions. However, a minimum flow of zero has been recorded several times during the 17-year period of record. Under such extreme low flow conditions, the withdrawal of water during the leaching period might not be possible.

Pipeline Construction Effects Construction of the proposed raw water supply system would include the installation of 1.5 miles of buried pipeline between the plant area and the intake structure on Bayou Teche (see Section A.6.3.4.1), using installation techniques as described in Section A.3.4. No water ways would be crossed by the raw water pipeline (Figure A.6-7).

Water quality impacts of constructing pipelines could include changes in water-flow patterns, BOD, dissolved oxygen, pH, nutrients, heavy metal concentrations, salinity, and turbidity. Since the raw water line would pass through agricultural land, these effects would be minimal. The raw water supply pipeline would be constructed using conventional pipe-laying methods and would involve the excavating of 8,000 cubic yards of material at the rate of about one-half mile or 3000 cubic yards per day.

Impact of Brine Disposal System Construction

Effects on Receiving Aquifers The proposed method for brine disposal is by emplacement in sands containing saline water. This can impact ground water supplies in various ways including increasing the salinity portion of the injection sands into fresh water portions of the same sands, or inducing migration of brine or moderately saline water from the injection sands into a fresh water aquifer via such avenues as abandoned wells or faults.

The proposed receiving formations for injection of brine at Iberia range in depth from 5,000 feet to 7,000 feet, well below any aquifers containing fresh or slightly saline water. The increase in salinity, therefore, would be restricted to water that would not be economically competitive for desalination due to the large quantities of fresh and slightly saline water (1000 mg/l to 3000 mg/l) available in the region.

The likelihood of the occurrence of problems caused by abandoned wells is small because generally the only wells extending to the depth of the injection zone are oil wells whose locations are usually well documented.

In certain geologic provinces where the rock is under stress it may be possible to generate earthquakes or activate faults by high pressure injection of fluids. However, in southern Louisiana, the geologic formations are not in a state of stress and are relatively permeable; thus, they provide the path of least resistance to flow, in preference to flow along faults. Standard operating procedures and routine monitoring of injection wells should preclude hydrofracturing. In addition, the extremely dense brine would tend to move down dip in the receiving formation; the relatively slow movement would not induce mixing with the fluids already present in the formation.

It may thus be concluded that no adverse impact on water quality would occur from the use of deep well injection as the method of brine disposal. Additional site-specific studies would need to be conducted to confirm the technical feasibility of injecting brine in the proposed quantities, however.

Pipeline Construction Effects Construction of the proposed brine disposal injection well system would require installation of 1.5 miles of buried pipeline between the plant area and the wellheads southeast of the dome (Figure A.6-7). A permanent roadway would be constructed to each wellhead; therefore the 23,000 cubic yards of required excavation would be performed using conventional techniques. As no major water bodies or other sediment transporting waterways would be crossed by the system, only minimal impact on water quality due to sediment release and drainage from spoil would be anticipated.

Impact of Oil Distribution System Pipeline Construction

Construction of the proposed oil pipeline would require that 14.6 miles of pipe be installed to Weeks Island. The existing Weeks Island to St. James pipeline would transport the oil to or from the terminal. The proposed oil distribution pipeline would follow the route of the water supply pipeline between the site and Bayou Teche. The oil pipeline route would then cross Bayou Teche and proceed generally southwest and south toward Weeks Island. Further to the south, the oil pipeline route would cross Little Valley Bayou and Stumpy Bayou. Between Stumpy Bayou and Weeks Island, the proposed oil pipeline route would traverse a low lying region labyrinthed by numerous interconnecting bayous and tidal creeks which drain into Weeks Bay (Figure A.6-1). The primary water courses crossed by the pipeline route within this region are Bayou Patout, Warehouse Bayou, and their feeder channels. Weeks Bay is located to the west of Weeks Island and the north of Shark Island, and constitutes the northeast portion of larger Vermilion Bay.

Between the site and Bayou Teche, the impacts resulting from construction of the oil pipeline would be the same as for the raw water pipeline, previously discussed. For pipeline construction from Bayou Teche to Weeks Island, a total of 324,000 cubic yards of sediments would be excavated in this region, potentially releasing 10 acre-feet of interstitial water to the surrounding water bodies. Potential construction effects on the local water quality would be similar to those discussed in Section C.4.3.1.2. The effects would be locally severe but temporary, and not of significance to the region.

Accidental Brine Release

The estimated quantity of brine spilled during leaching of the Iberia cavities is 23 barrels onto lands crossed by the pipelines leading to the disposal wells. Water quality impacts should be negligible. Maximum credible spills of up to 30,000 barrels are considered possible, though highly unlikely (see Appendix E). Such spills could have very serious effects on local water quality, vegetation, and wildlife.

A brine spill at the site or along the disposal pipeline could locally impact the water quality in the upper unit of the Chicot aquifer. The brine would tend to migrate downward within the formation and downdip along the formation due to density differences. A massive spill, although highly unlikely, could possibly impact the quality of municipal water supplies pumped from aquifers in the area by causing increased salinities in those aquifers. However, as the Chicot aquifer is contained by a 100-foot layer of clay and silt, potential spills from the membrane-lined brine pit or from the pipeline are likely to have negligible impact on water quality.

Storm surge studies conducted by the U.S. Army Corps of Engineers indicate that the 100-year flood elevation at Iberia is +13.5 feet MSL (Roy, personal communication). As the brine pond would be protected by a levee of minimum elevation +20 feet MSL, there is little likelihood of a catastrophic failure resulting in release of up to 100,000 barrels of brine.

Construction of Alternative Facilities

Alternative systems to provide raw water for cavern leaching include use of Lake Fausse Pointe, withdrawal from the Gulf of Mexico, and pumping of moderately saline ground water. An alternative brine disposal method is disposal in the Gulf of Mexico through a diffuser. A more northerly crude oil distribution pipeline route would connect with the Weeks Island-St. James pipeline near Napoleonville.

Alternative Raw Water Source - Lake Fausse Pointe Lake Fausse Pointe would be reached via a 7.3 mile pipeline to an intake structure east of the storage plant area at the mouth of Bayou Teche (Figure A.6-7). Withdrawal of the required 42 cfs of water would have a negligible effect on the water quality or quantity of the lake.

The pipeline connecting the intake structure to the plant would be installed using conventional pipelaying methods. About 42,000 cubic yards of material would be excavated for pipe installation. The area affected by the action would be about 71 acres.

Alternative Raw Water Source - Gulf of Mexico A pipeline to a raw water intake on the coast of the Gulf of Mexico could supply the raw water requirements of the Iberia site with insignificant effects on the quantity or quality of water in the Gulf of Mexico. Pipeline construction effects would be more significant than for other alternatives. A 22 mile-long pipeline utilizing conventional, push-ditch, flotation canal and conventional pipelaying installation could have an estimated total on-land excavation of about 233,000 cubic yards. Releases of interstitial water could total 8.2 acre-feet, affecting as much as 200 acres of nearby wetlands.

The pipeline would be installed adjacent to the oil pipeline right-of-way, which crosses Bayou Teche, and goes south/southwest to Weeks Island. The brine disposal line would then extend to the south; the intake would be located in West Cote Blanche Bay south of Weeks Island (Figure A.4-1).

Alternative Raw Water Source - Ground Water Ground water from aquifers in the site vicinity is an alternative source for leaching water. In the event constraints were placed on use of surface water it would be possible to install large capacity wells in the lower unit of the Plaquemine aquifer and pump the required quantities of moderately saline water (3,000 to 10,000 milligrams per liter dissolved solids) for leaching of the storage cavities and for displacement of oil from storage. Leaching operations would require water over a three year period at a rate of about 18,700 gpm.

Impacts that might result from withdrawal of such large quantities of water include lowering of the piezometric level in the pumped zone, land subsidence, and intrusion of the pumped zone by waters of different salinities. Land subsidence and salt-water intrusion result directly from drawdown or reduction of the piezometric level in the aquifer. This in turn depends upon such factors as pumping rate, well spacing and completion, and aquifer thickness. With due consideration to well spacing and completion methods and given the great thickness and high permeability of sands containing moderately saline water in the site vicinity, it should be possible to provide the required quantities of water with less than 100 feet of drawdown in the vicinity of the well field. Data provided in publications by Pettit and Windslow (1957), Hammond (1969), and Sandeen and Wesselman (1973) indicate that about one foot of subsidence results from 100 feet of drawdown in the Texas coastal area. However, there is apparently no documented evidence of subsidence associated with ground water withdrawal in the Capline project area. This may be partly due to the relative lack of development of ground water resources in the area. The impact of those ground water withdrawals on water quality would be primarily an increase in salinity of the water in the production zone. This would be due to a decrease in pressure inducing migration from underlying more saline zones. The increase in salinity can be minimized by proper spacing and completion of wells. In addition, the proposed production zone contains moderately saline water (3,000 to 10,000 milligrams per liter dissolved solids) which is not economically attractive for desalination because of the large quantities of slightly saline water (1,000 to 3,000 milligrams per liter dissolved solids) available in the site region.

Construction of the well field would require a total of 3.7 miles of pipeline trench, with 19,500 cubic yards of excavation.

<u>Alternative Brine Disposal System - Gulf of Mexico</u> On-land construction of a brine disposal pipeline would affect stream, bayou, and marsh water quality, since it would have eight water crossings. Runoff from the spoils could affect adjacent surface waters by causing eutrophication from nutrient runoff, high turbidity, lowered pH and dissolved oxygen, and increased heavy metal and pesticide concentrations. In the sluggish streams and bayous, sedimentation and altered water

flow could occur. Surface drainage patterns and rates may also be altered. After backfilling, appropriate measures to prevent erosion would be required. In addition, a 32.1-mile offshore pipeline would be constructed through the shallow waters of West and East Cote Blanche Bays, terminating in 20-feet of water in the Gulf 11.5 miles south of South Point, Marsh Island. The same brine diffuser location as planned for Weeks Island SPR expansion (Section C.5.2.1) would be used. Potential impacts to offshore water quality due to construction would include dredging for laying pipe and disposal of brine used in leaching. The impacts would be similar to those described in Section C.5.2.1.

Alternative Crude Oil Distribution Pipeline A 39-mile pipeline would extend from Iberia to the existing Weeks Island-St. James pipeline near Napoleonville. Approximately 449,000 cubic yards of material would be excavated while crossing 68 acres of agricultural land, 87 acres of bottomland forest, 177 acres of swamp, and 116 acres of open water for a total acreage of 448 acres. This pipeline would follow the alternative raw water pipeline right-of-way to Lake Fausse Pointe (7.3 miles). It would then cross Lake Fausse Point and the Atchafalaya Basin Channel (4.5 miles under water), 3 miles of bottomland forest, and 3.2 miles of swamp forest to reach an existing crude oil pipeline right-of-way near Little Pigeon Bayou. The new pipeline would parallel the existing pipeline to Napoleonville, through 9.7 miles of swamp forest and 6 miles of bottomland forest. This pipeline would run through the heart of the Atchafalaya Basin and would cross several major water bodies such as Lake Fausse Pointe, the Atchafalaya River, and Bayou Plaquemine. Many other smaller creeks and bayous would be crossed by this route.

C.6.3.1.3 Air Quality

During site preparation and construction, the air quality impacts for expansion at Iberia would be very similar to the air quality impacts for Napoleonville as described in C.4.3.1.3. Construction impacts associated with development of early storage capacity at Bayou Choctaw and Weeks Island are given in FES 76-5 and 76/77-8.

All downwind concentrations due to construction would be well below state and national air quality standards. However, since background HC levels often exceed the 3-hour standard in southern Louisiana infrequent additional exceedances may be expected. All construction impacts would be short-term in nature and confined to a relatively small area.

Alternatives

Use of alternative sources of raw water would have some effect on construction emissions. Development of a ground water well field east of the site would increase drill rig emissions by an estimated 50 percent. Construction of a 7.3 mile pipeline to Lake Fausse Pointe would increase pipeline emissions by roughly a factor of 5 compared to use of Bayou Teche. Construction of a 22.1 mile pipeline to West Cote Blanche Bay would increase total emissions by a factor of 15, though they would not be concentrated in any one area for more than a few days.

Construction of a 52.2-mile pipeline for brine disposal in the Gulf would replace a significant source of continuous emissions at Iberia (well field drill rig emissions) with emissions associated with pipeline construction dispensed over a wide geographical area.

Construction of a 39 mile oil distrubition pipeline would approximately double the emissions from those of the proposed pipeline.

C.6.3.1.4 Noise

The following sections describe the analysis of possible construction impacts on noise levels near the Iberia site associated with SPR development. Noise levels associated with the major construction equipment are specified. Using hemispherical sound radiation assumptions, the noise levels are extrapolated to nearby locations off the site to determine the effect on ambient sound levels. Terminology used in this section is defined in Appendix B.2.4.

Noise Sources

Drilling New Cavity Entrance and Brine Disposal Wells Conventional oil well drilling rigs would be used for drilling the new cavern entry wells. It is estimated that two large drill rigs may be operating simultaneously on the site. The equivalent sound level, L_{eq}, contribution of this activity is estimated to be 67 decibels (dB) at 500 feet. Assuming that drilling activity is continuous throughout a 24-hour day, the daytime and nighttime equivalent sound level L_d and L_n contribution to ambient noise levels are both estimated to be 67 dB at 500 feet. Development of each storage cavern would require 60 to 90 days of rig time, brine disposal wells would require 30 days of rig time. Assuming 6 new cavern wells and 21 disposal wells, drilling operations would last 360 to 540 days.

Activities associated with conversion of existing caverns to storage facilities would contribute negligibly to ambient sound levels.

Leaching of Cavities Leaching is accomplished by pumping raw water into the drill holes and displacing the resulting brine. The major noise sources associated with leaching are pumps. These pumps would be housed within a sheet metal pumphouse. Outdoor pump sound levels add negligibly to the ambient sound at 500 feet, due to wall attenuation at the pumphouse.

Construction of Support Facilities Facilities to be constructed on the site include the main pump building, control building, warehouses, laboratory, offices, surge ponds, oil tanks and oil and water metering equipment. Access roads and on site piping would also need to be constructed. The sound levels associated with equipment used for construction of the facilities are summarized in Table C.4-3. The equivalent sound level, L_{eq}, contribution at 500 feet is estimated to be 68 dB. Since construction would take place for 10 hours per day, a daytime equivalent sound level contribution of 66 dB at 500 feet is estimated.

Pipeline Construction Raw water supply, brine disposal and crude oil distribution would require construction of pipelines. Three basic techniques can be used for pipeline construction: 1) flotation canal method; 2) push-ditch method; and 3) conventional dry method. Typical equipment and the sound levels associated with each of these methods are presented in Table C.4-4. Since various methods would be employed for specific section of the pipeline, a conservative estimate is made. An L_{eq} of 69 dB at 500 feet and a L_d dB at 500 feet is estimated for pipeline construction.

Roadways would be constructed along the pipeline rights-of-way and landfill would be required. It is assumed that two dump trucks and one bulldozer would be used for this road construction. Table C.4-5 presents sound levels and usage factors for the equipment. The L_{eq} is estimated to be 68 dB at 500 feet; the daytime equivalent sound level, L_d, assuming construction activity takes place 10 hours per day is 66 dB at 500 feet.

Summary of Construction Noise Sound levels from construction activities presented above are summarized in Table C.6-3.

Ambient Sound Levels During Construction of Proposed Facilities

Major construction activities would occur at the Iberia SPR site and along the pipeline route to Weeks Island, the brine disposal well field and the raw water supply source at Bayou Teche. Since no site-specific prefacility ambient noise levels are available, the estimates discussed in Section B.5.3.4 are used. It is assumed that within the site area, the prefacility ambient day/night sound level, L_{dn}, is on the order of 53 dB. This is a conservatively low estimate. Construction activity noise levels are extrapolated using hemispherical sound radiation to determine the distance to which construction activity would contribute significantly to the ambient sound levels. Within a circle defined by this radius, with its center at the center of the activity, (or in the case of pipeline construction, within a corridor width along the pipeline defined by this distance), average day/night sound levels would be increased by at least 3 dB, a discernable amount. These distances are presented in Table C.4-9. The assumption of hemispherical radiation does not account for attenuation due to foliage, air, or ground effects, and is therefore conservative. Furthermore, populated areas would probably have prefacility day/night sound levels higher than 53 dB, and therefore the impact zones at these locations would be appreciably smaller.

Since pipe laying and access road construction progresses along the pipeline route at approximately one-half mile a day, areas would be impacted for only a short duration. Since most of the pipelines run through uninhabited marshlands, the impact would be negligible.

TABLE C.6-3 Summary of Construction Noise Impact Iberia Dome SPR Development

Area	Activity	Impact Zone Radius (feet)[a]
Iberia Dome	Drilling new wells	5000
	Support facility construction	2000
Pipeline Routes	Laying of pipes	1800
	Access road construction	1600

The state of Louisiana has no noise regulation limiting the proposed activity.

The U.S. Environmental Protection Agency has identified that annual day/night average ambient sound levels below an L_{dn} of about 55 dB do not degrade the public health and welfare. Within the impact zone, the L_{dn} would be above 55 dB during construction activity. Since there are no residences within the impact area for the site, these impacts will be negligible. There are no structures within the impact zone of the brine disposal field and the pipeline.

Noise impacts due to pipeline construction would be most significant where the oil pipeline crosses the Bayou Teche. An excess of 50 residences would be exposed to sound level increases of more than 3 dB for periods of up to 1 week.

Ambient Sound Levels During Construction of Alternate Facilities

Construction of either the brine disposal or raw water supply pipeline to the Gulf would produce elevated noise levels for more than one hundred residences, particularly in the vicinity of Bayou Teche. Duration of impacts would be less than one week.

Construction of the raw water supply wells along the pipeline route may elevate noise levels at 100 or more residences along Bayou Teche over a period of 3 weeks to one month. As some of the wells would be drilled on agricultural land, noise attenuation due to vegetation would be negligible.

Construction of the 39-mile oil distrubition pipeline would pass through largely unpopulated areas which would not be noise sensitive.

C.6.3.1.5 Impact on Ecosystems and Species

Salt Dome Development

Development of the Iberia site would involve several impacts on the biota of the area. These impacts include loss of terrestrial and aquatic habitats, increases in turbidity, and indirect effects on fish and wildlife due to force migration, noise, and human disturbance. The total area involved for each habitat is presented in Tables A.6-1 and B.5-3.

Approximately 48 acres of pasture and 1 acre of bottomland forest would be used for onsite development. Grading 48 acres to a depth of up to one foot would also severely impact any small invertebrates in the surface vegetation and topsoil. Populations of nematodes, mites, collembola (springtails), insect larvae, spiders, and oligochaetes (worms) would be destroyed. Secondary productivity by these groups, while unknown exactly for the site, is probably moderate due to the characteristic of gradual nutrient turnover in the habitat. Loss of primary and secondary terrestrial production would be localized but permanent.

If construction is completed relatively early in the growing season a plant community (pasture grass) would become established within several months. This vegetation would help retard runoff, thereby reducing soil erosion and associated turbidity. It would also serve as cover and a source of food for some species of birds, small mammals, and other wildlife which frequent areas of human activity.

Approximately 49 acres of wildlife habitat would be lost due to grading associated with site development within the fenced 160 acre storage site. Habitat types to be affected include cleared land, existing oil field development and bottomland forest. Since 160 acres at the site will be enclosed by fencing, it can be assumed that, except in the case of avifauna, the available resources provided by the habitat would be permanently lost to many other wildlife groups. Species likely to be affected by construction are mentioned in Section B.3.5.

Wildlife species to be directly affected by construction would be minimal but might include non-mobile species of small rodents, amphibians, and reptiles. Direct effects on resident wildlife (small mammals, birds, amphibians, and reptiles) would vary depending on whether or not construction occurred during the nesting season. Direct effects of the construction (other than death resulting directly from construction activities) include permanent habitat loss (loss of food, cover, nesting and breeding areas), forced migration of resident wildlife, and animal loss resulting from increased activity and road traffic.

Indirect effects of construction include impacts on wildlife of forced migration, increased noise, and human disturbance. The effects of migration would be dependent upon the availability of resources in an adjacent habitat. Critical factors include availability of space, protective cover, food, and the status of existing animal populations. Noise and human disturbance during construction would discourage wildlife within the area by the species as noted in Table B.2-15 under the appropriate habitat types to be affected. Upon completion of construction activities, some wildlife species are likely to return to the impacted area. However, due to the extensive fencing planned for the area, some wildlife species would be permanently displaced.

Earth moving activities for leach pad construction, roads, and other construction operations would increase turbidity and add nutrients to Bayou Tete. Increases in turbidity from construction would affect most of the surface water onsite by decreasing light penetration and hence possibly reducing plankton production. However, an influx of nutrients from the sediments and fill could increase phytoplankton, periphyton, and macrophyte production in areas not buried by fill, thus mitigating the effects of reduced light levels on plant productivity. Community composition also could be affected since different species have different physiological tolerances and ecological dependencies.

Brine Disposal

The proposed brine disposal system would include 4.4 miles of pipeline, associated roads, disposal well pads and other construction operation covering a total of 55 acres (see Section A.6 and Figure A.6-7). Nearly all of the construction would occur on agricultural lands. The total area involved for each habitat is presented in Table B.5-3. For the brine disposal system, 48 acres of cleared land (agricultural) and 7 acres of bottomland forests would be affected.

The elimination of the cover vegetation within the pipeline right-of-way is expected to have a negligible short term adverse impact. In efforts to reduce this impact, disturbance to natural plant communities adjacent to the proposed pipeline right-of-way would be avoided.

Clearing of the cover vegetation and removal of topsoil from the proposed pipeline right-of-way would cause several secondary impacts. Most important of these is a decrease in productivity of forage material within the right-of-way corridor. Another impact results from altering the composition of the vegetation community; an example is the "invasion" of the right-of-way by low-productivity "decreaser" plant species having little or no forage value. In addition, clearing and/or spraying the right-of-way would have the secondary effect of increasing the fire danger due to drying out the brush and increasing human activity. Restoring the topsoil and reseeding the right-of-way with native grasses would serve to minimize the impacts of construction. It is likely, however, that agricultural activities will be initiated soon after construction is completed.

Human activities, construction, and the release of dust, dirt, and fumes would most likely cause the migration of resident wildlife species from the direct impact areas due to loss of protective cover, and feeding, breeding, and nesting areas. Some animal losses are expected from the direct and indirect effects of pipeline construction. Animal losses are expected to be greatest among the small rodents and other less mobile wildlife species. The potential losses resulting from pipeline construction would be greatest during the major nesting and young-bearing season.

The effects of pipeline construction on wildlife in cleared land habitats are expected to be minor and short term. Most of the wildlife species commonly found in cleared lands are able to survive despite fluctuating conditions and altered habitats. Some loss of the less mobile species is expected during construction. The temporary loss of habitat and resources provided by that habitat would probably last 6 months to 1 year in oil field and pasture areas. Other areas (urban and industrial) would probably require less recovery time.

Raw Water Supply

The proposed raw water supply system from Bayou Teche has a 1.5 mile long pipeline which will use 15 acres of farmland (Table B.5-3, Figure A.6-7). Since all of the area used by this system would be on cleared land, the terrestrial impacts would be minimal in these areas, though of the same type as those discussed for the brine disposal system.

The primary aquatic effects related to the raw water supply system would be the entrainment of plankton, drifting invertebrates, and larval fish from Bayou Teche, and the impingement of juvenile fish on the intake screen. Entrained organisms would be lost since they would be unable to withstand the high salinity within the cavities. Assuming an even distribution of entrainable organisms, about 10 percent will be lost, based on an average daily flow in Bayou Teche of 500 and a maximum intake rate to the storage site of 18,700 gpm (42 cfs). This would impact no more than one mile of the Bayou; therefore, the overall impact would be moderate to low for the overall system.

The impingement of aquatic organisms on the intake screen would be primarily limited to juvenile fish (usually less than about 4 inches long). Since all of the impinged fish would be returned to the bayou, it is likely that many would survive. The actual survival rate would depend on flume design, and location and operating procedures used for the intake structure. Assuming that the intake structure is not located in the vicinity (or just downstream) of major fish spawning areas, the impact probably would be small.

Increased turbidity caused by higher flow velocities in Bayou Teche may decrease stream productivity and further stress fish and benthos populations. Present water quality is already turbid, thus minimizing possible adverse impacts.

Oil Pipeline Construction

The proposed oil pipeline from Iberia to Weeks Island would parallel the raw water line to Bayou Teche then go south/southwest to highway LA 83, then south to Weeks Island. A total disturbance of 170 acres would be required over a distance of 14.6 miles, 40 acres of swamp forest, 39 acres of marsh land, 1 acre of open water, and the remaining 90 acres of agricultural land.

The effects of pipeline construction on wildlife at river crossings would be minimal and temporary. Construction activities would force most wildlife away from the crossings. Most mammals, birds, and herpetofauna would return to the area once human activities decrease.

Permanent loss of habitat is expected in the wooded bottomlands and swamps. Brush and trees would be completely removed within the right-of-way in these areas. This removal would result in a loss of habitat, feeding areas, protective cover, and nesting areas for woodland species. Arboreal species of wildlife and woodland perching and nesting avifauna would be adversely affected. Some species within these grouping include the squirrels, raccoon, opossum, broadheaded skink, eastern gray treefrog, red-tails and red-shouldered hawks, other hawks (Buteo spp.), owls, and most passerines (Appendix B, Table B.2-18). The loss of feeding areas would be permanent for some species (i.e., squirrels); however, once recovery of grasses, shrubs, and emergent macrophytes takes place, the area may provide a food source for some wildlife species. Loss of protective cover and nesting areas in the pipeline right-of-way in bottomland woods and swamps would be permanent for most species of wildlife unless dense stands of tall, herbaceous vegetation are permitted to remain.

A positive factor derived from construction is the creation of an "edge effect", a transitional area where two major biotic communities meet and blend together. An edge includes organisms common to the communities on both sides of it, as well as other more versatile species. It allows a diversity of habitat that in turn provides resources for a more diverse fauna. The edge may serve as a food source for animals of the forest or travel lanes for large and medium-sized mammals. Many important game species are characterized as "edge" species, including quail, rabbits, and the white-tailed deer.

The effects of pipeline construction on wildlife that inhabit the swamps and wetland habitats would probably be significant because of the vast number of wildlife species that inhabit these areas. Habitat loss in the swamps and wetlands may be temporary however, alteration of existing drainage patterns in the wetlands could force water-dependent herpetofauna species into marginal habitats where their chances of survival would be greatly reduced.

A large number of furbearers, waterfowl (winter), and marsh-inhabiting bird species would be adversely affected by pipeline construction in that some feeding and nesting areas would be lost. The mobility of avian species would reduce some of the anticipated impacts. Effects of construction on swamp and wetland areas may be evident for one to two years or more.

The primary impacts from pipeline construction on the aquatic environment are the destruction of benthic habitat where wetlands and streams (or other water bodies) are crossed, and the turbidity caused by instream construction and land runoff. The biological details of these impacts were discussed earlier in this section.

Water bodies that would be affected by pipeline construction include Bayou Teche, Little Valley Bayou, Stumpy Bayou, Weeks Bayou and several smaller bayous and canals. Proper construction methods, backfilling of the pipeline trench, and use of existing ROW should minimize the significance of short term impacts and the potential for long term disruption of surface flow patterns.

Accidental Brine Release

The expected quantity of brine accidentally spilled from the retention pond onsite or from the brine injection system during leaching is 23 barrels (Appendix E and Section C.2). These spills would not be anticipated to have significant adverse impacts on more than an acre or two of terrestrial or aquatic habitat in the vicinity of the site. A maximum credible spill of up to 30,000 barrels of brine could have significant local impacts on both the vegetation and animals in the spill area; however, the probability of such a spill is extremely small.

Should a maximum credible brine spill occur on the salt dome or along the brine disposal pipeline, the brine could spread across the cleared land or possibly go into Bayou Tete. Impacts on crops and on animal life which could not avoid the brine in these areas would be locally devastating. Tens of acres could be destroyed and the resulting salt concentrations in the soil could remain above levels tolerated by growth of new vegetation for several years. However, it must be emphasized that such a spill is statistically very unlikely to occur, especially from so short a section of pipeline.

Construction of Alternative Facilities

Alternative Raw Water Source - Lake Fausse Pointe

The alternative raw water supply system from Lake Fausse Pointe has a 7.3 mile long pipeline which would use 69 acres of cleared land (Table B.5-3, Figure A.6-7). The terrestrial impacts of this system would be minimal due to its short length, but they would be of the same kind as those discussed for the primary brine disposal system. The impacts related to the aquatic ecosystem would be similar to those discussed for the proposed raw water system. However, entrainment and impingement impacts would be greater, since the lake provides a large water reservoir, and because resident fish populations are expected to be more abundant.

Alternate Raw Water Source - Gulf of Mexico The alternative raw water supply system from the Gulf of Mexico would follow the oil distribution pipeline to Weeks Island; a 5.5 mile pipeline would lead to West Cote Blanche Bay. An additional 20-foot ROW is expected to be required adjacent to the Weeks Island pipeline. Acreages of various habitats directly affected are given in Table B.5-3. Entrainment and impingement of marine organisms would affect large numbers of individuals but a very small proportion of the existing bay populations.

Alternative Raw Water Source - Ground Water The alternative raw water supply system from the well field south of the site has a 3.7 mile long pipeline and would use 9 acres of terrestrial habitat (Table B.5-3, Figure A.6-7). The only adverse effects on biota would occur as a result of pipeline and well field construction.

Alternative Brine Disposal System - Gulf of Mexico Construction of the 52.2 mile brine disposal pipeline would traverse 20.1 miles of cleared land, deciduous swamps, and marshes. The impacts on these habitats would be similar to those described previously in this section. In addition, the pipeline would underlie 32.1 miles of bay and gulf waters. Since the underwater pipeline would be the same as that proposed for the Weeks Island expansion, the impacts are similar to those described in Section C.5.2.1.5.

An additional impact which must be considered is the effect of brine disposal during cavern leaching on the aquatic biota of the Gulf of Mexico. A description of expected biological impacts of brine on organisms in the water column and on the ocean bottom near the diffuser is given in Section C.5.2.1.5. In summary, it is expected that brine disposal in the Gulf should not have a significant regional effect on plankton or nekton. Increases in salinity may affect species diversity and populations on the bottom near the diffuser. Also it is possible that altered salinity levels could slightly modify migration patterns of shrimp near the diffuser.

Alternative Crude Oil Distribution Pipeline Nearly all of the 39 mile alternative crude oil pipeline route is characterized by the highly productive habitat of undisturbed bottomland forest and deciduous swamp of the kind discussed for the Bayou Choctaw site (Section B.5.2.5). The impacts of the construction can be described as being similar to those discussed for the proposed crude oil distribution pipeline.

C.6.3.1.6 Natural and Scenic Resources

Storage Site

Construction at the Iberia Dome would diminish the quality of the natural and scenic resources in the immediate vicinity of the dome only slightly because of the agricultural nature of the site and the surrounding petroleum facilities. Loss of some trees and other vegetation would occur due to construction of one of the well pads and associated roads. Grading and filling at the site would further alter the natural terrain. Dust, noise, fumes and siltation would have a slightly adverse effect during construction. For the most part, these impacts would not be visible to residents along Bayou Teche.

Oil Distribution Pipeline

The oil pipeline to Weeks Island would cross Bayou Teche then go south/southwest to Weeks Island. The initial 7.4 miles of the pipeline would cross agricultural areas; the next 5.4 miles would cross swamp forest and marsh.

The 1.8 miles of pipeline that crosses swamp, forest and marsh near Weeks Island would cause the removal of trees and other vegetation from the right-of-way. Sections of the pipeline in both swamp forest and marsh may be visible at some points from public roadways (Highway 83).

The pipeline construction activities would have significant adverse impact on the natural areas crossed. The dust, noise, fumes and vibration of construction would also have negative impacts on the aesthetic quality of the areas crossed particularly on Bayou Teche. These effects would be temporary in most cases.

Brine Disposal System

The brine disposal system would impact primarily cleared land areas southeast of the dome. This construction would be similar to ongoing petroleum related activities in the general area especially southwest of the dome. For the limited number of individuals passing the area during construction the scenic qualities of the area would not be significantly diminished.

Raw Water Supply

The intake structure for raw water supply would significantly diminish the scenic qualities of the area along Bayou Teche for those few individuals passing down the bayou. The raw water pipeline would be located adjacent to the oil distribution pipeline discussed previously.

Alternative Systems

Raw Water The use of Lake Fausse Pointe might have significant adverse effect on the natural and scenic resources along the shoreline for the limited number of individuals that might use the lake.

The use of ground water would require a slight addition to the land required for the oil distribution pipeline which it would parallel. The additional impact to scenic and natural resources would be minor or insignificant.

Construction of a raw water pipeline to the Gulf of Mexico would cause a significant increase in the adverse impact of the project on natural and scenic resources. Although the pipeline would follow existing pipeline rights-of-way, the construction impacts would affect many miles of natural marshland, coastal swamps, agricultural land, and transportation corridors.

Brine Disposal The alternative brine disposal system to the Gulf of Mexico would have impacts similar to those described for the raw water supply from the Gulf.

Crude Oil The 39 mile pipeline would cross a large area that has not been previously impacted. Removal of trees and other vegetation could cause a noticeable and significant adverse effect on the scenic and natural resources to the limited number of individuals who live in or use the area.

C.6.3.1.7 Archaeological, Historical and Cultural Resources

Storage Site

There are numerous sites of historic, archaeological or cultural significance in the area immediately surrounding the storage site. While no direct impact on any of these resources is anticipated, new sites may be discovered during development. If any archaeological or historic material were found, it would be immediately reported to State officials so that appropriate action could be taken to protect or preserve the material.

Oil Distribution Pipelines

There are no known areas of historic, archaeological or cultural significance in the right-of-way at this time.

Raw Water Supply System

This system would follow the oil distribution network with no anticipated impacts.

Brine Disposal System

The brine disposal field would be located in an area of no known archaeological significance.

Alternative Physical Facilities

No anticipated adverse impacts are expected as a result of developing a raw water supply at Lake Fausse Pointe or a ground water well field along the pipeline route. The 39 mile pipeline would not have any adverse impacts as a result of construction.

The brine disposal and raw water supply lines to the Gulf of Mexico cross a substantial amount of land with potential for cultural sites. However, the additional ROW required for each line is only 20 feet.

Furthermore, the cultural survey that would be conducted for the oil distribution pipeline should establish the likely existence of sites adjacent to the ROW.

C.6.3.1.8 Socioeconomic Environment

Storage Site

Land Use Construction activities would have a significant impact on land use at the storage site. Most of the land has been previously cleared for pasture. Development would impact some previously undisturbed wooded areas.

The project would require fencing of a 160 acre tract of land at the storage site for the plant area, roadways, wellheads, pipelines, and brine pond. Approximately 49 acres of land within this tract would be directly developed with facilities. An additional 241 acres would be developed off-site.

Transportation

Construction at the Iberia site will have a slight impact on traffic in the surrounding area. The current average daily traffic on Route 87 at Route 86 was 2220 in 1976 (Louisiana Department of Highways, 1977). Assuming 10% of the traffic would occur during each peak hour, the highest hourly volume currently experienced near the site would be 222 vehicles. During the first labor intensive months, up to 300 workers would be commuting to the site along with increased truck and heavy equipment traffic. During the remainder of the construction period traffic impacts will be much smaller since from the sixteenth to fifty-fourth month less than 100 workers will be employed. The traffic impacts might be divided among Routes 182, 87, and U.S. 90 depending upon commuting patterns. Areas surrounding the site may experience slight increases in traffic related to project construction.

It is not anticipated that major traffic congestion would result from project construction. Some minor increase in existing traffic problems may occur in localized areas, however. To the extent that traffic associated with the project does not coincide with existing peak hours the impacts would be reduced. Construction workdays frequently coincide with the available daylight hours.

Other modes of transportation, such as railroads, are not expected to be significantly impacted during construction. The oil distribution pipeline to Weeks Island would cross Routes 182, 87 and U.S. 90 but should not impact local traffic if contructed by tunneling under the roadway.

Population Construction of the Iberia site is not likely to significantly change population in Iberia. While the daytime population might increase, most of the construction workers are expected to commute from their current residences in nearby parishes leaving the permanent local population unchanged for the most part. Even those workers who move to the area for the duration of construction are likely to reside in areas such as Lafayette, New Iberia, Jeanerette or Franklin where more urban services are available.

Housing Housing, like population, is not expected to be significantly impacted during the construction phase. There is a large pool of labor within commuting distance of the site and it is unlikely these workers would relocate their households for the short period during which most of the construction would take place.

Should some workers wish to relocate closer to the site, there are relatively few housing units available in the New Iberia or Jeanerette areas. Those wishing to move to the area might be forced to wait for new units to be constructed or import portable housing to the area.

Economy The large increase in daytime population in Iberia Parish related to storage site construction for the Iberia site would stimulate the local economy significantly. In the local area retail services such as gas and food sales would experience significant increased demand.

To the extent that local contractors or workers are employed, further stimulation to the local economy would occur. The surrounding parishes such as Iberia and St. Mary's would also be affected.

Project employment would be greatest during the second through fifth months of construction. The peak in employment would occur during the second month when 336 workers would be employed. The payroll over the first five months would approach 1.7 million, while the total wages paid throughout construction would be approximately 5.8 million (see

Table C.6-4). During the latter months of construction, employment and wages would drop to a level of 32 workers and $56,000 in wages for months 19-49.

The project would displace no current jobs but might impact on the user of the onsite pasture.

Construction is unlikely to induce a large amount of economic growth in Iberia Parish due to the regional market from which it would draw material and labor and due to its short duration. Most of the wages earned through construction would be spent in Iberia Parish. Some minor secondary growth would occur in the local economy.

The project would have a beneficial impact on unemployment in Iberia Parish if local labor is used. The beneficial impact on unemployment would be short term.

Government Construction of the site would remove 160 acres from the Parish and State tax rolls. Ownership and operation by the Federal government would make the property tax-exempt. Personal income related to the project may bring a slight increase in sales and property taxes in the Parish.

The project would slightly increase the demands on local services such as police and fire. Increased traffic and daytime population in the area could increase police calls. In case of large scale accidents local police and fire services might be required to provide auxiliary services.

Medical facilities in the area are not expected to be significantly impacted by normal construction operations. Should a large scale disaster occur transport of some of the injured to larger urban medical facilities may be necessary.

Because most employees are expected to commute from their present residential areas, no significant increase in school enrollment locally is anticipated.

Oil Distribution Pipeline

Land Use The construction of oil distribution pipeline would occur within the ROW previously described. The connection from the Iberia storage site to Weeks Island would be 14.6 miles in length and require

TABLE C.6-4 Estimated Monthly Employment and Payroll - Iberia

Month [1]	Monthly Employment	Monthly Wages	
0-1	78	$ 136,500	
1-2	336	588,000	
2-3	256	448,000	
3-4	156	273,000	
4-5	139	243,250	
5-6	84	147,000	
6-16	108	1,890,000	(x 0)
16-19	62	325,500	(x 3)
19-49	32	1,680,000	(x 30)
49-54	8	70,000	(x 5)
	TOTAL	$5,801,250	

[1]begin construction = month 0

the conversion of 90 acres of cleared agricultural land, 40 acres of swamp forest, 39 acres of marsh, and 1 acre of open water. Portions of the ROW would be allowed to return to the natural (or agricultural) state if not required for pipeline access.

Transportation Construction of the oil distribution system would have a minor impact on transportation. Pipeline construction would cross several roads including Routes 87, 90, 674, 85 and 83. In addition the construction would cross several waterways including Bayou Teche, Little Valley, Stumpy and Weeks Bayous and several small canals. The pipeline would also cross the Southern Pacific and Missouri Pacific Railroads. In most cases it would be possible to bore under the roads and railroads minimizing the effect on local traffic. However, some of the waterways may require more disruptive construction techniques. Overall the construction impacts should not be felt in any single location for more than one to two weeks. The construction activity would require the transport of materials to the point of activity. This could cause minor traffic congestion on two-lane highways if slow-moving vehicles are used. Pipeline work areas would be set up to accomplish most of the installation work. Local traffic congestion could occur in these areas.

Population Construction of the pipeline, like storage site construction, is not expected to significantly affect population in Iberia Parish or the region.

Housing With a large pool of labor within commuting distance, the effects on housing nearby the pipeline route is anticipated to be minimal. Little housing is available in urban areas along the route.

Economy The economic effects of pipeline construction are included in those discussed for the storage site above. The employment for pipeline construction would occur during a five month period and employ a small portion of the total work force (165 men) required for the project. To the extent local workers and services are employed the income would affect the local economy. Services in the small towns nearby the pipeline route would receive a small temporary stimulant to their economy.

Government Construction would provide a source of revenue to local parish and state governments. The income taxes and sales taxes collected would probably exceed the loss in property taxes associated with the removal of 90 acres of farmland, 40 acres of swamp forest and 39 acres of marsh from the tax rolls.

It is unlikely that construction would place unusually severe demands on local services such as police, fire, or schools. Only in case of accidents would medical facilities be impacted.

Raw Water Supply System

Land Use Construction of the proposed raw water supply system would have a minor impact on land use. The planned pipeline route would follow the right-of-way used for the oil distribution pipeline to Bayou Teche, requiring 15 additional acres for construction. At Bayou Teche, one to two acres of land would be required to construct an intake structure for raw water. All these facilities would have small effects on land use.

Transportation The construction of the proposed water supply system would cause no additional impacts on transportation beyond those that would occur during oil pipeline construction.

Population The effects are the same as for oil pipeline construction.

Housing No significant effects on housing are anticipated as discussed for the oil distribution system.

Economy Construction would provide a small stimulant to the economy that would be insignificant relative to the overall economic activity.

Government Construction of the water supply system would place no demands on local governments during normal operations. The construction would remove a few acres of land from the tax rolls but would also produce some sales tax revenue.

Brine Disposal

Land Use Construction of the brine disposal system would occur in a cleared agricultural area. This would permanently affect land use, converting this area to industrial use. The short segment of bottomland forest along the rights-of-way would not be allowed to revegetate; agricultural lands along the pipeline could be replanted soon after construction.

The brine disposal field would require a total of 55 acres of land, including roadways, drill pads, and pipelines. This would cause a significant impact on existing land use in the area.

Transportation Brine disposal system construction would have a minimal impact on transportation. Some increase in traffic related to this system would occur in roads surrounding the Iberia site but this would only be a small addition to the traffic associated with construction at the dome itself.

Population Construction of this facility would have an insignificant impact on population as discussed earlier for storage site construction.

Housing Like population, no significant impact on housing is expected due to brine disposal facility construction.

Economy Construction would serve as a temporary minor stimulant to the economy. Only a small portion of the total labor force associated with this storage facility, as described in the section on the storage site itself, would be employed in construction of brine disposal facilities.

Government The brine disposal system would require the removal of 55 acres of land from the local tax rolls. It is impossible to tell at this time whether income generated from its construction would outweigh this loss. No special government services are expected to be required during construction except in case of accidents.

Alternative Facilities

Raw Water Supply

Intake at Lake Fausse Pointe This alternative would have a minor effect on land use in the area adjacent to the lake. Some trees would be removed and excavation for the pipeline would be required. This would constitute a notable change in land use but would occur in a small area; most of the construction would be in cleared agricultural land. The additional impact would be insignificant.

Use of this alternative would not significantly alter the anticipated impacts to local population, housing, economy, and urban services.

Ground Water Use of ground water instead of the proposed system would require 9 acres of agricultural land south of the storage site. This could convert land from crop production to industrialized use, a minor addition to the land use impacts of the project.

This alternative would tend to increase traffic slightly but no significant adverse impact is anticipated. There may also be a slight increase in labor and materials requirements for this alternative, but the economic effect of the project as a whole would not be significantly altered.

No significant change in the impact on population, housing or urban services would occur with this alternative. A slight loss of locally taxable land would occur, however.

Gulf of Mexico Construction of a 22.1 mile raw water supply line to the Gulf of Mexico would require an additional 197 acres on land along the oil distribution right-of-way to Weeks Island and then out to the Gulf and 49 acres offshore. Much of the land crossed would be coastal marsh, agricultural land, and swamp forest. The impact on land use would be minimized by use of existing rights-of-way for nearly all of the pipeline to the Gulf. Construction would, however, briefly disturb the vegetation along the edge of the right-of-way.

This type of water supply system would require additional construction materials and workers beyond those required for the proposed system. The resulting effects on local transportation would be to spread traffic over a larger area south of the project toward Weeks Island. The pipeline route would cross US 90 and several waterways, but the construction impacts are anticipated to be temporary and nondisruptive. This alternative would cause a significant increase in the regional economic effects of the project, increasing purchases of labor, materials, and services. To the extent that local markets provide these inputs, the local economies would benefit.

No significant effects on housing or population are expected, as most of the laborers used are expected to commute from their current area of residence. Similarly, normal construction efforts would not impact local urban services; however, in case of accidents police, fire and hospital services could be affected.

Brine Disposal

Gulf of Mexico Construction of a pipeline for brine disposal to the Gulf would follow the same route as the water supply line to the

Gulf. If both are built, the additional impacts resulting from construction of the brine pipeline would be minimal. Some additional labor and materials would be necessary to lay the second pipeline and the diffuser into the Gulf. If the brine line alone were constructed, the impacts would be almost the same as those for the water supply line.

Crude Oil

Construction of the pipeline would have a notable affect on land use within the pipeline right-of-way. Portions of the ROW would be allowed to return to the natural state, but no trees would be allowed to grow within the area to be maintained.

Roads in the area to be used for construction access are needed. There would be some affect on local traffic around pipeline work areas. Transportation access would be most readily available using the waterways and some of the waterway crossings may require more disruptive construction techniques.

Use of this alternative would not significantly alter the anticipated impacts to local population, housing, economy, and urban services.

C.6.3.2 Impacts from Operation and Standby Storage

Operational impacts associated with Iberia dome and with associated raw water and brine disposal pipelines are considered in this section. Operation of the oil pipeline from Iberia to the tie-in with the 36-inch line to St. James at Weeks Island is also considered. Operational impacts of terminal facilities are described in Section C.3. No additional oil spill or right-of-way maintenance exposure occurs from the pipeline between Weeks Island and St. James due to use of Iberia dome. Cumulative impacts of oil spills and air emissions at St. James or along the Mississippi River for this group alternative were considered in Section C.6.2.2.

C.6.3.2.1 Land Features and Geologic Impacts

Effects of operation and standby of the Iberia storage site on land features are expected to be minimal. Compared to the 401 acres required during construction offsite and within the 160-acre fenced area, 313 acres would need to be maintained during operation. No significant disturbance of site soils is expected after construction is completed. Soils will stabilize soon after they are revegetated.

Iberia is located in an area identified as seismic Zone 1, that is with an expectation of minor earthquake damage (Figure B.2-8). Underground storage caverns are much less susceptible to damage from seismic events than surface tanks.

It is conceivable, though extremely unlikely, that the salt roof over one of the caverns could collapse. Appendix F considers the possible mechanism by which such an event could occur. A possible result would be the formation of a deep surface depression, probably resulting in a lake over the dome. Should such an event take place, significant quantities of oil or brine could be released to the surface or to shallow ground water aquifers. Impacts on surface storage equipment could be potentially significant. The structural integrity of the storage cavities would be monitored and every available measure would be taken to preserve cavern integrity (Appendix E).

Alternatives

Use of alternative raw water or brine disposal systems would impact land features during project operation and standby storage only through required maintenance of pipeline right-of-way (Table A.6-3). The brine disposal and raw water supply pipeline to the Gulf would have greater maintenance requirements than the proposed systems. Compared to the 201 acres required during construction, only 126 acres would be required for maintenance. The use of the 39-mile crude oil pipeline would require that approximately twice as much land be maintained than would the proposed oil pipeline.

C.6.3.2.2 Water Resources

Impacts to water resources during facility operation may occur as a result of raw water withdrawal for oil displacement, brine disposal during oil filling, and possible oil or brine spills.

Operation of Storage Site

During construction of the Iberia storage site, measures would be incorporated into the design to minimize sediment transport and erosion at the site. These measures would include grading, diking and reseeding. Runoff from precipitation would therefore have minimal impact on water systems.

All sanitary wastes from the storage facility would be conveyed to a treatment plant sized to conform to Louisiana Health Department Standards, then routed to a receiving stream. As the number of operational employees would be small, no adverse impact on stream water quality would be expected.

Operation of Raw Water Supply System

Operational water requirements for the storage site would be based on the 22 cfs (9700 GPM) used for crude oil displacement during the 150-day withdrawal period. As expected for the 60 cfs withdrawal necessary for a period of about two years during the leaching cycle, the higher rate during five anticipated withdrawals should not have significant impact on Bayou Teche during normal flow conditions. However, during low flow conditions, an excessive drawdown may occur locally, inducing flow upstream from the east.

Zinc anodic protection would be used along the raw water supply pipeline at intervals of approximately 1000 feet. This may result in the release of 0.6 grams of zinc per square meter of pipe surface area per year (the exact mechanisms of the release are not clearly understood). Since the pipeline would be buried under several feet of sediment, little of the zinc could be expected to enter the water columns unless sediments were disturbed for pipeline repairs. Operation of the pipeline would have no significant effect on hydrology.

Operation of Brine Disposal System

When oil is pumped into the storage caverns, brine would be displaced to the injection wells at an average rate of 175,000 B/D and at a maximum rate of 240,000 B/D. Filling would take 286 days at the average rate. As even the maximum expected fill rate is only 37 percent of the planned brine disposal rate during cavern leaching (Section C.6.3.1.2), there should be no adverse effect on the condition of ground water aquifers.

Oil or Brine Spills

During project operation, oil spills could occur from pipelines connecting the storage site with the surge tanks, and from the wellheads at Iberia (releases from the underground storage caverns are not quantified, see Appendix E). Brine spills could occur from the brine disposal pipeline and from the brine reservoir. A thorough description of possible modes of spills, methodologies of spill calculations, quantification of expected spill volumes and frequencies, spill dispersion characteristics, and spill prevention and control measures is provided in Appendix E. A summary of oil and brine spill expectations is also given in Section C.2 and in Tables C.2-1 through C.2-9. Possible effects on water resources of spills in the vicinity of Iberia dome are considered in this section. Total spills occurring from all group activities are considered in Section C.6.2.2.

Spills occurring at Iberia dome would flow toward Tete Bayou, which drains this portion of the Teche ridge into Lake Fausse Point and the Atchafalaya Basin to the east. Spills occurring from the oil pipeline where it crosses the Teche ridge south of the dome would generally spread across the agricultural land without entering a water body (except any which occur within the lands of Bayou Teche). South of Teche ridge, pipeline spills would enter swamp forest or marsh drained by the New Iberia Canal and Weeks Bayou to the Intracoastal Waterway and Weeks Bay west of Weeks Island.

Quantities of oil and brine expected to be released from the Iberia storage site and pipeline facilities are listed by source and location in Table C.2-5. Total oil spillage for five fill/withdrawal cycles from the Iberia storage site is 125 barrels; spillage from the section of pipeline to Weeks Island is estimated to total less than 40 barrels. The maximum credible spill events are estimated to be 10,000 barrels from a pipeline rupture and 5000 barrels from the storage site.

Brine spills would occur only from the piping system at Iberia and southeast along the disposal pipeline. Total spillage is estimated to be 27 barrels. The maximum credible spill event is estimated to be 30,000 barrels.

A description of weathering processes which occur to oil released into the environment is provided in Section C.4.3.2.2. Evaporation, dissolution, emulsification, sedimentation, biological degradation, and chemical oxidation all tend to change the physical and chemical form of crude oil.

The fairly limited geographical distribution of possible spill sites creates a small range of oil spill situations. Spills occurring in swamp forests or marsh lands would be difficult to control, however.

Two potentially significant impacts of oil spills on water resources would be the potential for buildup of toxic fractiosn and depletion of oxygen levels in shallow, poorly flushed water bodies. The most likely location of such impacts would be in swamp forests adjacent to the dome and in marshes located near Weeks Island.

Oil spills reaching Bayou Teche should not have regionally significant impacts on water quality because of the potential for dilution and for oil recovery. Oil which sinks to the bottom or is deposited on the riverbank or shoreline may provide a local source of petroleum hydrocarbons to the water column for several weeks or even months, however.

Oil spills occurring anywhere outside diked areas could affect human use of water (industrial, domestic, or recreational).

The Chicot aquifer is overlain by about 100 feet of clay and silt in the vicinity of Iberia dome. Oil spilled from the pipeline should not reach potable ground water supplies, except possibly some perched water table aquifers at Weeks Island.

Should a subsurface spill occur, either from a defective well casing or collapse of a storage cavity, then oil would tend to collect at the water table and migrate laterally along the water surface. Crude oil tends to migrate very slowly through subsurface formations, and then only under pressure. However, some components of the oil, particularly the lighter aromatic hydrocarbons, might be sufficiently soluble to impart an objectionable taste and odor to the water.

Spills of brine or saline water have less potential for adverse effects on water quality than do oil spills because of the limited spill potential. Except for a very large brine spill, normal flushing of local water bodies (i.e., Tete Bayou, Bayou Teche) would quickly dilute salt concentrations to normal levels, resulting in very temporary water quality degradation. Flushing is not as effective in shallow water bodies or in the swamp forest and marsh, however; salinity excesses would continue for several days or weeks and may remain in the substrate.

The potential exists for relatively frequent and possibly large crude oil spills from the Capline Group of SPR sites, as indicated in Section C.6.2.2.2. Calculations of spill probability at Iberia dome indicates that significant impacts on local water resources should be very infrequent.

Hazards Due to Flooding

Surface facilities at Iberia would not be subject to flooding caused by hurricanes or tropical storms. Surface elevations over the dome are approximately +5 to +10 feet MSL. Data supplied by the U.S. Army Corps of Engineers indicates that the 100-year flood level at Iberia is +13.5 feet MSL. There should not be any destructive currents or waves to threaten surface facilities, however.

Storm floods greater than the 100-year event could occur and could damage surface facilities. In the event of an oncoming storm, oil would be removed from the surface tanks, thus eliminating the largest spill potential. If surface piping is ruptured, a few barrels of oil could escape. Damage to wellhead piping could result in loss of a few barrels from the cavern. Brine from the settling pond would be quickly diluted by flood waters.

As only limited quantities of oil could be released in the event of a damaging storm flood, environmental effects due to the flood waters and winds are expected to be much greater than due to loss of oil or brine.

Alternative Facilities

Operation of the brine disposal pipeline to the Gulf of Mexico would increase the potential for brine spills by a factor of about 15 over what is proposed. More than half this exposure would occur in the Gulf, but due to dilution would have less potential for adverse impacts on water quality.

Discharge of up to 240,000 BPD of brine to the Gulf would occur at the brine diffuser during operation. The water quality impacts would diffuser slightly from the leaching procedure but would be similar to the Weeks Island operational brine discharge described in Section C.5.2.2.2.

Use of alternative raw water supply systems for oil displacement would have similar impacts on water supply as described for leaching (Section C.6.3.1.1). Water withdrawal rates would e less than half the rate required for leaching.

Operation of the 39 mile crude oil pipeline would approximately double the potential for oil spills over the proposed pipeline. The occurrence of oil spills within the network of canals in the Atchafalaya floodplain would have the potential of affecting a larger area.

C.6.3.2.3 Air Quality

The largest potential effects on air quality associated with the operation of the proposed oil distribution system would result from hydrocarbon emissions during fill and withdrawal cycles. Data presented in Section B.2.3.3.2 indicate that non-methane hydrocarbon concentrations in the area frequently exceed the national and state standard of 160 $\mu g/m^3$ (3-hour average, 6-9 a.m.). Hydrogen sulfide losses are expected to be minimal since most of the crude oil that is expected to be stored in the Capline system would have weathered sufficiently during overseas transit to essentially eliminate the H_2S component.

Generally, the air quality impacts during operation at Iberia would be similar to those described for Napoleonville (Section D.4.3.2.3). The total hydrocarbon emissions at the Iberia dome storage site over the life of the project are estimated to be 125 tons from the brine pond and 35 tons from the small oil surge tank on-site. These emissions should have no signficant impact on air quality near the dome.

C.6.3.2.4 Noise

The impacts associated with operation of the SPR facility at Iberia dome are essentially identical to those previously discussed in Section C.6.2.2.4 for the Bayou Choctaw site.

C.6.3.2.5 Species and Ecosystems

Operation of the 160-acre storage facility and associated raw water, brine disposal and oil delivery systems at Iberia would have little environmental impact in addition to that caused by construction. The types of impacts that would occur, however, are discussed in Section

C.6.2.2.5. Total offsite acreage required to be maintained is 153 acres. However, all but 5 acres of bottomland forest and 50 acres of marsh and swamp forest are cleared agricultural land.

Entrainment effects of raw water drawdown from Bayou Teche would be considerably less than during construction due to reduced water requirements.

Total expected quantities of oil and brine spillage are 165 barrels and 27 barrels, respectively, during the project lifetime. Unless a very large spill should occur (for which the likelihood is extremely small), no significantly adverse biological impacts should result. If a large spill did occur from the dome and oil is carried into the Atchafalaya Basin via Tete Bayou, there is a potential for widespread, significant impact.

The terrestrial impacts are of least concern, whereas the aquatic impacts related to brine disposal in the Gulf of Mexico, and entrainment and impingement associated with the raw water supply system would be of greatest concern. A comparison between the impacts of construction and impacts of operation may be made for various habitat types in Table B.5-3 (Section B.5.3.5).

In summary, it may be concluded that the very low frequency of oil and brine spills indicates that chronic biological impacts should generally not be experienced. Very large spills are fairly improbable and represent a small likelihood of regionally significant adverse impact, but the potential for such impact is fairly large depending on spill location. Except for the case of a large spill in the Gulf or lower Mississippi River being transported to near-shore waters and coastal bays prior to recovery, adverse impacts should not be of regional significance.

Alternatives

Construction of a pipeline for brine disposal in the Gulf of Mexico would increase the potential for brine spills by a factor of 15 and would expose additional areas of wetlands to possible brine spills. During operation, the discharged brine and its components would have similar impacts to aquatic organisms as described for the Weeks Island diffuser (Section C.5.2.3.5). Drawdown of water from Lake Fausse Pointe would likely destroy a large number of aquatic organisms in Bayou Teche. Entrainment impacts would be avoided by using a well water supply system. Other alternatives would alter biological impacts primarily through the area of right-of-way maintenance required (Table B.5-3). Construction of the 39 mile crude oil pipeline would approximately double the potential for oil spill over the proposed system and would expose additional areas to oil spills. Impacts are similar to the proposed oil distribution pipeline.

C.6.3.2.6 Natural and Scenic Resources

Storage Site

Operation and maintenance of the storage site area would have fewer impacts on the scenic and natural resources than construction. Some areas would be allowed to revegetate although this would be routinely maintained. Some operational fume, dust, and traffic would occur, but at a much lower level during routine operations.

Oil Distribution

Normal maintenance of the pipeline route would have minimal impact on natural resources. In some areas, natural vegetation such as trees would not be allowed to return, but some grass would grow instead. In case of accidental pipeline leak or other unexpected occurrence, this pipeline could have a significant adverse effect on natural marsh grass.

Raw Water Supply

Operation of the raw water supply system would have minor impacts on the natural and scenic resources of surrounding areas. The intake structure is likely to cause the death of a few fish and other organisms; however, this would be minimized through the use of EPA standards for intake current. The structure itself would not be in keeping with the visual quality of the surrounding natural setting, but would be relatively small in scale, minimizing the negative impact.

Brine Disposal System

Operation and maintenance of the brine disposal pipeline and injection field are anticipated to have a minimal impact on natural and scenic resources. Some loss of vegetation at the site would continue and the location of the facilities would lower the aesthetic quality of the agricultural area.

Alternative Physical Facilities

Raw Water Supply Operation of the raw water supply system alternative from Lake Fausse Point would impact a more valuable natural environment than that affected by the proposed system. Lake Fausse Point is far less developed, having largely undisturbed scenic beauty. The raw water intake would destroy fish and other lake organisms as well as disrupt the scenic vista.

The use of ground water would not significantly increase the impacts on natural and scenic resources anticipated for the proposed alternative. However, the presence of wellheads and pads would slightly modify the visual character of the agricultural areas in which they are located.

Operation of a water supply pipeline from the Gulf of Mexico would not significantly change the impacts on natural and scenic resources expected if the proposed Bayou Teche was used. This assumes that previously planned rights-of-way would be followed.

Brine Disposal Use of the Gulf of Mexico for brine disposal could negatively impact marine life near the diffusion area. If such effects occur, a significant adverse impact on natural and scenic resources would result.

Crude Oil Maintenance of the 39 mile oil pipeline would have minimal impact on natural resources, but an oil spill could have significant effects on the natural marsh grass.

C.6.3.2.7 Socioeconomic Impacts

Storage Site

Land use at the storage site would remain industrialized during operation and maintenance. The area would be fenced and not be available for cultivation. Traffic to and from the site would be significantly reduced with the elimination of most materials deliveries and a smaller work force.

There may be a small, permanent increase in population and housing demand attributable to project operations but it is likely to be distributed among several urban places near the project and would be insignificant.

The operation of the storage site would not substantially alter the basic economy of the surrounding area. Approximately 15 new permanent jobs and an additional 17 intermittent jobs related to fill and withdrawal would be created.

The effects of this project will be to slightly ease local unemployment and increase income by approximately $56,000 per month (gross wages) during fill and withdrawal, and $26,000 per month during standby storage. Much of this income would remain in the Iberia, Lafayette and St. Mary Parish area. Purchases of supplies and equipment locally would act as a minor stimulant to the local economy.

Project operations would present few demands on local urban services. A slight increase in school children related to the increase in project workers could occur, but would be spread over several school districts. Demands on police, fire and health services would remain unchanged. Tax revenues from the site would be lost to the local governments for the duration of the project.

Oil Distribution

During normal operations the oil distribution system would have no additional impacts on land use or transportation. Land previously under cultivation would revert to this use in most cases, but wooded and marsh areas would be allowed to revegetate only to a limited degree. Only in cases of a pipeline leak or other accident would land use or transportation be significantly affected during operation of this system.

Population, housing, and the local economy would not be significantly affected by the operation of this system. The pipeline right-of-way would still be available to taxation as part of a federal facility causing tax losses.

Raw Water Supply

The proposed raw water supply system would insignificantly impact land use during operations. The intake structure would permanently require one to two acres of land, but much of the water pipeline right-of-way, which follows the oil pipeline route, would be returned to previous agricultural use. These facilities would have no significant impact on transportation during their operation.

Population, housing, the economy and government would not be significantly affected by these facilities.

Brine Disposal

This system would continue to use 36 acres of land in the operational phase. The roadways and well pads would be permanently dedicated to industrialized uses. In some areas the pipeline right-of-way may revert to cultivation. No operational impacts on transportation are anticipated, as the roadways in the area are all private.

No significant effect on population, housing, or the local economy would occur due to the operations of this system. The land removed from local tax rolls would continue to be tax-exempt, having a minimal impact on local revenues.

Alternative Physical Facilities

Raw Water Use of Lake Fausse Pointe would increase the land impacted during operations over that required for the proposed alternative. Most of the right-of-way would, however, be available for agricultural use during operations. The intake structure would constitute a permanent commitment of land for its use for the duration of the project. This alternative would not significantly increase the minimal impacts anticipated for the proposed system in the areas of population, housing, transportation, the local economy, and government.

The operation of a well field to provide raw water from ground water would not significantly change the socioeconomic impacts anticipated for the proposed alternative during the operational phase.

A raw water pipeline to the Gulf of Mexico would not have significantly different land use impacts during operation from those of the proposed raw water system, since it follows other planned and existing rights-of-way.

Brine Disposal This alternative system would follow the land route of the raw water supply system from the Gulf and would have similar operational impacts as discussed above. Offshore, the operational impacts would be minor unless brine disposal impacts commercial fishing, in which case an economic effect could result.

Crude Oil This alternative would have similar operational impacts as discussed for the proposed crude oil pipeline.

C.6.4 Impact Due to Termination and Abandonment

No specific plan for termination and abandonment of the Iberia and Bayou Choctaw oil storage site has been established. However, the DOE will be required to develop such a plan near the termination of the action. To date, no specific experience with the abandonment of an oil storage cavern facility has been developed in the United States. However, various feasible plans are available. Environmental hazards that must be considered include surface subsidence and release of residual oils squeezed from the workings by possible long-term plastic closure.

At present, it is intended to put the facility to some beneficial use rather than abandon it. Beneficial use might include disposal of wastes, such as dredge spoil, slurried fly ash, radioactive waste, or other polluted or toxic materials. Another possibility is to develop a compressed air storage facility for peak power use. The final selection of an abandonment plan will likely depend on the economic and environmental trade-offs and regulations that are in effect at the time of termination.

Use of the facility in the manner described above would assure continued surveillance of the cavern. The inherent integrity of the cavern would prevent any leakage of material into the environment. Certain activities associated with the specific use, such as waste transport, would impose some potential for environmental damage resulting from traffic, spillage and noise.

Should no beneficial use be found for the facility, the wells could be sealed and the caverns left filled with brine. No adverse environmental effects are likely to result from such action.

C.6.5 The Relationship of the Proposed Actions to Land-Use Plans, Policies, and the Controls for the Affected Areas

There are pressently no official plans, policies, or controls established by Federal, state, or local government agencies in Iberia and Iberville Parishes. Furthermore, lands under consideration for use in developing the Strategic Petroleum Reserve Facility at Iberville and Bayou Choctaw are presently devoted to industrial uses.

Although a Coastal Zone Management Plan is in preparation in Lousiana, there is no apparent project conflict with the basic concepts established by the Louisiana Advisory Commission on Coastal and Marine Resources (1973), which are expected to be an important part of the ultimate plan. Thus, development would occur at a previously established industrial site and oil transportation would follow established corridors. It is not anticipated that any land use policies or plans would be in conflict with the proposed Iberia and Bayou Choctaw Strategic Petroleum Reserve Facilities.

C.6.6 Summary of Adverse and Beneficial Impacts

Development of the Iberia and Bayou Choctaw salt domes as oil storage facilities is not likely to generate significant regional environmental impacts except for the possibility of a major oil spill and the uncontrolled release of hydrocarbon vapors during oil transportation.

Table C.6-5a and C.6-5b provides a summary tabulation of the findings of the various discipline analyses of impacts of project development. Impacts of project operation are summarized in Table C.6-6a and C.6-6b. The data are in both qualitative and quantitative form, as appropriate.

TABLE C.6-5a Summary of environmental impacts caused by development of Bayou Choctaw SPR facilities.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT ALTERNATIVE PHYSICAL FACILITY
Geology and Land Features	Bayou Choctaw dome and immediate vicinity	Site Preparation 19,000 cy of excavation and 62,400 cy of fill for cavern wellhead drill pads, containment dikes, access roads, and other surface facilities. Direct impacts on 27 acres. Cavern Leaching Up to 12×10^6 cy of salt removed from the dome by leaching. Brine Disposal Pressurization of brine disposal aquifers.	
	Terminal Facilities	Site Preparation (see Table C.3-2)	
	Pipeline Corridors Between Bayou Choctaw and: ICW		Raw Water Supply 5300 cy of temporary excavation from 8 acres in pipeline ROW.
	Mississippi River	Raw Water Supply 29,000 cy of excavation (temporary) and clearing of vegetation from 53 acres in pipeline right-of-way.	
	Gulf of Mexico		Raw Water Supply 1,301,000 cy of excavation (mostly temporary) and clearing of vegetation from 672 acres pipeline ROW to Gulf. Brine Disposal 1,643,100 cy of excavation (mostly temporary) and clearing of 672 acres of vegetation in pipeline ROW to Gulf.
	Ground Water		Raw Water Supply 25,000 cy of excavation (mostly temporary) and clearing of vegetation from 12 acres in pipeline ROW. Possible surface subsidence over well field.
Water Resources	Bull Bay, ICW, and wetlands near the storage site	Site Preparation Significant volumes of sediment and construction pollutants carried into water bodies by rainfall runoff. Oil and Brine Spills Very small possibility of some release reaching water bodies; maximum credible brine spill could have significant impact.	Raw Water Supply Withdrawal from ICW would only lower water levels and increase drainage rates from adjacent wetlands insignificantly; pipeline construction impacts very minor.
	Water bodies and wetlands crossed by pipeline ROW	Site Preparation and Pipeline Construction Locally significant volumes of sediment and construction pollutants carried into water bodies by rainfall runoff.	

TABLE C.6-5a continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT: PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT: ALTERNATIVE PHYSICAL FACILITY
	Mississippi River	Raw Water Supply Withdrawal of up to 1,000,000 BPD would not significantly affect river quality or flow rate. Terminal Construction (see Table C.3-2)	
	Gulf of Mexico		Raw Water Supply Withdrawal from Gulf; no significant effect on water quality; construction of supply pipeline would have significant local affects for most of its 98.3 mile length. Brine Disposal Disposal of brine in Gulf could cause local salinity excesses of 12 percent or less over several hundred acres; pipeline construction could alter surface water quality on land and in the Gulf.
	Subsurface aquifers	Brine Disposal Pressurization of deep disposal aquifers could possibly displace saline water to potable aquifer directly or by migration up old wells.	
			Raw Water Supply Withdrawal from subsurface aquifers could affect water table and induce surface subsidence, though considered unlikely; construction effect locally significant.
Air Quality	All construction sites	Site Preparation Minor quantities of particulates, SO_2, CO, HC, and NO_2 released from construction equipment; minimal effect.	
	Bayou Choctaw	Site Preparation and Painting Short term HC concentrations of up to 104 ug/m^3 at 1 km downwind during painting of tanks; possible exceedance of ambient air quality standards due to high background levels during 3 day period at Bayou Choctaw.	
			Raw Water Supply Development of a well field for raw water supply may decrease emission at Bayou Choctaw (except HC from painting) by 50 percent. Construction of raw water supply lines to ICW or the Gulf of Mexico would alter the direction and location of construction emission but not the degree of impact. Brine Disposal Construction of a brine disposal pipeline to the Gulf eliminates locally continuous emissions at Bayou Choctaw and adds dispersed pipeline emissions.
	Terminal Facilities	Site Preparation and Painting (see Table C.3-2)	

TABLE C.6-5a continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT PROPOSED PHYSICAL FACILITY	ALTERNATIVE PHYSICAL FACILITY
Noise Level	Storage Site	Site Preparation and Cavern Well Drilling Maximum radius of noise impact (3 dB increase over ambient), 5000 feet; as many as 20 residences may be affected.	
	Pipeline Routes	Pipeline Construction Maximum zone of noise impact, 1800 feet; 50 to 75 structures may be affected	
			Raw Water Supply ICW water supply would not affect noise sensitive areas. Ground water supply well field would raise noise levels for 25 or more residences.
			Brine Disposal Brine disposal and raw water supply pipeline to Gulf would affect noise levels for up to 50 residences.
	Terminal Facilities	Site Preparation (see Table C.3-2)	
Species and Ecosystem	Terrestrial Agricultural Land	Site Preparation and Pipeline Construction Temporary loss of 64 acres due to facility construction. Minimal impact importance.	
			Raw Water Supply Loss of 12 acres (agricultural land) due to raw water well field. Temporary loss of 8 acres agricultural land due to raw water pipeline and pumping station at ICW. Temporary loss of 133 acres due to raw water pipeline to Gulf.
		Terminal Construction (see Table C.3-2)	
			Brine Disposal Temporary loss of 10 acres agricultural land due to brine injection well field construction along raw water pipeline. Temporary loss of 139 acres due to brine disposal in Gulf.
	Bottomland and Swamp Forest	Site Preparation Loss of 50 acres due to facility construction. Revegetation of 14 acres likely. Minimal impact importance. Brine Spills Large brine spill could destroy several acres near Bayou Choctaw dome.	
			Brine Disposal or Raw Water Supply Loss of 241 acres of mostly swamp forest habitat due to construction of brine disposal or raw water supply pipeline to Gulf.
	Marsh		Brine Disposal or Raw Water Supply Temporary loss of 298 acres of marsh due to construction of raw water or brine disposal pipeline to Gulf.

TABLE C.6-5a continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT: PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT: ALTERNATIVE PHYSICAL FACILITY
	Aquatic ICW		Raw Water Supply Destruction of phytoplankton and zooplankton during the three year leaching period. Impact on regional biotic resources considered insignificant.
	Local water bodies near construction sites	Site Preparation Minimal local impacts due to erosion and runoff. Brine Spills Major brine spill remotely possible; significant loss of biota would follow.	
	Mississippi River	Raw Water Supply Minor additional displacement of plankton through lift pumps.	
	Gulf of Mexico		Brine Disposal Brine effluent could affect benthos community structures over several hundred acres. Should not be significant to plankton and nekton except possibly adjacent to brine diffuser. Dredging could destroy benthic habitats and reduce productivity. Raw Water No effect on Gulf of Mexico water quality or quantity due to withdrawal.
Natural and Scenic Resources	All Pipeline Construction	ROW Clearing Locally significant impact due to clearing along pipeline right-of-way.	
Socioeconomic Conditions	Cultural Resources	All Sites Possibly loss or disruption of significant cultural resources.	
	Land Use	Alteration of land use on total of 117 acres.	
	Transportation	Total construction wages, $6.5 million, much of which would be spent outside the local area.	
	Government	Possibly significant loss of property and severance tax revenues.	

TABLE C.6-5b Summary of environmental impacts caused by development of Iberia SPR facilities.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT: PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT: ALTERNATIVE PHYSICAL FACILITY
Geology and Land Features	Iberia dome and immediate vicinity	Site Preparation: 16,000 cy of excavation, 79,500 cy of fill for onsite, pipelines, access roads, and other surface facilities. Direct impacts on 49 acres. Cavern Leaching: Up to 10 million cy of salt removed from the dome by leaching. Brine Disposal: Pressurization of brine dis-posal aquifers.	
	Terminal Facilities	Site Preparation: (see Table C. 3-2)	
	Pipeline Corridors between Iberia and: Terminal	Crude Oil Distribution: Temporary excavation of 324,000 cy of earth and clearing of vegetation from 169 acres in the pipeline ROW.	Crude Oil Distribution: Temporary excavation of 449,000 cy of earth and clear-ing of vegetation from 332 acres in pipeline ROW for pipeline route via Napoleonville.
	Bayou Teche	Raw Water Supply: 8,000 cy of temporary excava-tion from 15 acres in pipe-line ROW.	
	Gulf of Mexico		Raw Water Supply; Brine Disposal: 742,000 cy of excavation (mostly temporary) and clearing of vege-tation from 201 acres in pipe-line ROW.
	Ground Water	Brine Disposal: 23,000 cy of excavation (mostly temporary) 63,000 cy of fill, and clearing of vegetation from 55 acres in pipeline ROW.	Raw Water Supply: 19,500 cy of excavation (mostly temporary) and clearing of vege-tation from 9 acres in pipeline ROW. Possible surface subsidence over well field.
	Lake Fausse Point		Raw Water Supply: 42,000 cy of excavation (mostly temporary) and clearing of vege-tation from 72 acres in pipeline ROW.
Water Resources	Teche Bayou and wetlands adjacent to the storage site	Site Preparation: Significant volumes of sedi-ment and construction pollu-tants carried into water bodies by rainfall runoff. Oil and Brine Spills: Very small possibility of some release reaching water bodies; maximum credible brine spill could have significant impact.	
	Water bodies and wetlands crossed by pipeline ROW, includ-ing Bayou Teche.	Site Preparation and Pipeline Construction: Locally significant volumes of sediment and construction pol-lutants carried into water bodies by rainfall runoff.	Pipeline Construction: Locally significant volumes of sediment and construction pollutants carried into water bodies by rain-fall runoff.
	Bayou Teche	Raw Water Supply: 641,000 BPD pumped from Bayou Teche during cavern leaching; minimal effect on water quality/quantity expected.	

TABLE C.6-5b continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT ALTERNATIVE PHYSICAL FACILITY
	Lake Fausse Point		Raw Water Supply Withdrawal from Lake Fausse Point could lower water level a small amount and increase drainage from adjacent wetlands during low flow process.
	Mississippi River	Terminal Construction (see Table C.3-2)	
	Gulf of Mexico		Raw Water Supply Withdrawal from Gulf would have no significant effect on water quality; construction of supply pipeline would have significant local affects for most of its 22.1 mile length. Brine Disposal Disposal of brine in Gulf could cause local salinity excesses of 12 percent or less over several hundred acres; pipeline construction could alter surface water quality on land and in the Gulf.
	Subsurface aquifers	Brine Disposal Pressurization of deep disposal aquifers could possibly displace saline water to potable aquifer directly or by migration of old wells.	
			Raw Water Supply Withdrawal from subsurface aquifers could affect water table and induce surface subsidence, though considered unlikely; construction effect locally significant.
Air Quality	All construction sites	Site Preparation Minor quantities of particulates, SO_2, CO, HC, and NO_2 released from construction equipment;minimal effect.	
	Iberia Dome	Site Preparation and Painting Short term HC concentrations of up to 104 $\mu g/m^3$ at 1 km downwind during painting of tanks; possible exceedance of ambient air quality standards due to high background levels during 3 day period at Iberia.	
			Raw Water Supply Development of well field for raw water supply may decrease emission at Iberia (except HC from painting) by 50 percent. Construction of raw water supply lines to Lake Fausse Point or the Gulf of Mexico would alter the direction and location of construction emission but not the degree of impact. Brine Disposal Construction of brine disposal pipeline to the Gulf eliminates locally continuous emissions at Iberia and adds dispersed pipeline emissions.
	Terminal Facilities	Site Preparation and Painting (see Table C.3-2)	

TABLE C.6-5b continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT: PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT: ALTERNATIVE PHYSICAL FACILITY
Noise Level	Storage Site	Site Preparation and Cavern Well Drilling Maximum radius of noise impact (3 dB increase over ambient), 5000 feet; as many as 25 structures may be affected.	
	Pipeline Routes	Pipeline Construction Maximum zone of noise impact, 1800 feet; 50 to 75 structures may be affected.	
			Raw Water Supply Lake Fausse Point Water supply would affect less than 10 structures. Ground water supply well field would affect noise levels of up to 10 structures.
			Brine Disposal Brine disposal pipeline and raw water supply pipeline would affect noise levels for up to 50 structures.
	Terminal Facilities	Site Preparation (see Table C.3-2)	
Species and Ecosystems	Terrestrial Agricultural Land	Site Preparation & Offsite Temporary loss of 202 acres due to facility construction. Minimal impact importance.	
		Raw Water Supply Temporary loss of 16 acres due to pipeline to Bayou Teche.	Raw Water Supply Temporary loss of 9 acres agricultural land due to raw water well field. Temporary loss of 69 acres due to pipeline to Lake Fausse Pointe. Temporary loss of 117 acres due to pipeline to Gulf.
		Brine Disposal Loss of 48 acres due to construction of injection well field.	
			Crude Oil Distribution Temporary loss of 68 acres due to pipeline to Napoleonville area.
		Terminal Construction (see Table C.3-2)	
	Bottomland and Swamp Forest	Site Preparation & Offsite Loss of 48 acres due to facility construction. Revegetation of 17 acres likely. Minimal impact importance.	
		Brine Spills Large brine spill could destroy several acres along pipeline route.	
		Brine Disposal Loss of 7 acres due to construction of injection well field (mostly temporary).	Brine Disposal and Raw Water Supply Loss of 66 acres swamp forest habitat due to construction of brine disposal or raw water supply lines to Gulf.
			Raw Water Supply Loss of 3 acres of bottomland forest due to use of Lake Fausse Point water source
			Crude Oil Distribution Loss of 264 acres due to construction of pipeline to Napoleonville area.

TABLE C.6-5b continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT: PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT: ALTERNATIVE PHYSICAL FACILITY
	Aquatic		
	Bayou Teche	Raw Water Supply Destruction of phytoplankton and zooplankton during the three year leaching period. Impact on regional biotic resources considered insignificant.	
	Tete Bayou and local water bodies near construction sites	Site Preparation Minimal local impacts due to erosion and runoff.	
		Brine Spills Major brine spill remotely possible near Tete Bayou significant loss of biota would follow.	
	Gulf of Mexico		Brine Disposal Brine effluent could affect benthos community structures over several hundred acres. Should not be significant to plankton and nekton except possibly adjacent to brind diffuser. Dredging could destroy benthic habitats and reduce productivity.
Natural and Scenic Resources	All Pipeline Construction	ROW Clearing Locally significant impact due to clearing along pipeline right-of-way.	
Socioeconomic Conditions	Cultural Resources	All Sites Possibly loss or disruption of significant cultural resources.	
	Land Use	Alteration of land use on total of 290 acres in Iberia and St. Mary Parishes.	
	Transportation	Total construction wages, $5.8 million, much of which would be spent outside the local area.	
	Government	Possibly significant loss of property and severance tax revenues.	

TABLE C.6-6a Summary of environmental impacts caused by operation of Bayou Choctaw SPR facilities.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT PROPOSED PHYSICAL FACILITY	ALTERNATIVE PHYSICAL FACILITY
Geology and Land Features	Land Surface	Cavern Collapse Remote possibility of roof collapse causing surface subsidence and formation of a lake onsite.	
Water Resources	Bull Bay, ICW, and small water bodies near Bayou Choctaw dome	Oil and Brine Spills Impacts from expected oil and brine spills negligible. Possible very large spill could seriously degrade water quality for several weeks or months.	Raw Water Supply Withdrawal from ICW would only lower water level and increase drainage rates from adjacent wetlands insignificantly.
	Mississippi River	Raw Water Supply Withdrawal of up to 627,000 BPD for oil displacement over 150 day period expected to have no measurable effect on water quality or quantity. Oil Spills Could have significant local impacts. Terminal Facility (see Table C.3-3)	
	Gulf of Mexico		Raw Water Supply or Brine Disposal No effect on Gulf of Mexico water quality and quantity due to withdrawal; local alteration of salinity and water quality near brine diffuser; increased brine spill exposure.
	Ground Water	Brine Disposal Brine injection should have no adverse impact. Oil and Brine Spills Very slight chance of local ground water pollution due to surface or brine oil spill; collapse of cavity roof could seriously degrade ground water supplies for Plaquemine area but such an occurrence is highly unlikely.	Raw Water Supply Surface subsidence potential expected to be small due to ground water withdrawal of up to 640,000.
Air Quality	Oil Handling and Storage	Total Emissions Emissions from 289 MMB oil storage facility for 5 fill and withdrawal cycles equal 53,790 to 59,800 tons, 38 percent due to expansion, 140 tons at Bayou Choctaw, 160 Tons at Iberia. Storage in Surge Tanks (see Table C.3-3) Dock Transfers (see Table C.3-3)	

TABLE C.6-6a continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT: PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT: ALTERNATIVE PHYSICAL FACILITY
Noise		Storage Site Operation: No significant increase in ambient sould levels on or adjacent to the site with either proposed or alternative facilities.	Onsite Power Generation: Would cause significant hydrocarbon emissions at Bayou Choctaw.
Species and Ecosystems	Terrestrial		
	Agricultural Land	Oil and Brine Spills: Possible oil or brine spills would have local, short-term adverse effect on agricultural productivity.	
			Raw Water Supply: Withdrawal of water from wells would reduce area of pipeline ROW maintenance by 25 acres.
			Raw Water Supply or Brine Disposal: Use of Gulf of Mexico for raw water supply or brine disposal would greatly increase acreage required for right-of-way maintenance and would increase exposure to brine spills.
		Terminal Facilities (see Table C.3-3)	
	Bottomland and Swamp Forest	Oil and Brine Spills: Possible oil or brine spill from pipelines could have locally significant adverse impacts.	Raw Water Supply and Brine Disposal: Use of Gulf of Mexico for raw water supply or brine disposal would greatly increase required acreage for right-of-way maintenance, and would increase exposure to brine spills.
		Storage Site Maintenance Clearing: Continued maintenance of 36 acres would reduce available habitat in region by an insignificant amount.	
	Marsh		Raw Water Supply and Brine Disposal: Use of Gulf of Mexico for raw water supply or brine disposal would greatly increase required acreage for right-of-way maintenance, and would increase exposure to brine spills.
	Aquatic		
	Bull Bay, ICW, and local water bodies near Bayou Choctaw dome	Oil and Brine Spills: Possibility of major spill of brine or oil from pipeline considered remote. Would cause locally significant impacts on aquatic life.	
			Raw Water Supply: Withdrawal of water from ICW could significantly reduce standing crop of plankton and other small organisms.
	Mississippi River	Oil Spills: Potential oil spill impacts could be locally significant, especially at dock site and in lower delta.	
		Raw Water Supply: No measurable impact on aquatic life due to water withdrawal.	

TABLE C.6-6a continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT: PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT: ALTERNATIVE PHYSICAL FACILITY
	Gulf of Mexico	Oil Spills Expected oil spill volume could significantly affect marine biota. Estimated total 4541 barrels of oil from all SPR operations in the Gulf during project lifetime. Possibly very large or maximum credible oil spill could have significant impacts to several thousand acres of shallow water or marsh if spill reaches shore before cleanup.	Brine Disposal Brine could destroy benthic habitats and reduce productivity. Small impact on plankton and nekton. Possible alteration of migration routes.
Natural and Scenic Resources		Oil Spills Adverse impacts associated with possible large oil spill which could foul swamp forest and marshes and contaminate water with oil. Operation and Maintenance Pipeline ROW maintenance would have small adverse aesthetic impacts.	Raw Water Supply or Brine Disposal Pipelines to Gulf Coast would have additional adverse resource impact. Onsite Power Generation Would require a 200 foot emissions stack at Bayou Choctaw.
Socioeconomic Environment	Economy	Storage Site Employment Total wages expected to be approximately $68,000 during each month of oil fill and withdrawal; $44,000 during standby.	

TABLE C.6-6b Summary of environmental impacts caused by operation of Iberia SPR facilities.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT: PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT: ALTERNATIVE PHYSICAL FACILITY
Geology and Land Features	Land Surface	Cavern Collapse Remote possibility of roof collapse causing surface subsidence and formation of a lake onsite.	
Water Resources	Tete Bayou and small water bodies near Iberia dome and along oil pipeline to Weeks Island.	Oil and Brine Spills Impacts from expected oil and brine spills negligible. Possible very large spill could seriously degrade water quality for several weeks or months.	
	Pipeline Corridor between Iberia and terminal		Crude Oil Distribution Maintained area of 207 acres. Possible impact from oil spill.
	Bayou Teche	Raw Water Supply Withdrawal of up to 333,000 BPD for oil displacement over 150-day period expected to have no measureable effect on water quality or quantity. Oil Spills Could have significant local impacts.	
	Lake Fausse Point		Raw Water Supply Withdrawal from Lake Fausse Point could lower water level a small amount and increase drainage from adjacent wetlands during low flow periods.
	Mississippi River	Terminal Facilities (see Table C.3-3)	
	Gulf of Mexico		Raw Water Supply or Brine Disposal No effect on Gulf of Mexico water quality and quantity due to withdrawal; local alteration of salinity and water quality near brine diffuser; increased brine spill exposure.
	Ground Water		Brine Disposal Brine injection should have no adverse impact. Oil and Brine Spills Very slight chance of local ground water pollution due to surface or brine oil spill; collapse of cavity roof could seriously degrade ground water supplies for Iberia area but such an occurrence is highly unlikely.
Air Quality	Oil Handling and Storage	Total Emissions Minor release of hydrocarbons from onsite brine pond and oil surge tanks, Total - 160 tons.	
			Onsite Power Generation Would cause significant increase in pollutant emissions at dome.

TABLE C.6-6b continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT PROPOSED PHYSCIAL FACILITY	ALTERNATIVE PHYSICAL FACILITY
Noise		Storage Site Operation No significant increase in ambient sound levels on or adjacent to the site with either proposed or alternative facilities.	
Species and Ecosystems	Terrestrial Agricultural Land	Oil and Brine Spills Possible oil or brine spills would have local, short-term adverse effect on agricultural productivity.	Oil Spills Possible oil spills would have local, short-term, adverse effects on productivity. Raw Water Supply Withdrawal of water from wells would slightly reduce pipeline ROW maintenance. Use of Gulf of Mexico for raw water supply would increase maintenance acreage along pipelines.
	Bottomland, Swamp Forest and Marsh	Oil and Brine Spills Possible oil or brine spill from pipelines could have locally significant adverse impacts. Facility and ROW Maintenance Clearing Continued maintenance of 56 acres would reduce available habitat in region by an insignificant amount.	Oil Spills Possible oil spills would have local, short-term, adverse effects on productivity.
	Aquatic Tete Bayou and local water bodies along oil pipeline ROW to Weeks Island	Oil and Brine Spills Possibility of major spill of brine or oil from pipeline considered remote. Would cause locally significant impacts on aquatic life.	Oil Spills Would cause locally significant impacts on aquatic life.
	Bayou Teche	Raw Water Supply No significant impact on aquatic life due to water withdrawal.	Raw Water Supply Withdrawal of water from wells would eliminate possibility of adverse effects on Bayou Teche.
	Lake Fausse Point		Raw Water Supply Withdrawal of water from Lake Fausse Point should have little regional effect on standing crop of plankton and other small organisms.
	Gulf of Mexico		Raw Water Supply Withdrawal of water from the Gulf of Mexico should have little regional effects on standing crop of plankton and other small organisms. Brine Disposal Brine could destroy benthic habitats and reduce productivity. Small impact on plankton and nekton. Possible alteration of migration routes.

TABLE C.6-6b continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT PROPOSED PHYSICAL FACILITY	ALTERNATIVE PHYSICAL FACILITY
Natural and Scenic Resources		Oil Spills Adverse impacts associated with possible large oil spill which could foul swamp forest and marshes and contaminate water with oil. Operation and Maintenance Pipeline ROW maintenance would have adverse aesthetic impacts.	Oil Spills Adverse impacts associated with possible large oil spill which could foul swamp, forest and marshes and contaminate water with oil.
		----	Raw Water Supply or Brine Disposal Pipelines to Gulf Coast would have additional adverse resource impact. Onsite Power Generation Would add a highly visible emissions stack to Iberia dome.
Socioeconomic Environment	Economy	Stroage Site Employment Total wages expected to be approximately $56,000 during each month of oil fill and withdrawal; $26,000 during standby.	

C.7 ALTERNATIVE GROUPING NO. 3 (EARLY STORAGE SITES PLUS CHACAHOULA DOME)

C.7.1 Introduction

The following sections detail the expected and potential environmental impacts associated with the third alternative development plan for the Capline Group. Sections C.7.1.1 and C.7.1.2 briefly summarize the types of impacts associated with the development and use of the Bayou Choctaw and Weeks Island early storage sites, which are treated in detail in previously published EIS's. Section C.7.1.3 briefly describes the activities related to the development of Chacahoula as a storage site. Section C.7.2 considers impacts associated specifically with the Chacahoula SPR development and also with significant cumulative impacts associated with full development of the Capline group.

C.7.1.1 Bayou Choctaw Dome Early Storage Site

Environmental impacts related to the development of Bayou Choctaw dome as an early storage site having a capacity of up to 94 MMB are discussed in FES 76-5 (Section 3.0) and its supplements. Construction impacts include those associated with the following activities:

- o on-site grading and construction of surface facilities;
- o construction of a 39-mile pipeline to the Mississippi River near St. James;
- o construction of one tanker dock, 4-200,000 barrel oil storage tanks, and associated terminal facilities at St. James.

Significant operational impacts would include:

- o possible oil and brine spills;
- o withdrawal of surface water for oil displacement;
- o disposal of brine during oil fill;
- o hydrocarbon emissions during oil transport and handling;
- o maintenance clearing on project lands.

C.7.1.2 Weeks Island Dome Early Storage Site

Development of Weeks Island dome as an early storage site having a capacity of 89 MMB will have anticipated environmental impacts as detailed in Section 4.0 of FES 76/77-8 and its supplements. Construction of proposed facilities would have impacts associated with the following activities:

- temporary shutdown of Morton Salt Mine and loss of employment for local workers;
- on-site grading and construction of surface facilities;
- construction of a 64.4-mile pipeline to the Mississippi near St. James;
- construction of one tanker dock, 4-200,000 barrel oil storage tanks, and associated terminal facilities at St. James.

Significant impacts would include:

- possible oil spills;
- hydrocarbon emissions during oil transport and handling;
- maintenance clearing on project lands.

C.7.1.3 Development of Chacahoula Dome

Development of 200 MMB storage facility at Chacahoula would have impacts similar in type to those at Bayou Choctaw. No storage capacity presently exists. New facilities required for SPR site expansion include the following: up to 24 leached storage cavities to create a storage capacity of 200 MMB (and bring the group capacity to approximately 383 MMB); a pump station/control house; a brine settling pond and a brine disposal pipeline to the Gulf of Mexico; on-site oil, brine, and raw water pipelines and access roads; a power utility corridor; a raw water supply line from Bayou Lafourche, and lift pumps at Donaldsonville; and an oil pipeline to terminal facilities.

The present report considers impacts associated with construction and operation of these new facilities and with expanded use of the early storage development facilities at the terminals (Section C.3). Particular attention is given to analyses of cumulative oil spill and air quality impacts which would be caused by the full 383 MMB Capline Group development.

System alternatives at Chacahoula include: a deep well injection system or an alternate diffuser location for brine disposal and raw water taken from the Gulf of Mexico, Mississippi River, or from subsurface salt water-bearing sands. Impacts of development and use of these alternatives are also considered in the following subsections.

C.7.2 Impacts of Development at Chacahoula Dome

C.7.2.1 Impacts of Site Preparation and Construction

The following section describes construction impacts for storage site facilities at Chacahoula dome and for related pipelines. Construction impacts of terminal facilities are described in Section C.3.

C.7.2.1.1 Land Features

Proposed Facilities

Quantities of material to be excavated or filled and acreages of land to be affected by grading and other construction activities at Chacahoula dome and along pipeline routes are listed in Table A.7-1.

Grading at the 450-acre fenced Chacahoula site would be confined to about 191 acres of disturbed area. The plant area, cavern wellheads and containment dikes, and other site construction would require 354,000 cubic yards (cy) of fill and 71,000 cy of excavation.

Construction of a brine disposal pipeline to the Gulf of Mexico would require a 40.4-mile on-land pipeline over which 6 acres of cleared land, 88 acres of deciduous swamp, and 298 acres of marsh would be altered. Approximately 635,900 cy of soil would be displaced and the excavated material used for backfill. Approximately 392 acres would finally be affected along the onshore section of the pipeline ROW. Alteration of existing land features would only be temporarily impacted providing recontouring and revegetation is carried out.

Leaching of up to 24 storage cavities in the Chacahoula salt dome would involve removal of about 200 MMB of salt by leaching for disposal in deep saline water bearing sands. This is equivalent to as much as 42×10^6 cy of salt. Sufficient wall thickness would be maintained between cavities to maintain cavern integrity (Section A.3.2.12).

Excavation impacts at the storage sites are considered to be long-term or permanent. Excavation along the pipeline routes, except where canals are necessary through the marsh, is primarily short-term.

Alternative Facilities

Quantities of material to be excavated or filled and acreages of land to be affected by grading and other construction activities at

Chacahoula dome and along pipeline routes are listed in Table A.7-2. Brine disposal to deep salt water bearing sands would substantially reduce the amount of land and soil excavated. Use of the Gulf of Mexico, Mississippi River, or subsurface aquifers for a raw water supply would slightly increase the amount of land required for the project.

An alternative brine diffuser site, located 22 miles south of the mouth of Caillou Lake, would have similar impacts on land features as the proposed diffuser pipeline, since the on-land row would be the same.

C.7.2.1.2 Water Resources

Site preparation and construction of the proposed facilities at Chacahoula may directly affect several water bodies, including: canals and small water bodies on-site; Bayou Lafourche; small bayous and canals crossed by the pipeline right-of-way; the Mississippi River; and ground water aquifers. Potential impacts are treated according to specific aspects of facility development.

Construction of Storage Site Facilities

Sediment represents the major nonpoint source of water pollution on most construction sites, especially on those which require extensive grading. Site preparation and construction activity at Chacahoula dome would involve a significant amount of earth movement. Approximately 425,000 cy of earth would be displaced (354,000 cy of fill, 71,000 cy of excavation) and approximately 190 acres of land would be disturbed. The land overlying the dome is almost exclusively marshland with an elevation of less than five feet above sea level. Because of the high level of annual precipitation encountered in the region, a significant amount of sediment may be transported from the disturbed surface areas into the surrounding surface water system. This sediment should pass initially into the swamps and canals in the vicinity of the dome. Some of the sediments would move into Bubbling Bayou and Donner Canal (Figure A.7-3), which are located within 0.5 mile of the site. Standard engineering practices such as interceptor ditches, dikes, and sedimentation ponds would be utilized where necessary to prevent any significant degradation of water quality due to plant site runoff.

The major sources of construction-related chemical and biological pollution can be broadly grouped under the following headings:

- Petroleum products
- Herbicides and pesticides
- Fertilizers
- Metals
- Soil additives
- Construction chemicals
- Miscellaneous wastes
- Biological pollutants.

They have been discussed in detail in Section C.4.3.1.2. There, it is noted that the primary causes of damaging pollution result from the improper disposal, handling or application of the various classes of chemicals, or poor sanitary conditions.

Prediction of the impact of such chemical and biological contaminants is quite difficult because of the human element involved. Assuming that effective waste management procedures are observed and that personnel are properly indoctrinated, the impact on the water environment should be minimal.

Raw Water Supply System Construction

Effects on Water Source The proposed source of raw water for leaching the Chacahoula SPR facilities during the mining cycle is Bayou Lafourche. Water would be obtained through a 6.5-mile pipeline terminating at an intake structure on the right bank of the channel about 5 miles upstream of Thibodaux (Sections A.7.2.3.1 and Figure A.7-1).

The water would be supplied by additional pumpage from the Mississippi River to Bayou Lafourche at Donaldsonville, located approximately 25 miles upstream of the water supply intake structure. The average water supply rate during the mining cycle would be 2,500,000 barrels per day (B/D), or approximately 162 cfs. In comparison, the average daily flow of the Mississippi River is on the order of 1,000,000 cfs, as discussed in Section B.2.2.1.2. Since the amount of water withdrawn would constitute a minor fraction of the Mississippi River flow, no significant impact on water supply would result.

As discussed in Section B.2.2.1.2, Bayou Lafourche has an average daily flow of 252 cfs at the USGS Donaldsonville gaging station. The additional pumpage of 162 cfs required during the mining cycle would increase the average flow in Bayou Lafourche approximately 75 percent between Donaldsonville and the water supply intake structure. The increase in stage of Bayou Lafourche would be approximately 0.70 to 0.75 foot at Donaldsonville, and less downstream toward the intake structure. A minor water quality impact in the form of increased turbidity would result in Bayou Lafourche between Donaldsonville and the water supply intake, due to the velocity increase in the Bayou.

Under normal operating conditions, use of Bayou Lafourche as a channel for delivering Mississippi River water to the intake structure should have little or no effect on water quality or quantity below the intake. However, whenever the intake pumps at Bayou Lafourche are shut down, pulses of higher-than-normal flow rate would travel downstream in Bayou Lafourche, increasing turbidity and stream bank erosion. In many cases, the lift pumps at Donaldsonville can be shut down simultaneously with, or prior to, the intake pumps, so that the downstream impacts should not be significant.

Pipeline Construction Effects Construction of the proposed raw water supply system would include the installation of 6.5 miles of buried pipeline between the plant area and the intake structure on Bayou Lafourche (see Section A.7.2.4.1), using installation techniques as described in Section A.3.4. A branch of Bubbling Bayou, and the Phillips Canal would be crossed, then 3.0 miles of agricultural land and about 3.5 miles of swamps would be crossed by the pipeline (Figure A.7-2).

Water quality impacts of constructing pipelines can include changes in water-flow patterns, BOD, dissolved oxygen, pH, nutrients, heavy metal concentrations, salinity, and turbidity. The disturbance of bottom sediments has the potential of: (1) creating low oxygen conditions by exposing the BOD of sediment to dissolved oxygen in surface waters, (2) lowering the pH of waters by exposing sulfides to oxidation and creating sulphuric acid, (3) increasing heavy metal concentrations by exposing complexed metals to low pH conditions; (4) releasing trapped nutrients, thereby stimulating local eutrophication, and (5) creating highly turbid conditions from mixing of water with the sediments.

The amount of material released to interact with the air and water as a result of pipeline excavation depends upon (1) the excavation process, (2) the total amount of sediment excavated, (3) the amount of sediment excavated per unit of time and distance, and (4) the physical-chemical characteristics of the sediment.

The raw water supply pipeline would be constructed using conventional and push-ditch pipelaying methods and would involve the excavating of 76,000 cy of material at the rate of about one-half mile or 3000 cy per day. Based on the assumption that 50 percent of the excavated material is water (LSU, 1975) and that no more than 10 percent of the water in the sediments will drain into surrounding water in any short time period (less than one week), about 2.4 acre-feet of interstitial water could drain to surrounding lands. Depending on water depths and mixing conditions, a 63-acre area of swamp forest and shallow water could be affected by low pH, low dissolved oxygen, and high nutrient concentrations. These effects should dissipate within a week of occurrence due to reaeration of water and use of nutrients by biota.

Impacts of Brine Disposal Construction

Effects on Receiving Waters

The proposed brine disposal location for the Chacahoula site is located in the coastal waters of the Gulf of Mexico, approximately 26 miles south of Pointe Au Fer at a depth of about 30 feet (Figure A.7-5).

During the construction phase, a maximum of approximately 100,000 BPD of brine with a salinity 200 parts per thousand (ppt) greater than ambient (about 30 to 35 ppt) would be disposed. In order to gain quantitative indication of the possible impacts of brine disposal to the Gulf of Mexico, computer simulation analyses were performed using a time-dependent model (NOAA, 1977). Model input included estimated varying current fields that closely approximate actual conditions and observed current patterns obtained from baseline monitoring at the Gulf diffuser site.

Using estimated current fields approximating actual conditions, the results of the analyses conclude that the current sequence has only a moderate effect on the maximum predicted concentration in the far field, but it has a substantial influence on the shape of the calculated concentration distribution. Periods of strong ambient current produce long, narrow plumes. Concentrations near the diffuser are relatively lo due to the positive dependence of near field dilution on current speed. During periods of stagnation, the plumes remain close to the diffuser. Concentrations near the diffuser are generally higher during stagnant conditions than for the strong net current cases due to concentration build-up (NOAA, 1977).

The sensitivity of the calculated concentration distributions due to a reduction in the horizontal and vertical turbulent diffusion coefficients was also tested. Reducing the vertical diffusion coefficient by a factor of 3.3 increases bottom concentrations by about 0.5 ppt over much of the plume. Reducing the horizontal diffusion coefficient by a factor of 3 decreases the lateral spreading of the plume and thereby increases the bottom concentrations predicted for the centerline of the plume. The effect on bottom areas of reducing vertical diffusion is greater than the effect of reducing horizontal diffusion because the former process transports mass away from the bottom while the latter process merely redistributes mass along the bottom (NOAA, 1977).

For the case of moderate current conditions (estimated), an increase of less than 5 ppt above ambient could be expected within a boundary of 10^6 square feet (23 acres). After an 8-day stagnation period, salinities in the near field would remain similar but would increase by a factor of 4 or 5 over the base case outside the near field (NOAA, 1977).

Using 14 days of actual current meter data collected at the Chacahoula site to allow the model to become stabilized, outputs were taken at 0, 3, 6, and 9 hours. The average area of the 4 outputs contained in the 3 ppt isohaline was 123 acres. No major variations were noted between the actual observed and simulated current outputs.

A comprehensive discussion of the brine disposal simulation analysis and presentation of results is contained in Appendix G.

Due to geothermal heating, the brine in the cavern may increase to a temperature from 120 to 150°F. The temperature of the brine at the diffuser would not be reduced greatly. However, due to turbulent mixing, temperature elevation would be less than 1°F within the 25-acre brine mixing zone, even during stagnation periods.

The main impact of the brine plume on water quality would be elevated salinity levels, up to 230 ppt. Associated with this increase would be an alteration in the normal ion ratios. Ca/Mg and K/Na ratios would be altered to a large extent; the balance of these ions have been shown to be an important ecological factor in the physiological function of several organisms. Increases in the concentrations of precipitates would parallel increased salinity. Possible settling of these particulates could influence sessile marine life in the disposal area.

Heavy metals are not expected to impact the discharge area since the concentrations of the trace metals are low in both the leachate source and the brine. The elevated salinity and temperature of the brine water would result in its deoxygenation. However, jet dilution at the diffuser site would cause a rapid increase in oxygen levels to near ambient concentrations.

The oil in brine analysis and experience gained during several years of operation of a similar facility in Manosque, France has shown that concentration of oil in the discharged brine should be well below the EPA recommended guidelines (see Appendix D).

Pipeline Construction Effects

The proposed brine disposal pipeline route would leave the site on a general southerly bearing and crosses Chacahoula Bayou, Tiger Bayou, and Bayou Black. Bayou Black extends from Houma to Bayou Chene, has a width of approximately 120 feet and a depth of 4 feet. No volumetric flow data are available for Bayou Black, which is reported by some observers to be essentially stagnant. Thereafter, the proposed brine disposal pipeline route woule cross Lake Cocodric, an unnamed east-west canal, and Bayou Penchant.

Below Bayou Penchant, the proposed brine disposal pipeline route traverses approximately 298 acres of coastal marsh containing numerous bayous, lakes, and tidal creeks. The pipeline route then proceeds offshore from Caillou Bay in the vicinity of Pelican Island approximately 23.6 miles and terminates at a multiport brine diffuser in the Gulf of Mexico. The location of the offshore brine disposal facilities is shown on Figure A.7-6.

Onshore construction of the proposed brine disposal system would require the installation of approximately 40.4 miles of buried pipeline between the site and the coast. Onshore pipeline installation will require approximately 635,900 cy of excavation, potentially releasing 20 acre-feet of interstitial water to the surrounding environment. Potential impacts resulting from pipeline burial are discussed in Section C.4.3.1.2.

Onshore construction of the pipeline would also continue the adverse trend of canalization within the coastal area. Considering the great length of the pipeline route to the coast, such an impact could be significant, particularly without restorative measures.

Potential water quality impacts related to construction of the offshore portion of the brine disposal line are similar to those discussed in Section C.5.2.1.2 (Weeks Island). Since the offshore portion of the brine disposal line is 23.6 miles in length, as compared to 32.1 miles for Weeks Island, the resulting impacts on water quality will be somewhat less than previously described.

Accidental Brine Release

The estimated quantity of brine spilled during leaching of the Chacahoula expansion cavities is 360 barrels onto lands crossed by the pipelines leading to the disposal wells. Water quality impacts should be negligible. Maximum credible spills of up to 30,000 barrels are considered possible, though highly unlikely (see Appendix E). Such spills could have very serious effects on local water quality, vegetation, and wildlife.

A brine spill at the site or along the disposal pipeline could locally impact the water quality in the upper unit of the Plaquemine aquifer. The brine would tend to migrate downward within the formation and downdip along the formation due to density differences. A massive spill, although highly unlikely, could possibly impact the quality of municipal water supplies pumped from aquifers in the area by causing increased salinities in those aquifers. However, as the Plaquemine aquifer is contained by a 100-foot layer of clay and silt, potential spills from the membrane-lined brine pit or from the pipeline are likely to have negligible impact on water quality.

Storm surge studies conducted by the U.S. Army Corps of Engineers indicate that the 100-year flood elevation at Chacahoula is +5.5 feet MSL (Roy, personal communication). As the brine pond would be protected by a levee of minimum elevation +15.0 feet MSL, there is little likelihood of a catastrophic failure resulting in a release of up to 100,000 barrels of brine.

Impacts of Oil Distribution System Construction

The proposed oil distribution pipeline would follow the route of the water supply pipeline between the site and Bayou Lafourche. The oil pipeline route crosses Bayou Lafourche approximately five miles upstream of Thibodaux and continues northeast about 1.5 miles. The oil pipeline route then turns northward to connect to the DOE terminal. Between Bayou Lafourche and the St. James terminal, the route crosses Bayou Petit Chackbay, Bayou Verret, Bayou Citamon, Coulee Michel, and the St. James Canal.

Between the site and Bayou Lafourche, the impacts resulting from construction of the oil pipeline would be the same as for the proposed raw water line, previously discussed. From Bayou Lafourche to St. James, pipeline installation would require approximately 200,000 cy additional excavation, potentially releasing 6.1 acre-feet of interstitial water to the surrounding environment. Potential construction effects on the local water quality would be similar to those discussed in Section C.4.3.1.2.

Construction of Alternative Facilities

Alternative systems to provide raw water for cavern leaching include withdrawal from the Gulf of Mexico, withdrawal from the Mississippi River, and pumping of moderately saline ground water. An alternative brine disposal method is deep well injection or an alternate diffuser location.

Alternative Raw Water Source - Gulf of Mexico A pipeline to a raw water intake on the coast of the Gulf of Mexico could supply the raw water requirements of the Chacahoula site with insignificant effects on the quantity or quality or water in the Gulf of Mexico.

The pipeline would be installed adjacent to the proposed brine diffuser pipeline right-of-way, which was previously discussed, and would have the same construction impacts.

Alternative Raw Water Source - Mississippi River Water would be pumped from the Mississippi River at St. James via a 21.9-mile pipeline. The amount of water withdrawn would constitute a minor fraction of the flow of the Mississippi, so no significant impact on water supply or water quality would result from the withdrawal and desander system.

The pipeline would be installed adjacent to the oil distribution pipeline right-of-way, which was previously discussed, and would have the same construction impacts.

Alternative Raw Water Source - Ground Water Ground water from aquifers in the site vicinity is an alternative source for leaching water in the event constraints were placed on use of surface water; it would be possible to install large capacity wells in the lower unit of the Plaquemine aquifer and pump the required quantities of moderately saline water (3000 to 10,000 milligrams per liter dissolved solids) for leaching of the storage cavities and for displacement of oil from storage. Leaching operations would require water over a three-year period at a maximum rate of about 75,000 gpm for three months.

Impacts that might result from withdrawal of such large quantities of water include lowering of the piezometric level in the pumped zone, land subsidence, and intrusion of the pumped zone by waters of different salinities. These impacts have been discussed in detail in Section C.4.3.1.2.

Construction of the well field would require a total of 10.2 miles of pipeline trench, with 103,000 cy of excavation.

Alternative Brine Disposal System - Deep Well Injection

Effects on Receiving Aquifers An alternative method for brine disposal is by emplacement in sands containing saline water. This can impact ground water supplies in various ways including increasing the salinity of the injection sands, displacing moderately saline water from one portion of the injection sands into freshwater portions of the same sands, or inducing migration of brine or moderately saline water from the injection sands into a freshwater aquifer via such avenues as abandoned wells or faults. These conditions are similar to those at the Napoleonville site and are discussed in more detail in Section C.4.3.1.2. Additional site-specific studies would need to be conducted to confirm the technical feasibility of injecting brine in the proposed quantities.

Pipeline Construction Effects Construction of the alternative brine injection well system would require installation of 18.1 miles of pipeline and 287,000 cy of excavation between the plant area and the injection wellheads. A permanent roadway would provide access to each well, and require a total of 392,000 cy of fill. Well pads would require an additional 365,000 cy of fill.

Alternative Brine Disposal System - Alternate Diffuser Location Use of the alternate diffuser location would have the same impact on land as the proposed location, but less offshore due to the shorter pipeline length of 22.3 miles.

C.7.2.1.3 Air Quality

During site preparation and construction, the air quality impacts for development of 200 MMB storage capacity at Chacahoula would be very similar to the air quality impacts for Napoleonville, as described in Section C.4.3.1.3. Construction impacts associated with development of early storage capacity at Bayou Choctaw and Weeks Island are given in FES 76-5 and 76/77-8.

All downwind concentrations due to construction would be well below state and national air quality standards. However, since background HC levels often exceed the three-hour standard in southern Louisiana, infrequent additional exceedances may be expected. However, construction impacts will be short-term in nature and confined to a relatively small area.

Alternatives

Air quality impacts associated with construction of a raw water supply well field and construction of pipelines to the Gulf of Mexico for brine disposal would be similar to those described in Section C.4.3.1.3, where the impacts were concluded to be minor.

C.7.2.1.4 Noise

Development of Chacahoula dome for SPR, construction techniques, and associated noise levels are similar to those described for the Napoleonville site (Section C.4.3.1.4).

Table C.7-1 presents radii for noise impact zones within which the ambient sound levels are raised 3 dB or more. Since the nearest residential area is the town of Chacahoula, over two miles from the site, no impact due to on-site construction noise is expected. There are, however, approximately 67 structures within the noise impact zone created by the development of the brine disposal wells.

Noise impacts due to pipeline construction would be most significant where the raw water supply and oil pipelines cross the Bayou Lafourche levee. In excess of 50 structures would be exposed to sound level increases of more than 3 dB for periods of up to 1 week.

Ambient Sound Levels During Construction of Alternate Facilities

Construction of the raw water supply and alternate brine disposal pipeline to the Gulf would produce elevated noise levels for people within 1800 feet of the pipeline. Duration of impacts would be less than one week.

Construction of the raw water supply wells may elevate noise levels at some residences over a period of three weeks to one month. As some of the wells would be drilled on agricultural land, noise attenuation due to vegetation would be negligible.

Construction of a brine disposal well field may also cause temporary noise impacts to some residences.

TABLE C.7-1 Summary of construction noise impact, Chacahoula SPR development.

Area	Activity	Impact Zone Radius (feet)[a]
Chacahoula Dome	Drilling New Cavern Wells	5000
	Support Facilities Construction	2000
Pipeline Routes	Laying of Pipes	1800
	Access Road Construction	1600

[a] This is the distance within which sound levels are raised three decibels or more by activity described. Center of this circle is at center of activity site.For pipeline construction activity, the radius describes a corridor along the pipeline.

C.7.2.1.5 Impact on Ecosystems and Species

Salt Dome Development

Development of the Chacahoula site would involve several impacts on the biota of the area. These impacts include loss of terrestrial and aquatic habitats, increases in turbidity, and indirect effects on fish and wildlife due to forced migration, noise, and human disturbance. The total area involved for each habitat is presented in Tables A.7-1 and B.6-1.

Impacts to ecosystems and species at Chacahoula dome are expected to be similar to those discussed for the development of Napoleonville. The differences would be related to the relative areas and volumes disturbed during construction of the facility.

Approximately 191 acres of wildlife habitat would be lost due to grading associated with site development within the fenced 450-acre storage site,and 1203 acres would be affected offsite. Habitat affected would be deciduous swamp. Since the 450 acres at the site will be enclosed by fencing, it can be assumed that, except in the case of avifauna, the available resources provided by the habitat would be permanently lost to many other wildlife groups.

The proposed brine disposal system would include 64.0 miles of pipeline, associated roads, disposal well pads,and other construction operations. A total of 969 acres would be affected, including 572 acres offshore (see Section A.7 and Figure A.4-4).

Direct effects of the construction (other than death resulting directly from construction activities) include permanent habitat loss (loss of food, cover, nesting and breeding areas), forced migration of resident wildlife, and animal loss resulting from increased activity, road traffic, and covering fill. Indirect effects of construction include impacts on wildlife of forced migration, increased noise, and human disturbance. Earth moving activities for leach pad construction, roads, and other construction operations would increase turbidity and add nutrients to swamps and other surface water systems in the area.

Clearing of the cover vegetation and removal of topsoil from the proposed pipeline right-of-way would cause several secondary impacts. Most important of these is a decrease in productivity of forage material within the right-of-way corridor. Another direct impact of construction of the proposed pipeline is the compaction and random mixing of the soil by heavy equipment and vehicles within the right-of-way.

Human activities, construction, and the release of dust, dirt, and fumes would most likely cause the migration of resident wildlife species from the direct impact areas due to loss of protective cover, and feeding, breeding, and nesting areas. Some animal losses are expected from the direct and indirect effects of pipeline construction. Animal losses are expected to be greatest among the small rodents and other less mobile wildlife species. The potential losses resulting from pipeline construction would be greatest during the major nesting and young-bearing season.

The effects of pipeline construction on wildlife in cleared land habitats are expected to be minor and short-term. Most of the wildlife species commonly found in cleared lands are able to survive despite fluctuating conditions and altered habitats.

The effects of pipeline construction on wildlife at river crossings would be minimal and temporary. Construction activities would force most wildlife away from the crossings. Most mammals, birds, and herpetofauna would return to the area once human activities decrease.

Permanent loss of habitat is expected in the marshes. Brush and trees would be completely removed within the right-of-way. This removal would result in a loss of habitat, feeding areas, protective cover, and nesting areas for woodland species. Arboreal species of wildlife and woodland perching and nesting avifauna would be adversely affected.

A positive factor derived from construction is the creation of an "edge effect," a transitional area where two major biotic communities meet and blend together. An edge includes organisms common to the communities on both sides of it, as well as other more versatile species. It allows a diversity of habitat that in turn provides resources for a more diverse fauna. The edge may serve as a food source for animals of the forest or travel lands for large and medium-sized mammals. Many important game species are characterized as "edge" species, including quail, rabbits, and the white-tailed deer.

The effects of pipeline construction on wildlife that inhabit the swamps and wetland habitats would be significant within the immediate right-of-way. Because of the vast number of wildlife species that inhabit these areas these impacts would directly affect only a small number of individuals compared to those which inhabit all similar habitats in the area. Habitat loss in the swamps and wetlands may be temporary, however alteration of existing drainage patterns in the wetlands could force water-dependent herpetofauna species into marginal habitats where their chances of survival would be greatly reduced.

A large number of furbearers, waterfowl (winter), and marsh-inhabiting bird species would be adversely affected by pipeline construction in that some feeding and nesting areas would be permanently lost. Effects of construction on swamp and wetland areas may be evident for one to two years or more.

The primary impacts from pipeline construction on the aquatic environment are the destruction of benthic habitat where wetlands and streams (or other water bodies) are crossed, and the turbidity caused by stream crossings and land runoff. The biological details of these impacts were discussed earlier in this section.

Water bodies that would be affected by pipeline construction include the swamp to the south of the site, Bubbling Bayou, Bayou Lafourche, and several smaller creeks and canals.

Pipeline construction impacts nearshore Gulf waters include direct destruction of benthic-habitat within the pipeline ROW, indirect stress on adjacent benthic habitat and portions of the water column due to increased turbidity and siltation, and possible reduction in dissolved oxygen levels. Increased turbidity would reduce plankton productivity and cause nekton to avoid the region. As the nearshore bays are naturally turbid, it is unlikely that indirect effects on benthos would be significant. Released oxygen levels should be temporary. Also, benthos should repopulate the construction ROW within one to two years. There are no reported oyster beds in the vicinity of the proposed pipeline ROW. Some increased uptake of resuspended trace metals and other pollutants may also occur.

Brine discharged into the Gulf of Mexico may impact the marine biota in and around the point of discharge. The distribution of the brine plume, as analyzed by NOAA(1977), is described in Section C.7.2.1.2 and in Appendix G.

The high temperature-salinity sector for the proposed diffuser site is anticipated to have excess salinity values of approximately 3 to 200 ppt, excess temperatures of 1 to 70^{o}F, excess turbulences and particulates, low dissolved oxygen levels, and atypical concentrations of chemical constituents. This sector would have a predicted average area of 123 acres. The above factors would directly affect the plankton, benthos, and nekton within a predicted average area of 40 acres around the diffuser site. Outside of this area, no one chemical component may be in high enough concentrations to be toxic, but a number of compounds may act synergistically to impact the regions near the diffuser sites.

Plankton would be entrained in the brine plume for several hours. During that time phytoplankton and zooplankton would experience physiological stress, inhibition of growth, or death. Primary production would be reduced as a result of increased turbidity and decreased dissolved oxygen. Approximately 43×10^6 phytoplankton cells and 475 zooplankton would be destroyed for each cubic meter of water entrained in the brine plumes. Benthic organisms in the near field would be destroyed at the rate of 3.6×10^6 organisms per acre.

Adult nekton would be minimally affected due to their ability to avoid the high salinity-temperature areas. Decreases in local nekton productivity may result from avoidance and reduced benthic and planktonic populations. However, within the 40 acres around the diffuser, the brine plume may impact developmental stages, eggs and larvae, by inhibiting metabolic functions, growth, and development.

Construction of the diffuser pipeline and discharge of cavern leachwater is not expected to impact any unique habitats or endangered species. A more detailed discussion of the impacts of brine diffusion on the local marine biota is presented in Appendix G.

Raw Water Supply

The proposed raw water supply system from Bayou Lafourche has a 6.5 mile long pipeline which will use 17 acres of terrestrial habitat and 1 acre of aquatic habitat. (Table B.6-1, Figure A.4-4). Since a major portion of the area used by this system would be on cleared or developed land, or deciduous swamp, the terrestrial impacts would be minimal in these areas.

The primary aquatic impact related to the raw water supply system would be the entrainment of plankton, drifting invertebrates, and larval fish from Bayou Lafourche, and the impingement of juvenile fish on the intake screen. Entrained organisms would be lost since they would be unable to withstand the high salinity within the cavities. Assuming an even distribution of entrainable organisms, about 39 percent would be lost, based on an average daily flow in Bayou Lafourche of 414 cfs (including increased pumped capacity) and a maximum intake rate to the storage site of 162 cfs. Although this a high proportion of the total flow in Bayou Lafourche, it is only a small fraction of a percent of the flow of the Mississippi River (from which most of the water in Bayou Lafourche is pumped). Therefore, the overall impact would be moderate to low for the overall system.

The impingement of aquatic organisms on the intake screen would be limited primarily to juvenile fish (usually less than about 4 inches long). Since all of the impinged fish would be returned to the bayou, it is likely that many may survive. The actual survival rate would depend on flume design, location, and operating procedures used for the intake structure. Assuming that the intake structure is not located in the vicinity (or just downstream) of major fish spawning areas such as bars and backwater areas, the impact probably would be small.

Increased turbidity caused by higher flow velocities in Bayou Lafourche may decrease stream productivity and further stress fish and benthos populations. Present water quality is already turbid, thus minimizing possible adverse impacts.

Oil Pipeline Construction

The proposed oil pipeline from Chacahoula to St. James would follow a new 80 foot construction right-of-way for most of the route. A total disturbance of 214 acres would be required over a distance of 21.9 miles, 60 percent in swamp forest and the remainder in agricultural land and water crossings. Aquatic and terrestrial habitat impacts would be similar to those described for the brine disposal system. An extensive swamp forest wetland area is crossed in St. James and Lafourche Parish just south of the terminal site. The only major water crossing would be Bayou Lafourche where increased turbidity and local destruction of benthic habitats would occur.

Proper construction methods, backfilling of the pipeline trench, and use of an existing ROW should minimize the significance of short term impacts and the potential for long term disruption of surface flow patterns.

Accidental Brine Release

The expected quantity of brine accidentally spilled from the brine retention pond onsite or from the brine injection system during leaching is 360 barrels (Appendix E and Section C.2). These spills would not be anticipated to have significant adverse impacts on more than 6 to 7 acres of terrestrial or aquatic habitat in the vicinity of the site. A maximum credible spill of up to 30,000 barrels of brine could have significant local impacts on both the vegetation and animals in the spill area; however, the probability of such a spill is extremely small.

Should a maximum credible brine spill occur on the salt dome or along the brine disposal pipeline, the brine could spread across the swamp forest possibly reaching Grand Bayou to the west. Impacts on vegetation and on animal life which could not avoid the brine in these areas would be locally devastating. Tens of acres of habitat could be destroyed and the resulting salt concentrations in the soil could remain above levels tolerated by growth of new vegetation for several years. However, it must be emphasized that such a spill is statistically very unlikely to occur, especially from so short a section of pipeline.

Construction of Alternative Facilities

Alternative Raw Water Source - Gulf of Mexico

The alternative raw water supply system from the Gulf of Mexico has a 42.4-mile-long pipeline which would use 99 acres of terrestrial habitat (Table B.6-1, Figure A.4-4). The terrestrial impacts of this system would be of the same kind as those discussed for the primary brine disposal system. As the pipeline would occupy a right-of-way adjacent to the brine disposal right-of-way, the impacts would be less than those due to construction of the brine pipeline. The impacts to the aquatic ecosystem would also less than those discussed for the proposed brine pipeline system. However, entrainment and impingement impacts would be less, since resident fish populations are expected to be less concentrated and only 2 miles of offshore pipeline would be needed.

Alternative Raw Water Source - Mississippi River

The alternative raw water pipeline from the Mississippi River would follow the crude oil pipeline right-of-way from Chacahoula for a distance of 21.9 miles. The first 6.5 miles of this pipeline would be the same as that discussed for the proposed raw water pipeline to Bayou Lafourche. The terrestrial impacts of this system would be of the same kind as those discussed for the crude oil distribution pipeline. Widening the existing oil pipeline right-of-way would use 55 acres of additional land. The only major water crossing would be Bayou Lafourche where increased turbidity and local destruction of benthic habitats would occur.

The primary aquatic impacts would be the entrainment of plankton, drifting invertebrates, and larval fish from the Mississippi River and the empingement of juvenile fish on the intake screen. Since the area impacted would be a small portion of the Mississippi River, the aquatic impacts would be negligible.

Alternative Raw Water Source - Ground Water

The alternative raw water supply system from the well field north of the site has a 10.2 mile long pipeline and would disturb 87 acres of terrestrial habitat (Table B.6-1, Figure A.4-4). The only adverse effects on biota would occur as a result of pipeline and well field construction.

Alternative Brine Disposal System - Well Field Injection

Construction of a brine disposal pipeline system to a well field for deep injection involve the same terrestrial impacts as the raw water supply system described above. Approximately 221 acres of terrestrial habitat and 1 acre of aquatic habitat would be disturbed by construction of pipelines and wells. No impacts to biota are anticipated by the normal disposal of brine to deep saline water bearing sands.

Alternative Brine Disposal System - Alternate Diffuser Location

Use of the alternate diffuser location would have the same impact on land as the proposea diffuser location, but less impact offshore because of the shorter pipeline.

C.7.2.1.6 Natural and Scenic Resources

Storage Sites

Construction at the storage site would diminish the quality of the natural and scenic resources in the immediate vicinity of the dome. Loss of trees and other vegetation would occur due to construction of well pads, roads and the plant area. Grading and filling at the site would further alter the natural terrain. Dust, noise, fumes and siltation would have a significant adverse effect during construction. For the most part, these impacts would not be visible from Route 20 or from the towns of Chacahoula or Thibodaux.

Oil Distribution Pipeline

The oil pipeline to Chacahoula would be 21.9 miles long. This segment would be in a natural state before construction. Construction activities would disrupt natural vegetation within the right-of-way. Sections of the pipeline would be visible at some points from public roadways (Highways 20, 308).

The pipeline construction activities would have significant adverse impact on the natural areas crossed. The dust, noise, fumes and vibration of construction would also have negative impacts on the aesthetic quality of the areas crossed, particularly on the Lafourche ridge. These effects would be temporary.

Brine Disposal System

The brine disposal system and its backup wells would impact both cleared land areas and natural swamp environments. The pipeline right-of-way would cross Bayou Black. This construction would significantly affect the natural qualities of the area by clearing vegetation and disrupting habitat. For the limited number of individuals passing the area during construction the scenic qualities of the area would be significantly diminished. However, this area does not offer any unique habitat types that could not be found elsewhere.

Raw Water Supply

The intake structure for raw water supply would diminish the scenic or natural qualities of the area along the pipeline route as discussed above. The 6.5 mile right-of-way is expected to have less impact than the longer oil or brine pipelines discussed above, due to its shorter length. The most significant impacts are expected where the pipeline crosses the cleared land adjacent to Bayou Lafourche.

Alternative Systems

The use of ground water would require a slight addition to the land required for the oil distribution pipeline which it would parallel. The additional impact to scenic and natural resources would be minor or insignificant.

Construction of a raw water pipeline to the Gulf of Mexico would cause a significant increase in the adverse impact of the project on natural and scenic resources. Although the pipeline would follow existing pipeline rights-of-way, the construction impacts would affect many miles of natural marshland, coastal swamps, agricultural land, and transportation corridors.

Construction of a raw water pipeline to the Mississippi River would occupy the same right-of-way as the crude oil distribution pipeline and have the same impact.

The alternative brine disposal system to a well field would have impacts similar to those described for the raw water supply from ground water aquifers. Construction of the pipeline to the alternate diffuser site would follow the same on-land right-of-way as the proposed diffuser pipeline. Impacts would therefore be similar.

C.7.2.1.7 Archaeological, Historical and Cultural Resources

Storage Site

There are numerous sites of historic, archaeological or cultural significance in the area immediately surrounding the storage site. While no direct impact on any of these resources is anticipated, new sites may be discovered during development. If any archaeological or historic material were found, it would be immediately reported to State officials so that appropriate action could be taken to preserve or protect the material.

Oil Distribution Pipelines

There are no known areas of historic, archaeological or cultural significance in the right-of-way at this time. Several sites are located north of the corridor but would not be impacted by construction.

Raw Water Supply System

This system would follow the oil distribution network with no anticipated impacts.

Brine Disposal System

The brine disposal field would be located just north of an area of known archaeological significance. At this time, no impact on similar sites is expected due to construction.

Alternative Physical Facilities

No anticipated adverse impacts are expected as a result of developing a raw water supply pipeline from the Mississippi River or a raw water supply or brine disposal system to well fields along the pipeline route.

The raw water supply and brine disposal lines to the Gulf of Mexico cross a substantial amount of land with potential for cultural sites. However, the additional ROW required for each line is only 20 feet. Furthermore, a cultural survey would be conducted and should establish the existence of sites in or adjacent to the ROW.

C.7.2.1.8 Socioeconomic Environment

Storage Site

Land Use Construction activities would have a significant impact on land use at the storage site. Some of the land has been previously disrupted during brining operations. Conversion of existing facilities and development in new areas would impact some previously undisturbed wooded areas.

The project would require fencing of a 450 acre tract of land at the storage site for the plant area, roadways, wellheads, pipelines and brine pond. Approximately 191 acres of land within this tract would be directly developed with facilities. An additional 1203 acres would be affected offsite (including 572 acres offshore).

Transportation - Project construction activities at the storage site would require most of the peak work force of nearly 600 employees during the third month of construction. Routes 309, 20, and 1 would be the most heavily impacted roads. These roads are two-lane highways closest to the site which would carry the heavy trucks and equipment to the site.

Route 309 currently has an average daily traffic or 1180 vehicles. Assuming that 10 percent, or about 118 trips occur during each peak hour, the project would have a significant effect on traffic on this highway. While peak capacity is not expected to be exceeded, some congestion could occur on the road during peak construction months. Route 1 and 20 are more heavily traveled highways and may experience congestion during construction. After the first seven months of construction, the traffic associated with the project would drop rapidly as employment declines. Project construction would briefly impact water traffic on Donner Canal.

Population - The peak construction work force would number near 600 workers for the overall project with most employed at the storage site. The first seven months are the most labor-intensive. During the next four months, the work force will drop to approximately 110 employees. Most workers are expected to commute from nearby communities such as Morgan City and Houma where oil industry construction workers are available. Others such as skilled specialists may commute from as far as New Orleans. Due to the commuting nature of the work force, the impacts on population in Terrebonne and Lafourche Parishes should not be significant. However, the increase in daytime population in the project vicinity would be quite significant. Small towns such as Chacahoula would experience a significant increase in daytime population as project workers pass through town. Thibodaux would also feel the effects of the large work force since it is the closest community with a variety of urban services.

Housing - The availability of both permanent and temporary housing is low in the project area. Communities such as Morgan City, Houma and Thibodaux would experience a substantial increase in demand for housing (especially temporary) during the first six months of the project. Demand will lessen considerably after that as labor force levels decline.

Economy - The storage site is located in a large oil-producing area. The site itself is not currently developed; consequently, the construction of the oil storage facility is not expected to affect the local oil-producing capabilities. Construction employment for the project including the storage site would have a beneficial impact on the local economy and employment levels. Louisiana has limited industrial development and the project would therefore exert a beneficial influence. Project payroll would total over $13 million (over three years) with 35 percent ($4.6 million) paid during the first six months (see Table C.7-2). Most of the employment and wages would result from activity at the

TABLE C.7-2 Estimated Monthly Employment and Payroll - Chacahoula

Month[1]	Monthly Employment	Monthly Wages
0-1	99	$ 173,250
1-2	456	798,000
2-3	617	1,079,750
3-4	541	946,750
4-5	492	861,000
5-6	431	754,250
6-7	436	763,000
7-8	152	266,000
8-11	132	693,000 (x 3)
11-20	109	1,716,759 (x 9)
20-32	132	2,772,000 (x 12)
32-55	63	2,535,750 (x 23)
	TOTAL	$13,359,500

[1]begin construction = month 0

storage site. The overall effect would be beneficial, although minor, since construction workers would take most of their pay home to spend in their local communities. However, the communities in the project area would benefit from the daytime spending patterns of the workers as they purchase gas, food and other retail services from local outlets. After the first seven months of the project, this level would drop off substantially.

Government - The project would increase the demand for public services near the storage site. Increased traffic surveillance and road maintenance would be provided, if necessary, by the parishes involved. The impact on health facilities would be minor due to the availability of facilities in the neighboring communities and the site's proximity to New Orleans and Baton Rouge. The parishes will not receive any severance or property taxes from the project, but would indirectly receive sales tax revenues from worker spending which would help offset incremental costs related to the project.

Oil Distribution

Land Use - Construction of a 21.9-mile oil pipeline from St. James to Chacahoula would impact the existing land use on 213 acres of land. This land, 40 percent agricultural and 60 percent swamp forest, would be converted from its current use to industrial construction for the duration of the building activity. Most areas would be only temporarily impacted by construction; however, the recovery from such activities would be much slower and more limited in wooded areas than in agricultural.

Transportation - Construction activity along the proposed oil pipeline would cross several major highways, Routes 1, 308, and 18. The pipeline would also cross Bayou Lafourche. While standard pipeline construction techniques would minimize the impacts on traffic related to major intersections, some minor traffic congestion may result from construction activities, especially at Bayou Lafourche. These impacts would be minimal and very temporary.

Population - Construction of the oil pipeline, as part of the total project construction, would have a minimal impact on the population of nearby areas. Because most of the workers are expected to come from the local labor pool, no significant immigration of workers and their families is expected.

Housing - Construction of the oil pipeline would not significantly impact housing in the areas through which it passes. Further, as suggested by the minimal population impacts cited above, no major increase in the demand for housing in the area is likely to occur.

Economy - The proposed oil distribution system, as a small part of the entire site construction, would provide a minor stimulant to the local economies of Terrebonne, Lafourche and St. Mary Parishes. These parishes are expected to provide most the labor and materials for the construction activities.

Government - Construction of the pipeline would not significantly increase demands on local government services. The removal of 213 acres of land from the local tax rolls could have a minor but significant impact on local revenues.

Raw Water Supply

Land Use - The proposed raw water supply system would have a minimal additional impact on land use if it is constructed within the oil pipeline right-of-way. Only one to two additional acres would be required for the pumping facility. This construction would constitute a significant change in land use.

Transportation - The raw water system would have no significant additional impacts on nearby transportation systems. Construction crews for this pipeline, as well as the oil pipeline, would increase the traffic on Routes 1, 308 and 18 in the vicinity of the right-of-way but these impacts would be minimal and of short duration.

Population - No significant increase in population would occur as a result of construction activities on the raw water supply system.

Housing - Because most of the labor for all construction activities would come from nearby urban areas, no noticeable increase in the demand for housing is anticipated.

Economy - The construction of the proposed raw water supply system would require a very small portion of the total labor force used for the project. A similar portion of the economic stimulus of the project would be attributable to the proposed system.

Brine Disposal

Land Use - The proposed brine disposal system would have a significant impact on land use during its construction. This system would impact hundreds of acres of wooded marsh and coastal marsh between the Chacahoula Dome and the Gulf of Mexico. To some extent, the land use impacts would be mitigated through the use of existing rights-of-way for the 40.4 miles of onshore pipeline construction. The 23.6 miles of offshore pipeline construction would have no significant land use effects in the traditional sense but would temporarily limit access to certain offshore areas in which construction was in progress.

Transportation - Construction of this pipeline would impact Highways 20 and 90. It would also cross many natural and man-made waterways including Bayou Black, the Intracoastal Waterway, Bayou Penchant and the Gulf of Mexico. These crossings could cause minor temporary localized traffic impacts during construction. In the Gulf, the pipelaying activities could have minor adverse impact on marine navigation and safety in the construction area. The diffuser area and construction vessels would be carefully marked with approved navigational devices. Anti-snag diffuser ports would be utilized to avoid damage to fishing gear.

Population - No significant change in population would occur as a result of construction of this brine disposal system.

Housing - Most of the labor would be drawn from local labor markets, thus, no significant increase in housing demands is anticipated.

Economy - Construction of the pipeline, as part of the larger storage project, would have a minor beneficial effect on the economies of the nearby urban areas. Should the brine disposal system construction adversely affect commercial fish in nearby coastal waters, a negative economic effect on this important local industry could occur.

Alternative Physical Facilities

Raw Water Supply Use of ground water for raw water supply would increase the land use impacts of the project over those associated with the proposed alternative. The construction of drill pads would require an additional 22 acres of land most of which is currently in agricultural use.

This alternative would remove more land from the local tax rolls than the proposed system. No significant change in the project's population, housing, transportation and economic impacts would occur should this alternative be adopted.

The use of the Mississippi River as an alternative raw water source would have the same impacts as the oil distribution pipeline plus a small incremental change in land use impacts.

Use of the Gulf of Mexico as an alternative raw water source would not significantly differ from the socioeconomic impacts associated if the proposed brine disposal right-of-way is adopted. If brine disposal in injection wells is adopted, the impacts of raw water supply from the Gulf would be significantly larger than those of the proposed system.

Brine Disposal - Construction of a brine disposal field north of the proposed storage site would have fewer impacts than those associated with the proposed brine disposal system. The land area impacted would be significantly reduced and would be more temporarily impacted due to its current agricultural use. Similarly, the reduced acreage associated with this alternative would benefit the local tax base. This alternative would further reduce potential impacts on local transportation systems. The beneficial economic effect of this alternative would be smaller than that of the proposed system. No significant change in population and housing would occur.

Socioeconomic impacts of an alternative brine diffuser site in the Gulf of Mexico would be similar to those described above for the construction of the proposed system.

C.7.2.2 Impacts from Operation and Standby Storage

The following section describes operational impacts for storage site facilities and for related pipelines. Operational impacts of terminal facilities are described in Section C.3.

Should an oil supply interruption occur while oil is stored at Chacahoula and the early storage facilities at Bayou Choctaw and Weeks Island, a total of up to 383 MMB would be available for distribution, either by tanker or by the CAPLINE Pipeline. Oil would be pumped from both the early storage sites at Weeks Island and Bayou Choctaw and the expanded SPR storage caverns at Chacahoula using separate 40-inch diameter pipelines. Oil would also be injected into the storage cavities via the same facilities. Until an oil supply interruption occurs these facilities would be maintained in readiness by monitoring storage cavity systems, leak-checking pipelines, activating valves, and other standard procedures.

Thus, SPR development at Chacahoula would not introduce any new or unique operational impacts to the program. Principal impacts of the Chacahoula SPR operation are associated with hydrocarbon emissions and oil or brine spills. Impacts expected to accompany early storage facility operation and Chacahoula facility operation are both given where appropriate to provide a perspective on program expansion impact significance.

C.7.2.2.1 Land Features and Geologic Impacts

Effects of operation and standby of the Chacahoula storage site on land features are expected to be minimal. No significant disturbance of site soils is expected after construction is completed. Soils will stabilize soon after they are revegetated. Continued maintenance of pipeline right-of-way would impact acreage as summarized in Table A.7-1.

Compared to the 1653 acres required during construction offsite and within the 450 acre fenced area, only 844 acres would need to be maintained during operation.

Chacahoula is located in an area identified as seismic Zone 1, that is with an expectation of minor earthquake damage (Figure B.2-8). Underground storage caverns are much less susceptible to damage from seismic events than surface tanks.

It is conceivable, though extremely unlikely, that the salt roof over one of the caverns could collapse. Appendix F considers the possible mechanism by which such an event could occur. A possible result would be the formation of a deep surface depression, probably resulting in a lake over the dome. Should such an event take place, significant quantities of oil or brine could be released to the surface or to shallow ground water aquifers. Impacts on surface storage equipment would be potentially significant. The structural integrity of the storage cavities would be monitored and every available measure would be taken to preserve cavern integrity (Appendix E).

Alternatives

Use of alternative raw water supply or brine disposal systems would impact land features during project operation and standby storage only through required maintenance of pipeline right-of-way (Table A.7-1). The brine disposal and raw water supply pipeline to the Gulf would have much greater maintenance requirements than the proposed system.

C.7.2.2.2 Water Resources

Impacts to water resources during facility operation may occur as a result of raw water withdrawal for oil displacement, brine disposal during oil filling, and possible oil or brine spills.

Operation of Site

During construction of the Chacahoula storage site measures would be incorporated into the design to minimize sediment transport and erosion at the site. These measures would include grading, diking and reseeding. Runoff from precipitation would therefore have minimal impact on water systems during the operation of the facility.

All sanitary wastes from the storage facility would be conveyed to a treatment plant sized to conform to Louisiana Health Department Standards, then routed to a receiving stream. As the number of operational employees would be small, no adverse impact on stream water quality would be expected.

Water supply requirements during operation of the Chacahoula site would be controlled by the 87 cfs required flow for the 150 day withdrawal cycle. This requirement would occur during each of 5 anticipated withdrawals over the 25-year life of the project.

The additional pumpage of 87 cfs from the Mississippi River into Bayou Lafourche would increase the average daily flow (velocity) of the bayou between Donaldsonville and the water supply intake structure by approximately 35 percent. The increase in stage of the bayou would be approximately 0.60-0.65 feet at Donaldsonville, and less downstream toward the water supply intake structure. The increased velocity may result in increased water turbidity over this reach of the bayou. Downstream of the intake structure, impacts on water quality or supply in the bayou would occur only when the pumps are shutdown occasionally (Section C.4.3.1.2).

Zinc anodic protection would be used along the raw water supply pipeline at intervals of approximately 1000 feet. This may result in the release of 0.6 grams of zinc per square meter of pipe surface area per year (the exact mechanisms of the release are not clearly understood). Since the pipeline would be buried under several feet of sediment, little of the zinc would be expected to enter the water column unless sediments were disturbed for pipeline repairs. Operation of the pipeline would have no significant effect on hydrology.

Operation of Brine Disposal System

When oil is pumped into the storage caverns, brine would be displaced intermittently to the Gulf of Mexico through the diffuser at an average rate of 270 or 540 MBCD over 2 or 1 years, respectively. Generally, the impacts of operational brine disposal would be similar to those of the leaching operation (Section C.7.2.1.2). However, discharge volumes would be less and would occur over a shorter period of time, lessening the impact. Maximum oil concentrations at the diffuser are expected to be less than 15 ppm and to average 6 ppm over the life of the project based on the theoretical oil in brine analysis and the experience of operation of a similar facility in France (see Appendix D).

Because the compensation water would remain in the cavern for a longer period of time than during leaching, the salinity of the brine would be close to saturation, 264 ppt. The oil-brine interaction that would occur only during the operational phase would result in a brine hydrocarbon concentration gradient of from 0 to 31.4 ppm during the initial oil fill. During subsequent refills, after a refractory layer had formed, the hydrocarbon content of the brine would vary from 4 to 15 ppm, depending on cavern geometry. However, reduction of oil content during brine discharge due to vaporization of light hydrocarbons and the mitigative oil skimming process would result in an estimated oil concentration in the discharged brine of approximately 6 ppm; this level is an order of magnitude greater than the ambient hydrocarbon concentration at the proposed diffuser site.

Oil or Brine Spills

During project operation, oil spills could occur from pipelines connecting the storage site with the surge tanks at the terminals, or from the well heads at Chacahoula (releases from the underground storage caverns are not quantified, see Appendix E). Brine spills could occur from the brine disposal pipeline and from the brine reservoir. A thorough description of possible modes of spills, methodologies of spill calculations, quantification of expected spill volumes and frequencies, spill dispersion characteristics, and spill prevention and control measures is provided in Appendix E. A summary of oil and brine spill expectations is also given in Section C.2 and in Tables C.2-1 through C.2-9. Possible effects on water resources are considered in this section.

Impacts of storage site operations on water quality would be similar to those described in section C.4.3.2.2. Site drainage is directly to Bubbling Bayou, and to a series of canals. No adverse impact on receiving waters is expected.

Quantities of oil and brine expected to be released from the early storage and Chacahoula facilities are listed by source and location in Tables C.2-7 through C.2-9. Total oil spillage from pipelines and at the storage site for five fill/withdrawal cycles is projected to be 970 barrels for the early storage facilities and an additional 671 barrels for the Chacahoula facilities (spill estimates for terminal tanker spills are discussed in Section C.3). The distribution of spills is projected to include 958 barrels at the storage sites and 683 barrels from the connecting pipelines. The maximum credible spill events are estimated to include 10,000 barrels from a pipeline rupture, and 6000 barrels at the storage sites.

Brine spills would occur only from the piping system at Chacahoula and south along the disposal pipeline. Total spillage is estimated to be 1545 barrels from Chacahoula, and 39 barrels from Bayou Choctaw (Weeks Island early storage facilities do not use brine to displace oil from storage) (Table C.2-9). The maximum credible spill event is estimated to be 30,000 barrels.

"Average" crude oil properties and fate of spills are detailed in Section C.4.3.2.2. That section discusses the dissolution, emulsification, sedimentation, and bacterial degradation of oil in detail.

Two potentially significant impacts of oil spills on water resources would be the potential for buildup of toxic fractions and depletion of oxygen levels in shallow, poorly flushed water bodies. The most likely location of such impacts would be in swamp forests along the pipeline route to St. James and in marshes located along the lower Mississippi River Delta. Most of the spills would occur in the Mississippi River or from diked areas at the terminals (see Section C.3).

Oil spills reaching the Mississippi River or the open gulf should not have significant impacts on water quality because of the potential for dilution and for oil recovery. Oil which sinks to the bottom or is deposited on the riverbank or shoreline may provide a local source of petroleum hydrocarbons to the water column for several weeks or even months, however.

Oil spills occurring anywhere on land outside dikes areas or in the Mississippi River could affect human use of water (industrial, domestic or recreational).

The Plaquemine aquifer is overlain by about 100 feet of clay and silt in the vicinity of Napoleonville. Oil spilled from the pipeline should not reach potable ground water supplies.

Should a subsurface spill occur, either from a defective well casing or collapse of a storage cavity, then oil would tend to collect at the water table and migrate laterally along the water surface. Crude oil tends to migrate very slowly through subsurface formations, and then only under pressure. However, some components of the oil, particularly the lighter aromatic hydrocarbons might be sufficiently soluble to impart an objectionable taste and odor to the water. This taste and odor could potentially reach users in the Plaquemine-Donaldsonville area as most domestic water supplies are taken from the Plaquemine aquifer.

Spills of brine or saline water have less potential for adverse effects on water quality than do oil spills because of the limited spill potential. Except for a very large brine spill, normal flushing of local water bodies (i.e., Grand Bayou) would quickly dilute salt concentrations to normal levels, resulting in very temporary water quality degradation. Flushing is not as effective in shallow water bodies or in the swamp forest, however; salinity excesses would continue for several days or weeks and may remain in the substrate.

The potential exists for relatively frequent and possibly large crude oil spills from the Capline Group of SPR sites. Calculation of spill probability and the nature of local water bodies, indicates the significant impacts on local water resources should be very infrequent.

Hazards Due to Flooding

Surface facilities at Chacahoula would not be subject to flooding caused by hurricanes or tropical storms. Surface elevations over the dome are approximately 5 feet, MSL. Data supplied by the U.S. Army Corps of Engineers indicates that the 100-year flood level at Chacahoula is +5.5 feet, MSL. There should not be any destructive currents or waves to threaten surface facilities, however.

Storm floods greater than the 100-year event could occur and could damage surface facilities. In the event of an oncoming storm, oil would be removed from the surface tanks, thus eliminating the largest spill potential. If surface piping is ruptured, a few barrels of oil could escape but would be retained within the storage area. Damage to well head piping could result in loss of a few barrels from the cavern. Brine from the settling pond would be quickly diluted by flood waters.

As only limited quantities of oil could be released in the event of a damaging storm flood, environmental effects due to the flood waters and winds are expected to be much greater than due to loss of oil or brine.

Operation of the brine disposal pipeline to the Gulf of Mexico increases the potential for brine spills. Nearly half this exposure would occur in the Gulf, however, with less potential for adverse impacts on water quality due to dilution. Discharge of up to 480,000 BPD to the Gulf should cause much less effect on salinity than leaching operations because flow rates are much lower (Section C.7.3.1.1).

Alternative Facilities

Use of alternative raw water supply systems for oil displacement would have similar impacts on water supply as described for leaching (Section C.7.3.1.1). Water withdrawal rates are about the same in both cases. Use of injection wells for brine disposal would reduce exposure to brine spills significantly. Disposal of the brine through an alternate diffuser pipeline would have operational impacts similar to the proposed system.

C.7.2.2.3 Air Quality

During operation, the air quality impacts for 200 MMB storage capacity at Chacahoula would be very similar to the air quality impacts for Napoleonville as described in Section C.4.3.2.3. The total hydrocarbon emissions at Chacahoula dome storage site over the life of the project are estimated to be 500 tons from the brine pond and 35 tons from the small oil surge tank onsite. These emissions should have no significant impact on air quality near the dome. Operational impacts associated with development of early storage at Bayou Choctaw and Weeks Island are given in FES 76-5 and 76/77-8.

C.7.2.2.4 Noise

The impacts associated with the operation of an SPR facility have been previously discussed in Section C.4.3.2.4 for Napoleonville. This discussion is applicable to the Chacahoula site.

It was concluded that noise due to pumps on the site would have a negligible contribution to the ambient sound level, due to attenuation by the corregated steel pump building. Tanker noise of short duration, low frequency, and low intensity would also not create a significant noise impact.

Alternatives

Operation of any of the alternative facilities would also not contribute significant sound levels at nearby noise sensitive areas.

C.7.2.2.5 Species and Ecosystems

Operational impacts of the proposed SPR facilities on biological resources in the area are principally related to brine discharge and the potential for oil or brine spills. Also, raw water must be withdrawn from Bayou Lafourche (and in turn pumped from the Mississippi River) to displace oil from the caverns; brine is discharged to deep salt water bearing sands during oil filling, with no resulting effects on aquatic resources. Normal surface activities at the 450-acre storage site would exclude wildlife from the immediate project vicinity, as well as 394 acres offsite of a pipeline maintenance. This is an expansion of the existing industrial use of the project lands but is not a new or significantly adverse impact.

Surface Operations

Operations of the storage facilities at Chacahoula should have little additional effect on the ecological aspects of the site. Minor adverse impacts such as weed control, periodic brush removal, increased noise and air quality changes should have little consequence to the plants and wildlife. Human activity associated with fill, withdrawal, and standby operations would result in increased site activity but these activities would have only minor effects on area wildlife. The greatest impacts from normal operations and standby activities at the Chacahoula site would be from withdrawal of raw water to displace oil and from possible oil spills (considered in succeeding subsections).

Approximately 94.3 miles of offsite pipeline and 13.5 miles onsite (oil, water, and brine) right-of-way must be maintained clear of woody vegetation to allow immediate access in case of system malfunction. Normally, up to a 50-foot wide right-of-way is required. A summary of construction and maintenance right-of-way averages for the proposed (and alternative) facilities is given in Table B.6-1.

The most significant adverse impact associated with ROW maintenance is the long-term loss of vegetation productivity and wildlife habitat in the deciduous swamp. Though grasses, shrubs and shallow water may provide some utility for forage and nesting, there is expected to be a net loss in carrying capacity. On cleared lands normal agricultural practices can be continued so that no additional biological impacts are expected.

Brine Disposal Systems

The predominant impact on vegetation and wildlife from normal operation of the brine disposal system (or one of the alternative systems) will result from the periodic maintenance required along the pipeline routes for access, surveillance, and monitoring. The impacts from these efforts are expected to be minor when compared to those which occur during construction.

During the operational phase of the proposed pipeline, the impact of right-of-way maintenance will cause a disruption in the soil and vegetation brought on by vehicular movement and chemical spraying for weed control. Spraying and mowing operations could increase the fire hazard potential unless proper procedures are utilized. The overall impact of pipeline maintenance can be minimized if care is taken to ensure that minimum vehicular movement in the right-of-way occurs, and weed control spraying is selective, localized, and performed only with biodegradable herbicides having short half-lives and minimum toxicity to animals and man.

Noise from operation may have an adverse effect upon wildlife; however, very limited noise increases would be associated with the brine disposal system.

Maintenance of the pipeline and the elimination of cover may have adverse effects on some wildlife species. Continued clearing of brush would prevent small rodents and other wildlife from becoming established on the pipeline corridor. The brush clearing would maintain the "edge" effect and would encourage new growth of established plant species, thus providing a continued food source for herbivorous wildlife.

Human intrusion during operation and maintenance of the pipeline would have minimal short-term effects on wildlife. These brief periods of human activity along the pipeline may cause wildlife to leave the immediate area, but only for a short period of time (in most instances, a matter of hours).

Impacts of brine disposal on marine organisms during operation would be similar to those during construction (Section C.7.2.1.5) although disposal during operation would occur at lower rates over shorter periods of time. The predicted area of major impact would be within 40 acres surrounding the diffuser. Additional impacts during operation resulting from elevated hydrocarbon concentrations in the brine (6 ppm) could cause repression of growth and photosysthesis in phytoplankton and decreased feeding and metabolic activity in zooplankton and nekton. Decreased growth, delayed hatching, and abnormal behavior and development may occur in fish and macroinvertebrate eggs and larvae. Incorporation of petroleum hydrocarbons may result in tainting of edible species. These effects would probably only be seen within a small area around the diffuser.

Raw Water Supply

The predominant impact on vegetation and wildlife of normal operation of the raw water supply system (or one of the alternates) would also result from the periodic maintenance required for the pipeline routes and would be the same as impacts discussed for the brine disposal systems.

Impacts to the aquatic environment would be primarily related to entrainment and impingement of aquatic organisms. The impacts due to entrainment and impingement are discussed in Section C.4.3.3.1.5 with respect to construction of the raw water supply system. However, the magnitude of the impacts during operation would be slightly less than during construction because the raw water requirements will be about 50 percent lower (see Section A.7.2.6).

Oil Delivery System

The predominant impact on vegetation and wildlife of normal operation of the oil delivery system would result from periodic maintenance required for the pipeline routes and would be the same as those discussed for the brine disposal system. There would be no impact on the aquatic environment from normal operation of the system. However, in the unlikely event of a major pipeline oil spill extensive and significant impacts to the environment are probable. The extent of these impacts would be directly related to the magnitude, location and duration of the spill. Oil spill risk, size frequency, rate of oil spillage, and potential environmental effects on terrestrial and aquatic environments are addressed in Section C.2 and in a later subsection. The most sensitive areas with respect to oil spills from the oil delivery system are the swamps and wetlands around the site and at Bayou Lafourche, a major waterway to be crossed by the pipeline.

Accidental Oil or Brine Release

The potential for oil or brine spills during project operation is described in Appendix E; expected annual spill volumes by mode of operation and by geographical location are summarized in Section C.2, (particularly Tables C.2-1 through C.2-9). In the event of an oil or brine spill, the expected movement from various spill locations, the weathering processes likely to occur, and the potential for water quality degradation are described in Section C.4.3.2.2. This section treats some of the biological effects which can occur as a result. A more complete treatment is given in Appendix D.

The information on frequency and volume of expected oil and brine spills for Chacahoula and early storage development of Weeks Island and Bayou Choctaw was summarized in Section C.7.2.2.2.

Frequencies of spills are also given in the summary tables. Except for transfer spills, all modes of spills are expected to be fairly infrequent. The recurrence interval calculated (Appendix E) for pipelines is 38 years for spills greater than 1000 barrels. For brine spills, there is a 72.9 percent chance of having no spills during the project lifetime for Chacahoula.

Because of the design safeguards provided in the storage systems and the relatively infrequent spill expectation, the potential biological impact from small, chronic oil spills at the Chacahoula storage site and along the oil pipeline system is expected to be small. The wellheads at Chacahoula would be diked to contain minor spills.

Cowel (1970) describes two forms of chronic pollution: 1) pollution that results from small successive spills occurring with a frequency greater than that which would allow complete recovery of the ecosystem; and 2) pollution that results from continuous discharge of low levels of oil and effluents such as those from refinery outfalls. The effects of small, frequent oil spills, and chronic oil spills has been discussed in section C.4.3.2.5. The effects of oil on vegetation depend upon several factors such as species and age of plant, time of year, whether plants are actively growing or dormant, the amount and type of oil involved and the degree of weathering of the oil (Baker, 1970). The primary effect of an oil spill on vegetation is that of developing an oil film on the stems and leaves of the plant. The film is difficult to wash off and subsequently the leaves turn yellow.

Biological degradation of crude oil appears to be an important factor in vegetative recovery after a spill. The rate of degradation is related to the type of oil, temperature, and the makeup of soil microflora. Other soil organisms such as bacteria, fungi, algae, etc., would not be affected uniformly since under conditions of a good oxygen, phosphate, and nitrogen supply they could grow, and eventually degradation can take place (Davis, 1976). This degradation is an important factor to the recovery of the vegetation following a spill. The rate of degradation is related to the type of oil spilled, the ambient temperature, and the composition of the soil microfauna.

If a large oil spill occurred along the Chacahoula pipeline the direct effect upon land mammals could be significant. Although most land mammals are highly mobile and could escape small spills on land, a large spill could cover a wide area in a short time.

The specific mechanisms which may adversely impact individuals or populations are discussed in detail in Section C.4.3.2.5. These specific effects include: ingestion; chemical burns; forced migration and crowding, starvation, predation, and disease; suffocation; destruction of habitat; destruction of waterproofing and insulating properties of birds' feathers; and birds' ingesting oil while attempting to clean their feathers.

Although some cattle graze in pasture land along the Bayou Lafourche levee, the effects of oil spills upon livestock are limited. Spills may result in short-term damage to the vegetation, however.

The impact of an aquatic oil spill becomes particularly far-ranging in a highly turbid aquatic system, such as the Mississippi River, since oil and petrochemicals are quickly absorbed by suspended matter such as clay. These particles may be transported over wide areas by the strong currents and large heavy oily globules may be formed and deposited on the river bottom far from the source. On the bottom, the globules can release water soluble substances which are toxic to aquatic life. Sediments which are covered by oil can become low in oxygen and subsequently may become anaerobic. Under these conditions, oil degradation is very slow and many of the toxic components are the slowest ones to be broken down (Murphy, 1971).

Petroleum products have been shown to damage aquatic biota in four principal ways (FWPCA, 1968):

- By direct contact with the organism
- By smearing gills or being swallowed with water and food
- By forming a surface film that may interfere with gaseous exchange or respiration
- By poisoning organisms with various water soluble substances leached from the oil

In summary, the impacts to biota due to normal operations of the Chacahoula storage site are expected to be rather small. Even in the case of occasional small oil spills, impacts are not expected to be widespread or serious. However, depending on the specific conditions, including location, season, volume, and spill-control effectiveness, a large oil spill may have a serious impact on the biota in the local environment. Furthermore, cumulative spill effects due to development of the full 383 MMB Capline Group capacity may be locally significant, especially at inshore transfer sites.

A pipeline spill would likely have the most intensive, localized biological impact. The recurrence interval of an oil spill is greater than 1000 years, even with oil left in the line during standby storage for 27 years; so that it is likely that no large pipeline spills would occur during the lifetime of the SPR project.

Small spills accompanying oil transfer operations constitute the vast majority of all spills expected from the SPR program. With appropriate deployment of booms and other oil recovery equipment, effects should be very localized.

Several scenarios may be described to evaluate potential effects of maximum credible spills for various oil spill modes. The bases of selected maximum credible spill sizes are provided in Appendix E. Ecological impacts are quantified on the basis of acres expected to be severely impacted using 25 barrels per acre of fresh crude causing 100 percent loss of vegetation for a period of at least two years in wetlands. In open water bodies, it has been estimated that, on the basis of a damage threshold of 10 ppm hydrocarbon, a contamination of 6 barrels per acre could cause total loss of productivity in shallow waters (2 to 4 feet deep) for periods of two weeks to several months, depending on water circulation and species affected (Dames & Moore, 1975).

Based on the above oil spill damage parameters, a pipeline spill of 10,000 barrels, (assuming 20 percent loss to evaporation and none recovered), might impact a wetland area of 320 acres or a shallow water area of 1340 acres. The swamp forests at Chacahoula are potentially vulnerable.

A 30,000 barrel spill of brine from the brine injection system would have serious biological impact. No comparable damage parameters are available to estimate acreage impacts. However, 30,000 barrels is approximately 4 acre feet of brine. Assuming uniform mixing, it would take several hundred acre-feet of fresh water to dilute the brine a few ppt, a reasonable threshold for measurable salinity effects. Thus, the potential for adverse impact in the wetlands at Chacahoula is great should a maximum credible brine spill occur.

In summary, it may be concluded that the very low frequency of oil and brine spills indicates that chronic biological impacts should generally not be experienced. Very large spills are fairly improbable and represent a small likelihood of regionally significant adverse impact, but the potential for such impact is fairly large depending on spill location. Except for the case of a large oil spill in the gulf or lower Mississippi River being transported to near shore waters and coastal bays prior to recovery, adverse impacts should not be of regional significance.

Alternatives

Construction of a system of injection wells for brine disposal would decrease the potential for brine spills but would expose additionals areas of wetlands to possible brine spills. A raw water pipeline from the Mississippi River would have the same impact as those described for the proposed raw water system. Construction of a well field or an intake in the Gulf of Mexico for raw water requirements would affect slightly greater acreages than the proposed systems. Development of the alternative offshore diffuser site would result in impacts similar to those described for the proposed site.

C.7.2.2.6 Natural and Scenic Resources

Normal operation of the Chacahoula site and associated facilities is not anticipated to bring additional impacts on scenic, recreational, or natural resources. In some cases the impacts would be reduced during this stage, as some areas at the storage site and along the pipelines would be allowed to revegetate.

The potential does exist for oil spills in the process of transporting oil to and from storage. Spills from the oil pipeline between the terminal and Chacahoula could degrade the scenic and recreational potential of sections of swamp forest or waterways crossed by the ROW.

Brine spills could degrade scenic and natural resources along the onshore 40.4-mile brine disposal pipeline leading from Chacahoula to the

Gulf of Mexico. Alternative brine, oil, or raw water distribution systems would have little effect on the type or degree of possible adverse impacts.

C.7.2.2.7 Archaeological, Historical and Cultural Resources

Following construction none of the operational characteristics of any of the facilities are expected to negatively impact any of these resources.

C.7.2.2.8 Socioeconomic Environment

Storage Site

Land Use There would be no additional impacts on land use during operation. The land at the site would already have been converted to developed use during construction. Some of the land disturbed during construction would be allowed to revegetate.

Transportation Less traffic related to the project would be generated during operation than during construction. A considerably smaller crew (25 to 60 employees) would be necessary to carry out fill and storage activities; however, their movements would be significant in comparison to current traffic volumes on county roads. The total traffic volume on these roads is expected to remain far below capacity, however, thereby minimizing this impact.

Population The operation of the storage site would have some effect on population in the surrounding area. The project would have a total of 60 employees on-site in three shifts during fill and withdrawal operations. During standby operations, only about 25 employees would work at the site. Most of these workers may come from the existing labor pool in the parishes surrounding the site. If all the employees were to migrate to the area with their families, the impact on the local population (Grand Bayou) would be significant; however, lack of housing is likely to spread any in-migration over several towns in the area. As an example, Thibodaux has grown rapidly recently; the population increase associated with the project would constitute only a minor increment compared to this recent growth.

Housing Project operation would have a minimal impact on housing. Many of the workers employed are expected to come from nearby communities within commuting distance.

Economy The operation of the SPR project would have a significant positive effect on the economy of the region. Supplies for some operations may be purchased from existing petrochemical and service industries. In some local areas a large beneficial effect would result from the increased purchases by employees. Maintenance and operation of the project would require a small work force relative to construction. Most of the workers are expected to come from the local labor pool although some may relocate in the area for the duration of filling (approximately two years).

During standby operations only about 25 employees would work at the site. This would decrease the employment opportunities available at the site compared to construction or fill/withdrawal operations.

Employment income from the project would average $113,750 per month during the filling and withdrawal phase. Most of this income is not expected to stay in Assumption Parish for the two years of filling.

During standby operations income would average approximately $17,000 a month for the 25 employees. This income is not expected to be sufficient to stimulate the local economy due to the wide area over which the employees would spend the wages.

Purchases in the region during operations could provide an economic stimulus. To the extent these purchases are made in Lafourche Parish, they would provide a minor stimulant to the local economy.

Urban Services The operation phase of the SPR project would have an impact on police and fire services similar to that of the construction phase. Except in the case of a major accident no use of such services is anticipated. Fire fighting equipment would be available on-site.

No adverse impacts on health services are expected during normal operations. Large scale accidents could easily overwhelm available services in the area, however.

The small number of families with children that may relocate in the area would have no significant impact on schools.

Operation of the storage facility would continue the loss of tax revenues begun during construction.

Oil Distribution, Raw Water Supply, and Brine Disposal Systems

Land Use The operation of the oil, water and brine systems would have no additional impact on land use. In some areas natural vegetation or crops may be allowed to be re-established. Large trees would not be allowed within the system maintenance ROW, however (Table A.7-1).

Transportation During normal operations the oil, water and brine systems would not effect any transportation systems in the region. In case of pipeline breaks, leaks, or other unexpected accidents, some temporary effects on transportation could occur; but these would be so temporary, they should be considered insignificant.

Population Operational impacts of the oil, water, and brine systems are anticipated to be negligible. The few workers required for maintenance are expected to come from the local labor pool.

Housing Because no significant change in population size or location is expected, housing is unlikely to be impacted.

Economy Operation of the pipeline systems would have an insignificant effect on the local or regional economy. The few workers required would generate slight additional income for the economy, but this would be minor compared to current economic activity.

Urban Services Except in the case of a pipeline accident, no urban services would be required by the pipeline facilities. If an accident occurred some use of local hospitals could be necessary.

Alternatives

No significantly different type or degree of socioeconomic impact is expected to result from operational use of alternative facilities. Use of water supply and brine disposal pipelines to the Gulf would require removal of significantly more land from local tax rolls; also, a few more employees would be needed for routine maintenance and system repairs.

C.7.3 Impact Due to Termination and Abandonment

No specific plan for termination and abandonment of the Chacahoula oil storage site has been established. However, the DOE will be required to develop such a plan near the termination of the action. To date, no specific experience with the abandonment of an oil storage cavern facility has been developed in the United States. However, various feasible plans are available. Environmental hazards that must be considered include surface subsidence and release of residual oils squeezed from the workings by possible longterm plastic closure.

At present, it is intended to put the facility to some beneficial use, rather than abandon it. Beneficial uses might include disposal of wastes, such as dredge spoil, slurried fly ash, radioactive waste, or other polluted or toxic materials. Another possibility is to develop a compressed air storage facility for peak power use. The final selection of an abandonment plan will likely depend on the economic and environmental tradeoffs and regulations that are in effect at the time of termination.

Use of the facility in the manner described above would assure continued surveillance of the cavern. The inherent integrity of the cavern would prevent any leakage of material into the environment. Certain activities associated with the specific use, such as waste transport, would impose some potential for environmental damage resulting from traffic, spillage and noise.

Should no beneficial use be found for the facility, the wells could be sealed and the caverns left filled with brine. No adverse environmental effects are likely to result from such action.

C.7.4 The Relationship of the Proposed Action to Land-Use Plans, Policies, and Controls for the Affected Areas

There are presently no official plans, policies, or controls established by Federal, state, or local government agencies in Lafourche Parish. Furthermore, lands under consideration for use in developing the Strategic Petroleum Reserve Facility at Chacahoula are presently devoted to industrial uses.

Although a Coastal Zone Management Plan is in preparation in Louisiana, there is no apparent project conflict with the basic concepts established by the Louisiana Advisory Commission on Coastal and Marine Resources (1973), which are expected to be an important part of the ultimate plan. Thus, development would occur at a previously established industrial site and oil transportation would follow established corridors. It is not anticipated that any land use policies or plans would be in conflict with the proposed Chacahoula Strategic Petroleum Reserve Facility.

C.7.5 Summary of Adverse and Beneficial Impacts

Development of the Chacahoula salt dome as an oil storage facility is not likely to generate significant regional environmental impacts except for the remote possibility of a major spill and the uncontrolled release of hydrocarbon vapors during oil transportation.

Table C.7-3 provides a summary tabulation of the findings of the various discipline analyses of impacts of project development. Impacts of project operation are summarized in Table C.7-4. The data are in both qualitative and quantitative form, as appropriate.

TABLE C.7-3 Summary of environmental impacts caused by development of Chacahoula SPR facilities.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT: PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT: ALTERNATIVE PHYSICAL FACILITY
Geology and Land Features	Chacahoula dome and immediate vicinity	Site Preparation 71,000 cy of excavation and 354,000 cy of fill for the central plant area, brine surge pond, containment dikes, access roads, and other surface facilities. Direct impacts on 191 acres Cavern Leaching Up to 42 x 10^6 cy of salt removed from the dome by leaching.	Brine Disposal Pressurization of brine disposal aquifers.
	Terminal Facilities Pipeline Corridors between Chacahoula and:	Site Preparation and Pipeline Connection (see Table C.3-2)	
	St. James Terminal	Crude Oil Distribution Temporary excavation of 255,000 cy of earth and clearing of vegetation from 213 acres in the pipeline ROW.	
	Bayou LaFourche	Raw Water Supply 76,000 cy of temporary excavation from 17 acres in pipeline ROW.	
	Mississippi River		Raw Water Supply 255,000 cy of excavation and clearing of vegetation from 54 acres in the pipeline right-of-way.
	Gulf of Mexico	Brine Disposal 1,009,700 cy of excavation (mostly temporary) and clearing of 392 acres of vegetation in pipeline ROW	Raw Water Supply 667,600 cy of excavation (mostly temporary) and clearing of vegetation from 99 additional acres (assuming raw water pipeline to Gulf is constructed in brine disposal pipeline ROW). Brine Disposal 989,100 cy of excavation (mostly temporary) and clearing of 392 acres of vegetation in pipeline ROW
	Ground Water		Raw Water Supply 103,000 cy of excavation (mostly temporary), 145,000 cy of fill and clearing of vegetation from 87 acres in pipeline ROW. Possible surface subsidence over well field.

TABLE C.7-3 continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT: PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT: ALTERNATIVE PHYSICAL FACILITY
Water Resources	Bubbling Bayou, Chacahoula Bayou and wetlands adjacent to the storage site	Site Preparation Significant volumes of sediment and construction pollutants carried into water bodies by rainfall runoff. Oil and Brine Spills Very small possibility of some release reaching water bodies; maximum credible brine spill could have significant impact.	
	Water bodies and wetlands crossed by pipeline ROW	Site Preparation and Pipeline Construction Locally significant volumes of sediment and construction pollutants carried into water bodies by rainfall runoff.	
	Bayou Lafourche	Raw Water Supply 2,810,000 BPD pumped from Mississippi River would increase turbidity and bank erosion from Donaldsonville to intake 5 miles north of Plaquemine and occasionally downstream; minimal effect on water quality/quantity expected.	
	Mississippi River	Raw Water Supply Diversion of 2,810,000 BPD of water to Bayou Lafourche would not significantly affect river quality or flow rate. Terminal Construction (see Table C.3-2)	Raw Water Supply Same as proposed.
	Gulf of Mexico	Brine Disposal Disposal of brine in Gulf could cause local salinity excesses of 12 percent or less over several hundred acres and could alter surface water quality. Pipeline construction would create locally significant levels of turbidity and possibly reduce dissolved oxygen. Resuspension of pollutants from sediment.	Raw Water Supply Withdrawal from Gulf - no significant effect on water quality; construction of supply pipeline would have significant local affects for most of its 42.4 mile length. Brine Disposal Same as proposed.
	Subsurface aquifers		Brine Disposal Pressurization of deep disposal aquifers could possibly displace saline water to potable aquifer directly or by migration up old wells. Raw Water Supply Withdrawal from subsurface aquifers could affect water table and induce surface subsidence, though considered unlikely; construction effect locally significant.
Air Quality	All Construction Sites	Site Preparation Minor quantities of particulates, SO_2, CO, HC and NO_x released from construction equipment; minimal effect.	

TABLE C.7-3 continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT ALTERNATIVE PHYSICAL FACILITY
	Chacahoula dome	Site Preparation and Painting Short term HC concentrations of up to 104 $\mu g/m^3$ at 1 km downwind during painting of tanks; possible exceedance of ambient air quality standards due to high background levels during 3 day period at Chacahoula.	
		Brine Disposal Construction of a brine disposal pipeline to the Gulf eliminates locally continuous emissions at Chacahoula and adds dispersed pipeline emissions.	Raw Water Supply Development of a well field for raw water supply may decrease emission at Chacahoula (except HC from painting) by 50 percent. Brine Disposal Same as proposed.
	Terminal Facilities	Site Preparation and Painting (see Table C.3-2)	
Noise Level	Storage Site	Site Preparation and Cavern Well Drilling Maximum radius of noise impact (3 dB increase over ambient), 5000 feet; as many as 10 structures may be affected.	
	Pipeline Routes	Pipeline Construction Maximum zone of noise impact, 1800 feet; 50 to 75 structures may be affected.	Raw Water Supply Ground water supply well field would raise noise levels for 25 or more residences. Brine Disposal Brine disposal pipeline and raw water supply pipeline would affect noise levels for over 25 residences.
	Terminal Facilities	Site Preparation (see Table C.3-2)	
Species and Ecosystem	Terrestrial Agricultural Land	Site Preparation Temporary loss of 100 acres due to facility construction. Minimal impact importance.	Raw Water Supply Loss of 53 acres agricultural land due to raw water well field. Loss of 22 acres agricultural land due to pipeline to Mississippi River. Loss of 2 acres to agricultural use due to pipeline to the Gulf.
	Bottomland and Swamp Forest	Site Preparation Loss of 422 acres due to facility construction. Revegetation of 151 acres likely. Minimal impact importance.	
		Brine Spills Large brine spill could destroy several acres near Chacahoula dome.	Raw Water Supply - Temporary Loss of 22 acres habitat due to construction of pipeline to Gulf of Mexico (in addition to acreage for brine disposal pipeline.)

TABLE C.7-3 continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT PROPOSED PHYSICAL FACILITY	ALTERNATIVE PHYSICAL FACILITY
		Brine Disposal Loss of 92 acres (swamp forest) due to construction of brine disposal supply lines to Gulf.	
			Raw Water Supply Loss of 34 acres of swamp forest due to use of raw water well field. Loss of 32 acres of swamp forest due to use of raw water pipeline to Mississippi River.
			Brine Disposal Same as proposed.
	Aquatic Bayou Lafourche	Raw Water Supply Destruction of phytoplankton and zooplankton during the three year leaching period. Impact on regional biotic resources considered insignificant.	
	Bubbling Bayou and local water bodies near construction sites	Site Preparation Minimal local impacts due to erosion and runoff. Brine Spills Major brine spills remotely possible near Bubbling Bayou; significant loss of biota would follow.	
	Mississippi River	Raw Water Supply Minor additional displacement of plankton to Bayou Lafourche through lift pumps.	Raw Water Supply Same as proposed.
	Gulf of Mexico	Brine Disposal Brine effluent could affect benthos community structures over several hundred acres. Should not be significant to plankton and nekton except possibly adjacent to brine diffuser. Dredging could destroy benthic habitats and reduce productivity.	Brine Disposal Same as proposed.
Natural and Scenic Resources	All Pipeline Construction	ROW Clearing Locally significant impact due to clearing along pipeline right-of-way.	
Socioeconomic Conditions	Cultural Resources	All Sites Possibly loss or disruption of significant cultural resources.	
	Land Use	Alteration of land use on total of 1653 acres in Terrebonne and St. James Parishes.	
	Economy	Total construction wages, $13.4 million, much of which would be spent outside the local area.	
	Government	Possibly significant loss of property and severance tax revenues.	
	Transportation	Potential for locally significant traffic increase at shift changes; overall; congestion should not be significant.	

TABLE C.7-4 Summary of environmental impacts caused by operation of Chacahoula SPR facilities.

SUBJECT AREA	AFFECTED ENVIRONMENT	PROPOSED PHYSICAL FACILITY	ALTERNATIVE PHYSICAL FACILITY
Geology and Land Features	Land Surface	Cavern Collapse Remote possibility of roof collapse causing surface subsidence and formation of a lake onsite.	
Water Resources	Bubbling Bayou and small water bodies near Chacahoula dome	Oil and Brine Spills Impacts from expected oil and brine spills negligible. Possible very large spill could seriously degrade water quality for several weeks or months.	
	Bayou Lafourche	Raw Water Supply Pumping of up to 2,500,000 BPD through Bayou Lafourche would increase stage, erosion, and turbidity. Oil Spills Small potential for oil spills.	
	Mississippi River	Raw Water Supply Withdrawal of up to 1,340,000 BPD for oil displacement over 150 day period expected to have no measureable effect on water quality or quantity. Oil Spills Could have significant local impacts. Terminal Facilities (see Table C.3-3)	Raw Water Supply Same as proposed.
	Gulf of Mexico	Brine Disposal Local alteration of salinity and water quality near brine diffuser; increased brine spill exposure	Raw Water Supply No effect on Gulf of Mexico water quality and quantity due to withdrawal. Brine Disposal Same as proposed.
	Ground Water	Oil and Brine Spills Very slight chance of local ground water pollution due to surface or brine oil spill; collapse of cavity roof could seriously degrade ground water supplies for Napoleonville area but such an occurence is highly unlikely.	Raw Water Supply Surface subsidence potential expected to be small due to ground water withdrawal of up to 2,500,000 BPD Brine Disposal Brine injection should have no adverse impact.
Air Quality	Oil Handling and Storage	Total Emissions Emissions from 383 MMB oil storage facility for 5 fill and withdrawal cycles equal 77,200 to 78,900 tons, 53 percent due to expansion, 535 tons at Chacahoula.	

TABLE C.7-4 continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT: PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT: ALTERNATIVE PHYSICAL FACILITY
		Storage in Surge Tanks (see Table C.3-3)	
		Dock Transfers (see Table C.3-3)	
		Terminal Facilities (see Table C.3-3)	
Noise Level		Storage Site Operation No significant increase in ambient sound levels on or adjacent to the site with either proposed or alternative facilities.	
Species and Ecosystems	Terrestrial		
	Agricultural Land	Oil and Brine Spills Possible oil or brine spills would have local, short-term adverse effect on agricultural productivity.	
		Purchase of Commerical Power Would require maintenance of a 5-mile transmission line ROW.	
			Raw Water Supply Withdrawal of water from wells would add 46 acres of pipeline ROW maintenance but eliminate possibility of adverse effects on Bayou Lafourche.
		Terminal Facilities (see Table C.3-3)	
	Bottomland and Swamp Forest	Oil and Brine Spills Possible oil or brine spill from pipelines could have locally significant adverse impacts.	Raw Water Supply Use of Gulf of Mexico for water supply would increase maintenance acreage required along pipeline.
		Storage Site and Pipeline Corridor Maintenance Clearing Continued maintenance of 271 acres would reduce available habitat in region.	
	Marsh	Brine Spill Brine spill from pipeline could have significant local impacts.	
		Pipeline Corridor Maintenance Clearing Continued maintenance of 186 acres would reduce available habitat in region.	
	Aquatic		
	Bubbling Bayou and local water bodies near Chacahoula dome	Oil and Brine Spills Possibility of major spill of brine or oil from pipeline considered remote would cause locally significant impacts on aquatic life.	
	Bayou Lafourche	Raw Water Supply Average flow rate increased by about 40 percent from Donaldsonville to Labadieville during oil withdrawal (150 day period, expected five times in project life); increased turbidity; impact on aquatic biota not expected to be of regional significance.	

TABLE C.7-4 continued.

SUBJECT AREA	AFFECTED ENVIRONMENT	EXPECTED IMPACT: PROPOSED PHYSICAL FACILITY	EXPECTED IMPACT: ALTERNATIVE PHYSICAL FACILITY
	Mississippi River	Oil Spills (see Table C.3-3)	
			Raw Water Supply: No measureable impact on aquatic life due to water withdrawal.
	Gulf of Mexico	Oil Spills (see Table C.3-3)	
		Brine Disposal: Brine could destroy benthic habitats and reduce productivity. Small impact on nekton and plankton. Possible alteration of migration routes.	Brine Disposal: Same as proposed.
Natural and Scenic Resources		Oil Spills: Adverse impacts associated with possible large oil spill which could foul swamp forest and contaminate water with oil.	
		Operation and Maintenance: Pipeline ROW maintenance would have adverse aesthetic impacts.	
			Raw Water Supply: Pipeline to Gulf Coast would have additional adverse resource impact.
Socioeconomic Environment	Economy	Storage Site Employment: Total wages expected to be approximately $114,000 during each month of oil fill and withdrawal; $17,000 during standby.	

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