

***Oil Research Program
Shallow Shelf Carbonate Reservoirs
Class II***



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Development of the Geological Classification System

Preliminary Grouping of Reservoirs

- **Classification meetings with Geologic Experts - strict geologic groupings of reservoirs utilizing geologic principles and statistical criteria**

Final Classification System

- **Decided to use geological considerations exclusively**
- **Validated methodology for describing reservoirs in terms of lithology, deposition, diagenesis and structural overprint**
- **Balanced the issues of
 - **Meaningfulness: distinct level & types of heterogeneities**
 - **Manageability: few enough groupings to serve as classes for the Oil Research Program****
- **Result: 22 Geologic Classes (16 Clastic; 6 Carbonate)**

Classification of Carbonate Reservoirs

Pentidal	Dolomitization
	Massive Dissolution
	Other
Shallow Shelf/Restricted	Dolomitization
	Massive Dissolution
	Other
Class II*	Dolomitization
	Massive Dissolution
	Other
Shallow Shelf/Open	Dolomitization
	Massive Dissolution
	Other
Shelf Margin	Dolomitization
	Massive Dissolution
	Other
Reefs	Dolomitization
	Massive Dissolution
	Other
Slope-Basin	Other

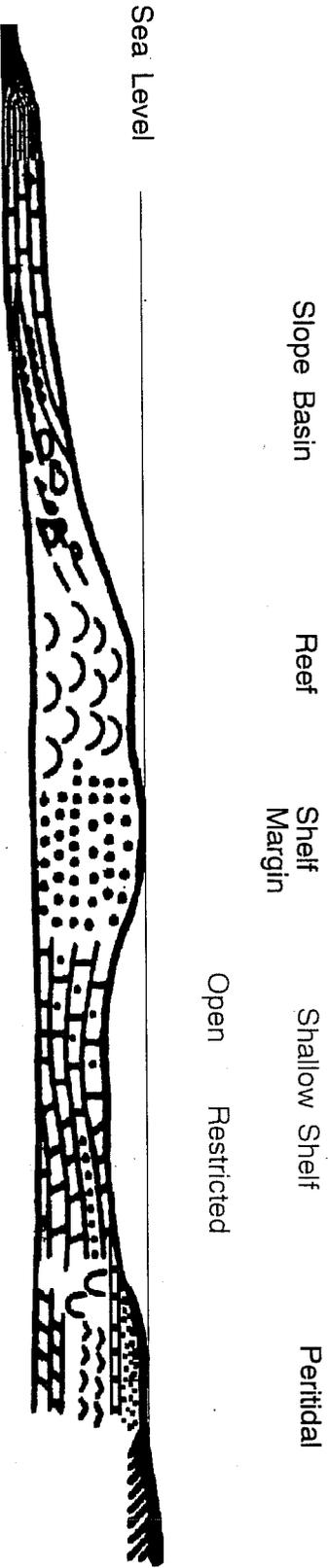
* Shallow Shelf Open & Restricted classes have been combined into one class (Class II).

Original Oil-in-Place in the TORIS Carbonate Reservoirs

- Over 100 billion barrels (nearly 1/3) of the U.S. light (>20° API) OOIP¹ is from the carbonate reservoir classes
- The Shallow Shelf Carbonate classes contained over 68 billion barrels (over two-thirds) of the carbonate OOIP
 - Shallow Shelf/Open = 43 billion barrels
 - Shallow Shelf/Restricted = 25 billion barrels

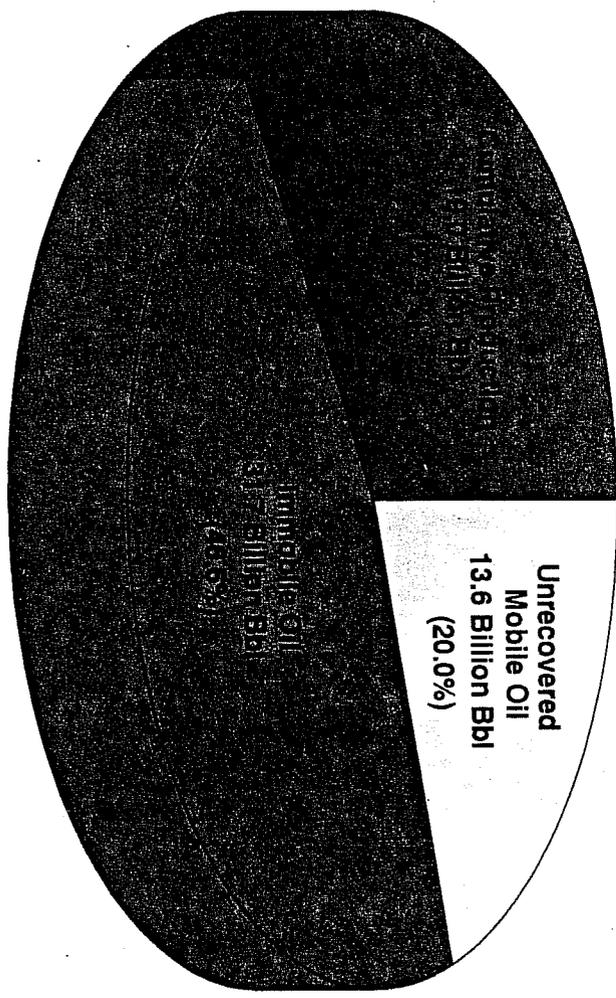
¹ Resource base in the Tertiary Oil Recovery Information System (TORIS) database maintained by US DOE/Bartlesville Project Office. TORIS contains data on 67% of the U.S. resource.

The Shallow Shelf Carbonate Environment



Source: Tyler et al, 1984.

Distribution of Original Oil-in-Place for Identified Shallow Shelf Carbonate Reservoirs*



Original Oil-In-Place = 68.0 Billion Bbl

*Light Oil (>20° API) reservoirs in TORIS

U.S. Department of Energy's Oil Research Program

Goal

- **Maximize the producibility of the domestic oil resource**

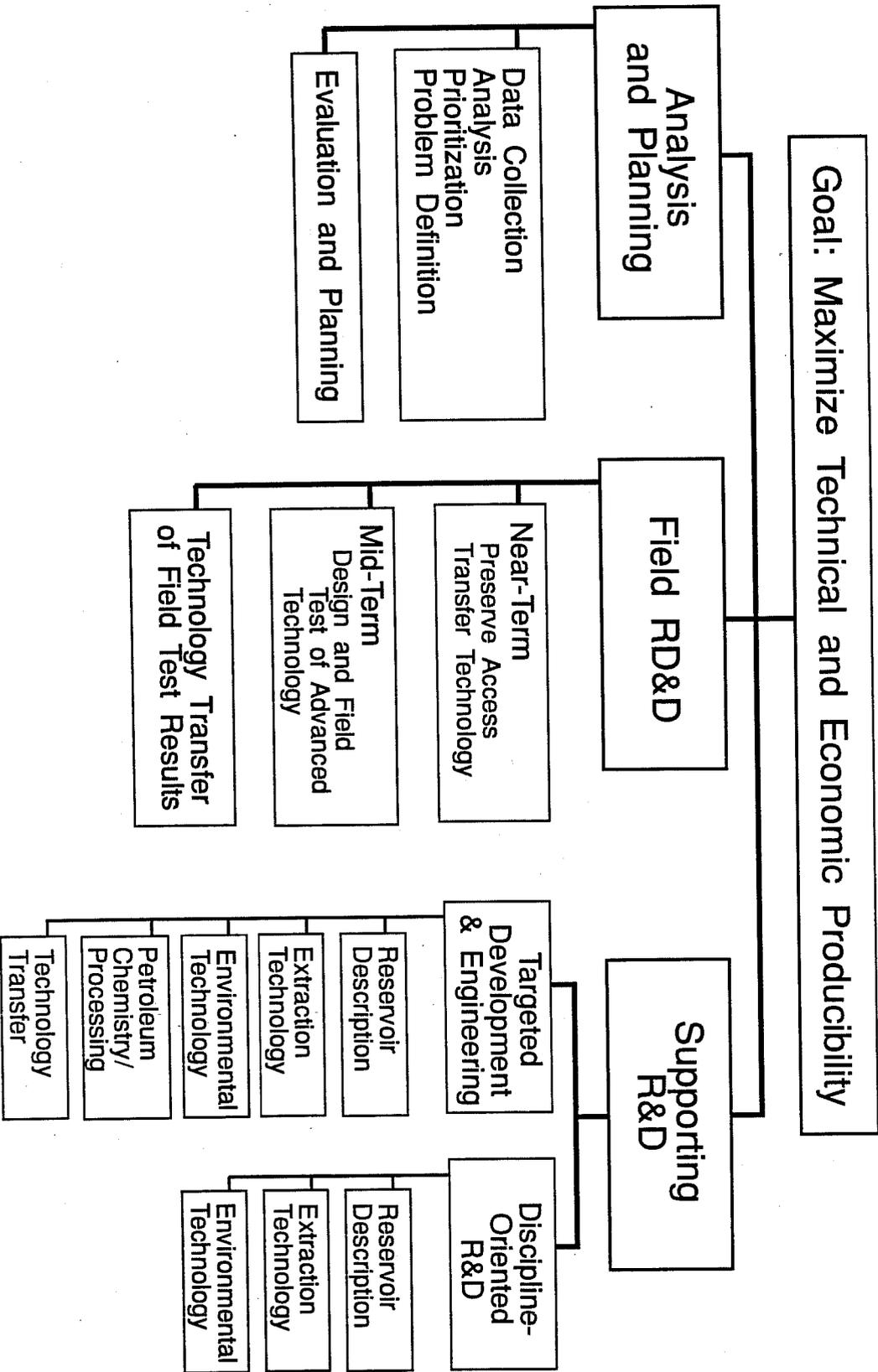
Approach

- **Focus on specific reservoir classes with similar geological heterogeneity, prioritized by remaining potential and abandonment risk, to maximize R&D benefits and speed results through coordinated technology transfer**

Objectives

- **Preserve access in the Near-Term**
- **Demonstrate advanced technologies in the Mid-Term**
- **Develop new technologies in the Long-Term**

Work Breakdown Structure



Near-Term Objectives

Preserve access to high potential reservoir classes that are approaching their economic limit

- Sustain production by broad application of currently available economic technologies through:
 - Field demonstrations of under-utilized technologies
 - Technology transfer workshops and field visits
- Reduce environmental constraints on production through focused research

Near-Term: Conventional Technologies

Proven, or conventional, oil recovery technologies that have a documented record of economic oil production through either increased reserves or more efficient production.

Mid-Term Objectives (within 10 years)

Develop and transfer the best currently defined advanced technologies to operators in high priority reservoir classes

- **Identify specific technical barriers to the successful application of advanced technologies**
- **Spearhead effort to overcome barriers to the application of advanced technologies**
- **Aggressively pursue technology transfer of successful results to operators, consultants and service companies**

Mid-Term: Advanced Technologies

Represent a significant improvement in process effectiveness or applicability over currently available technologies or represent a new technology not successfully demonstrated in the field. Examples of advanced technologies include:

- Advanced Reservoir Characterization Techniques or Tools
 - Cross borehole tomography
 - Measurement While Drilling (MWD)
 - Three dimensional simulation
- Advanced Recovery Technology
 - Mobility control agents (foams) with gas injection
 - Horizontal drilling
- Advanced Reservoir Management Techniques
 - Simulation
 - Fracture stimulation

Producibility Problems (Near- and Mid-Term)

- 1) Adequate reservoir characterization,
- 2) Reservoir characterization in defining the engineering aspects of SSC reservoirs,
- 3) Development & implementation of cost effective reservoir management strategies,
- 4) Recovery process design problems,
- 5) Poor sweep efficiency,
- 6) Low reservoir energy,
- 7) Operational problems,
 - Inadequate completions,
 - Fracture stimulation,
 - Artificial lift,
 - Scale reduction, and
 - Produced Water

Long-Term Objectives (beyond 10 years)

Pursue fundamental geoscience and extraction technology research

- **Develop new technologies to recover oil from reservoirs after utilization of the most advanced Mid-Term technologies, or where such technologies were not feasible**

CLASS II OPERATOR BREAKDOWN

Operator Breakdown - Shallow-Shelf (Carbonates) Restricted

Operator	1991 Oil Production (Barrels)	1991 Oil Production as a Percent of Class Total
MAJORS (over 250 million barrels domestic liquids reserves)		
AMOCO PRODUCTION COMPANY	22,274,534	20.539
ARCO OIL & GAS CO.	3,603,958	3.323
CHEVRON USA INC.	6,044,189	5.573
CONOCO INC.	6,403,292	5.904
EXXON CORPORATION	7,141,125	6.585
MARATHON OIL	22,573,699	20.814
MOBIL PRODUCING TX. & N. M. INC.	4,008,390	3.696
ORYX ENERGY COMPANY	2,036,213	1.878
PHILLIPS PETROLEUM CO	329,799	0.304
SHELL WESTERN E & P, INC.	443,302	0.409
TEXACO EXPL & PROD INC	5,576,570	5.142
UNION OIL CO OF CALIFORNIA	363,020	0.335
TOTAL MAJORS	80,798,091	74.501
LARGE INDEPENDENTS (over 100 million barrels domestic liquids reserves)		
AMERADA HESS	3,988,734	3.678
MERIDIAN OIL INC	2,754,888	2.540
MESA OPERATING LTD	10,730	0.010
MITCHELL ENERGY CORPORATION	4,254	0.004
PENNZOIL EXPLOR & PROD CO	34,599	0.032
UNION PACIFIC RESOURCES	475,288	0.438
TOTAL LARGE INDEPENDENTS	7,288,493	6.792

Operator

**1991 Oil Production
as a Percent of
Class Total**

MIDSIZE INDEPENDENTS (over 10 million barrels domestic liquids reserves)

ADOBE OPERATING COMPANY	97,108	0.090
AMAX OIL & GAS INC	32,796	0.030
AMERICAN EXPLORATION COMPANY	297,574	0.274
ANADARKO PETROLEUM CORP	283,254	0.261
APACHE CORPORATION	358,283	0.330
CENEX	407,559	0.376
COASTAL OIL AND GAS CORP.	200,418	0.185
ENERGY DEVELOPMENT CORP.	112,215	0.103
ENRON OIL & GAS COMPANY	76,251	0.070
HONDO OIL AND GAS COMPANY	9,050	0.008
KERR-MCGEE CORPORATION	66,695	0.061
MAXUS EXPLORATION COMPANY	29,884	0.028
MURPHY OPERATING CORP.	19,797	0.018
PARKER & PARSLEY DEVELOPMENT COMPANY	927,524	0.855
PRESIDIO EXPL INC	9,844	0.009

TOTAL MIDSIZE INDEPENDENTS 2,928,252 2.700

SMALL INDEPENDENTS (10 million barrels or less domestic liquid reserves) 17,457,006 16.097

TOTAL PRODUCTION - RESTRICTED 108,451,842 100

Operator Breakdown - Shallow-Shelf (Carbonates) Open

Operator	1991 Oil Production (Barrels)	1991 Oil Production as a Percent of Class Total
MAJORS (over 250 million barrels domestic liquids reserves)		
AMOCO PRODUCTION CO.	34,410,486	11.690
ARCO OIL & GAS COMPANY	11,301,981	3.840
CHEVRON U S A INC	11,868,212	4.032
CONOCO INC	2,517,921	0.855
EXXON CO USA	9,643,331	3.276
MARATHON OIL	20,931,190	7.111
MOBIL EXPL & PROD	7,257,767	2.466
ORYX ENERGY CO	928,273	0.315
PHILLIPS PETROLEUM CO	6,196,688	2.105
SHELL WESTERN E & P INC.	85,314,319	28.984
TEXACO E & P INC.	16,199,704	5.504
UNION OIL COMPANY OF CALIFORNIA	3,730,783	1.267
TOTAL MAJORS	210,300,655	71.445
LARGE INDEPENDENTS (over 100 million barrels domestic liquids reserves)		
AMERADA HESS CORPORATION	18,659,683	6.339
MERIDIAN OIL INC	847,140	0.288
PENNZOIL EXPL. & PROD. CO.	61,048	0.021
UNION PACIFIC RESC CO	30,731	0.010
TOTAL LARGE INDEPENDENTS	19,598,602	6.659
MIDSIZE INDEPENDENTS (over 10 million barrels domestic liquids reserves)		
ADOBE RESOURCES CORP	77,773	0.026
AMAX OIL & GAS INC	73,520	0.025

	1991 Oil Production	1991 Oil Production
	(Barrels)	as a Percent of
		Class Total

AMERICAN EXPLORATION COMPANY	354,768	0.121
ANADARKO PETROLEUM CORP	670,885	0.228
APACHE CORPORATION	329,216	0.112
BHP PETRO(AMERICAS)INC	11,057	0.004
COASTAL OIL & GAS CORPORATION	660,941	0.225
ENRON OIL & GAS CO.	7,563	0.003
HONDO OIL AND GAS COMPANY	435,549	0.148
KERR-MCGEE CORPORATION	895,936	0.304
MURPHY OIL USA, INC.	1,449	0.000
PACIFIC ENTERPRISES OIL CO. (USA)	16,310	0.006
PARKER & PARSLEY DEVELOPMENT COMPANY	75,127	0.026
PRESIDIO EXPLORATION INC.	11,297	0.004
SANTA FE ENERGY OPER. PART., LP	759,899	0.258
SNYDER OIL CORPORATION	63,640	0.022
SONAT EXPL	5,679	0.002
VINTAGE PETR INC	694	0.000

TOTAL MIDSIZE INDEPENDENTS	4,451,303	1.512
SMALL INDEPENDENTS (10 million barrels or less domestic liquid reserves)	60,001,129	20.452

TOTAL PRODUCTION - OPEN	294,351,689	100
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TOTAL 1991 PRODUCTION	402,803,531	
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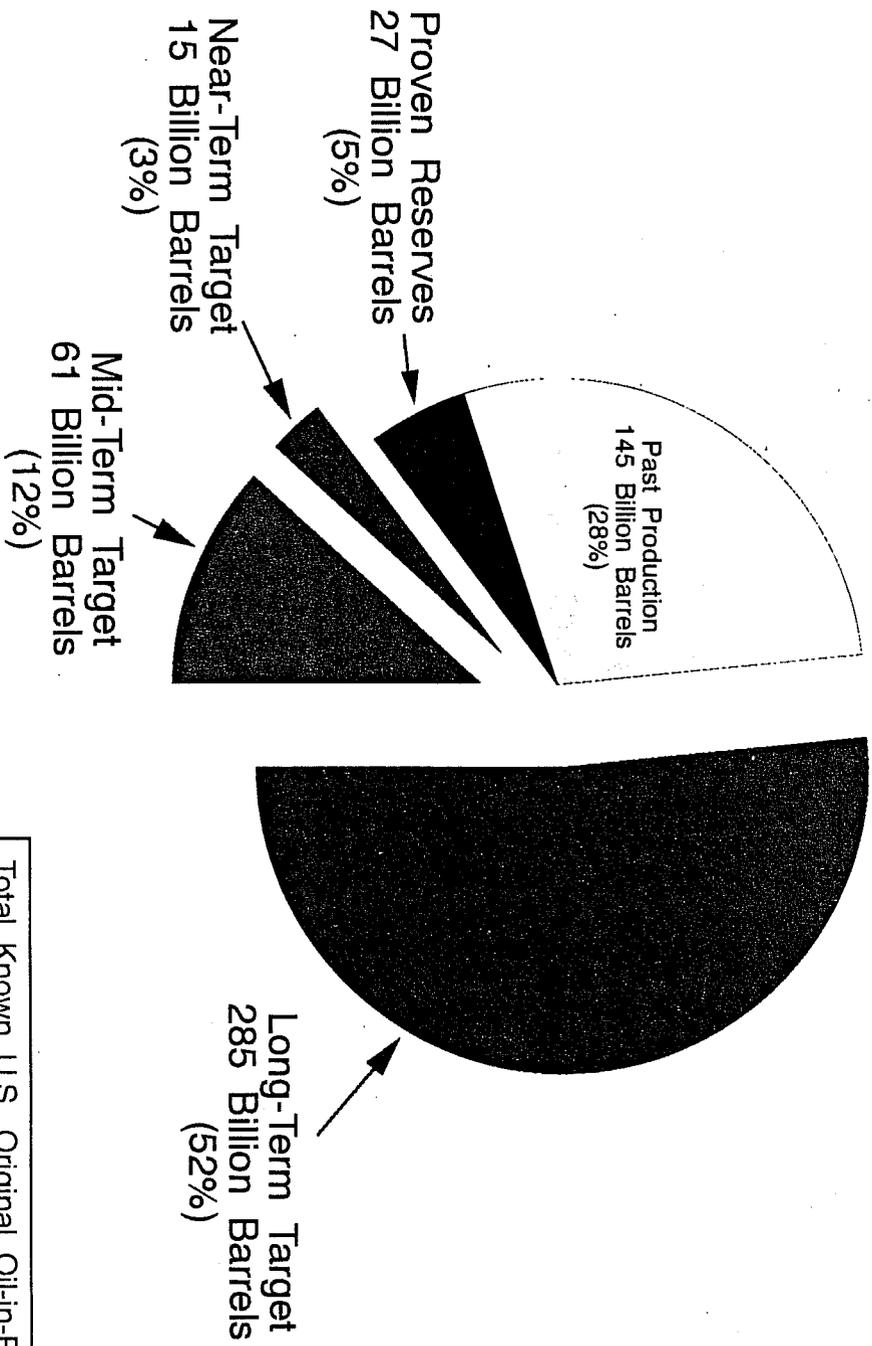
Shallow Shelf Carbonate Geology

- Shallow Shelf carbonates are deposited in the shallow marine environment below the influence of tides.
- "Restricted" and "Open" refer to the variables of water circulation, depth and salinity. These distinctions are inferred from the rock record and are open to *varying* interpretations.
- The depositional environments are co-located and can be overlapping.

Geographic Distribution of Shallow Shelf Carbonate Reservoirs

- **The reservoirs in the combined classes are spread over fourteen states and have greater geographic diversity**
- **Nine states contain the Shallow Shelf/Open Carbonate Reservoirs in TORIS**
- **Ten states contain the Shallow Shelf/Restricted Carbonate Reservoirs in TORIS**

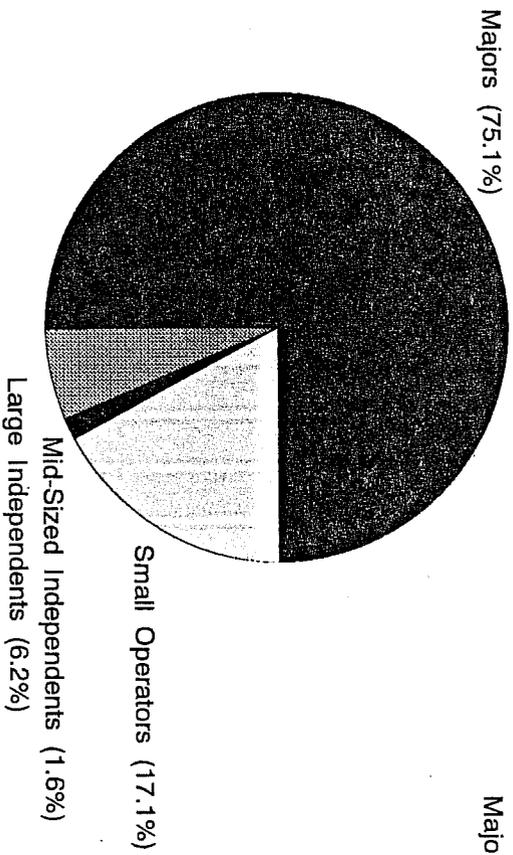
Three Time-Differentiated Targets of the Plan



Source: NPC 1984, BPO/TORIS 1988

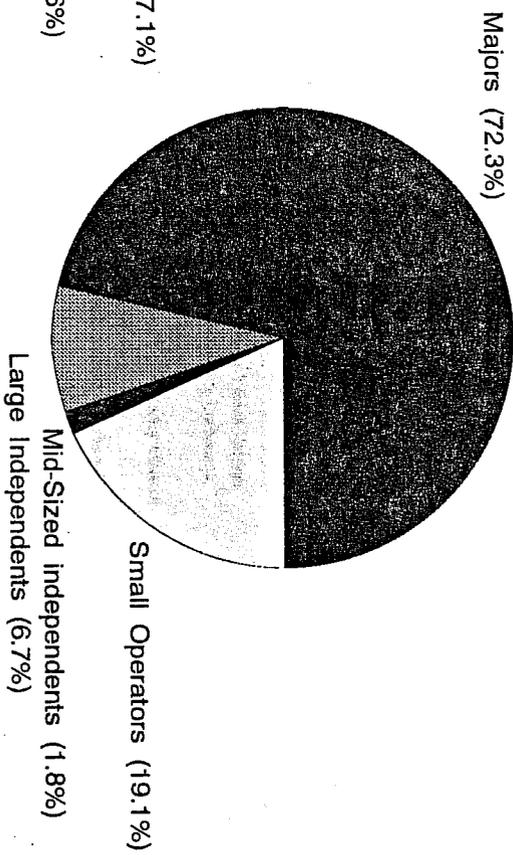
Operator Profile of Shallow Shelf Carbonate Reservoirs has Changed

1989 Production



TOTAL PRODUCTION = 422 MILLION BARRELS

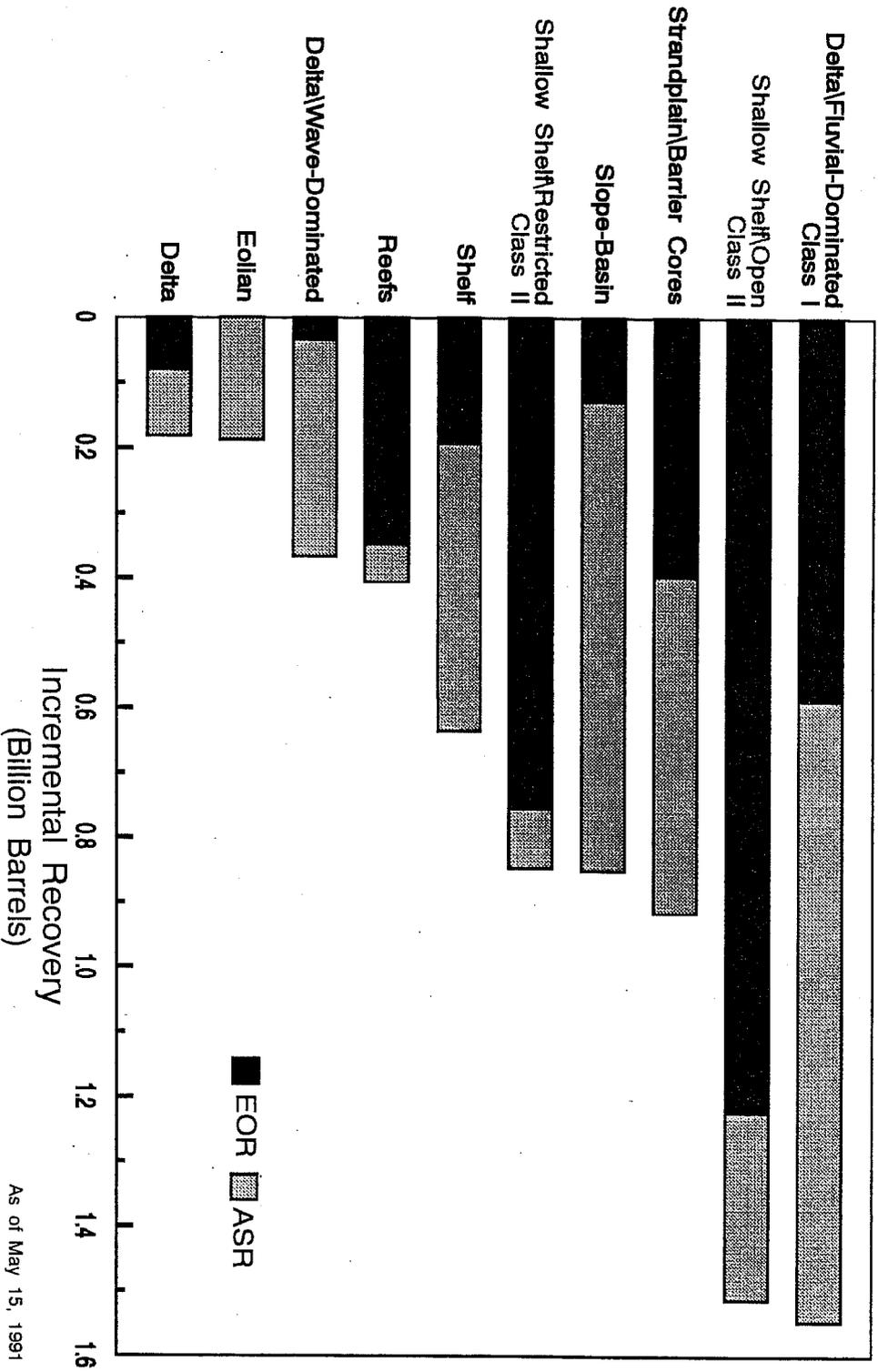
1991 Production



TOTAL PRODUCTION = 403 MILLION BARRELS

Domestic Liquids Reserves (OGJ 400,300)
 Majors: >250 MMBbls
 Large Independents: >100 MMBbls
 Mid-Sized Independents: >10 MMBbls
 Small Operators: <10 MMBbls

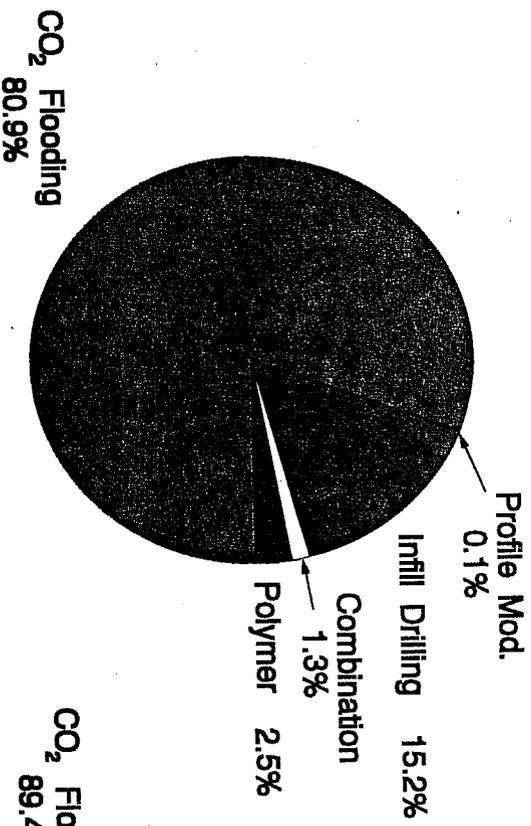
Incremental Recovery Potential Top Ten Classes in the Near-Term



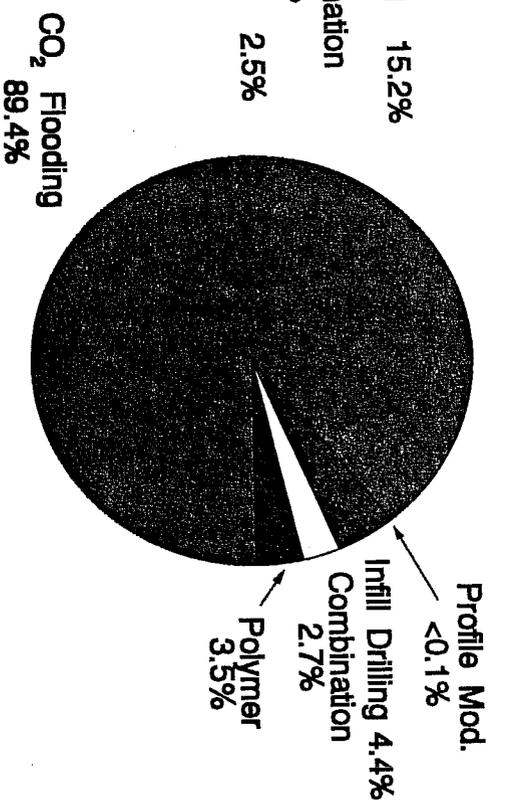
As of May 15, 1991

Near-Term Incremental Recovery Potential By Process

Shallow Shelf/Open

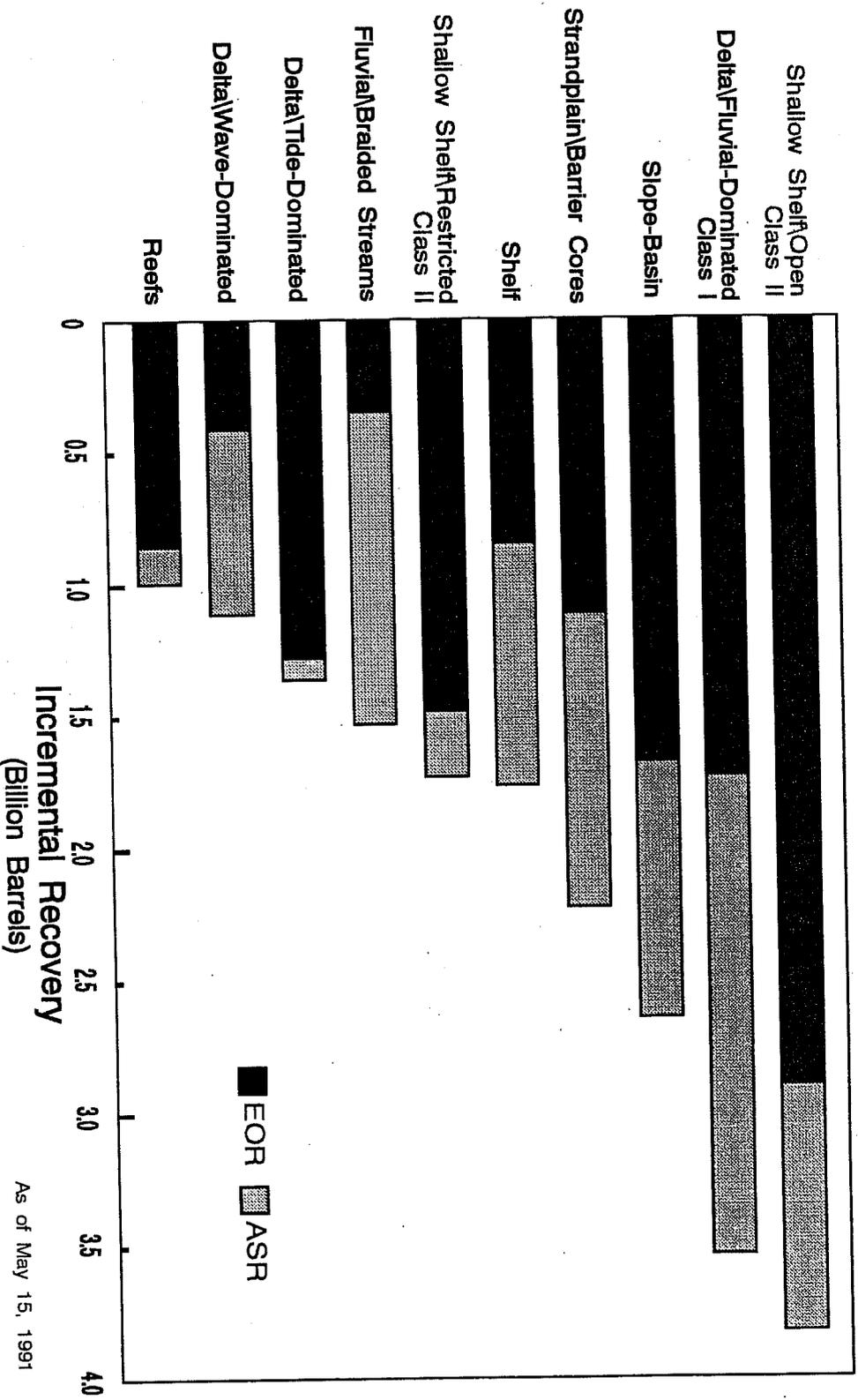


Shallow Shelf/Restricted



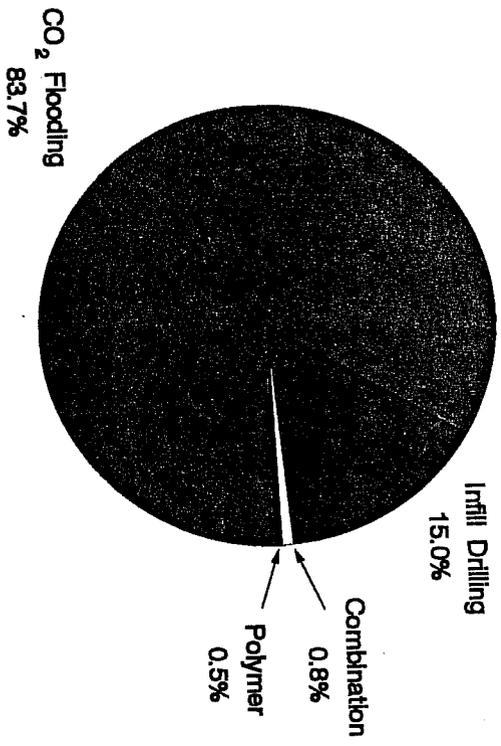
EOR Processes = CO₂ Flooding and Steam Flooding
 ASR Processes = Polymer Flooding, Profile Modification, Infill Drilling, and
 Infill Drilling in Combination with Other Processes

Incremental Recovery Potential Top Ten Classes in the Mid-Term



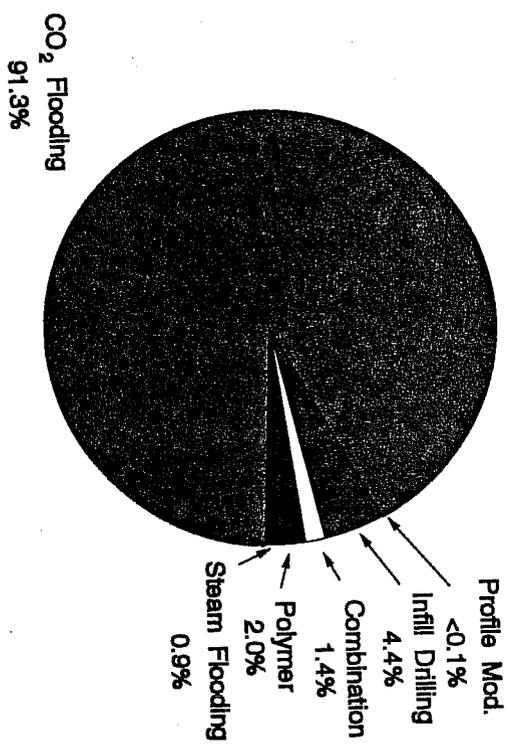
Mid-Term Incremental Recovery Potential By Process

Shallow Shelf/Open



3,461 Million Barrels

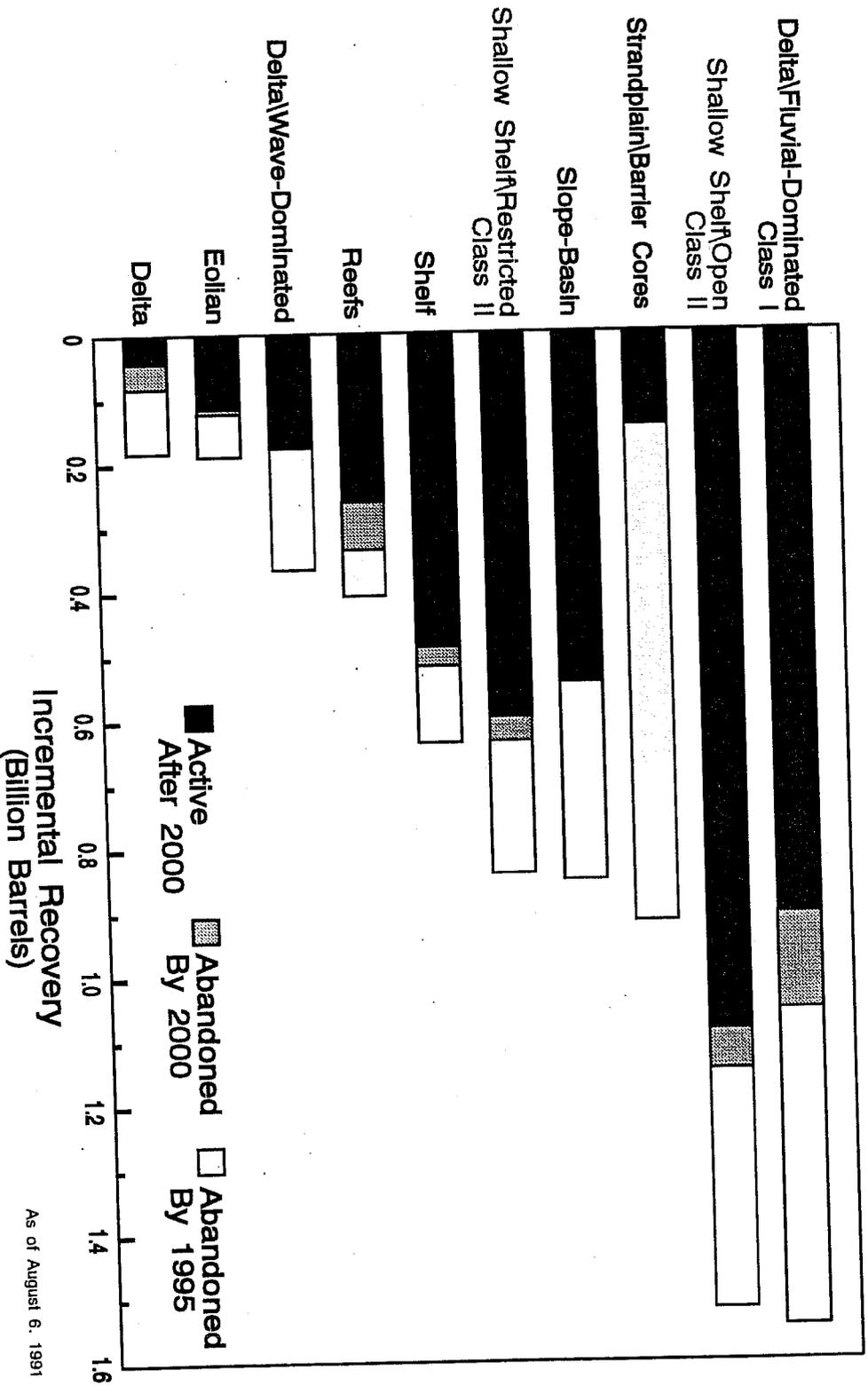
Shallow Shelf/Restricted



1,604 Million Barrels

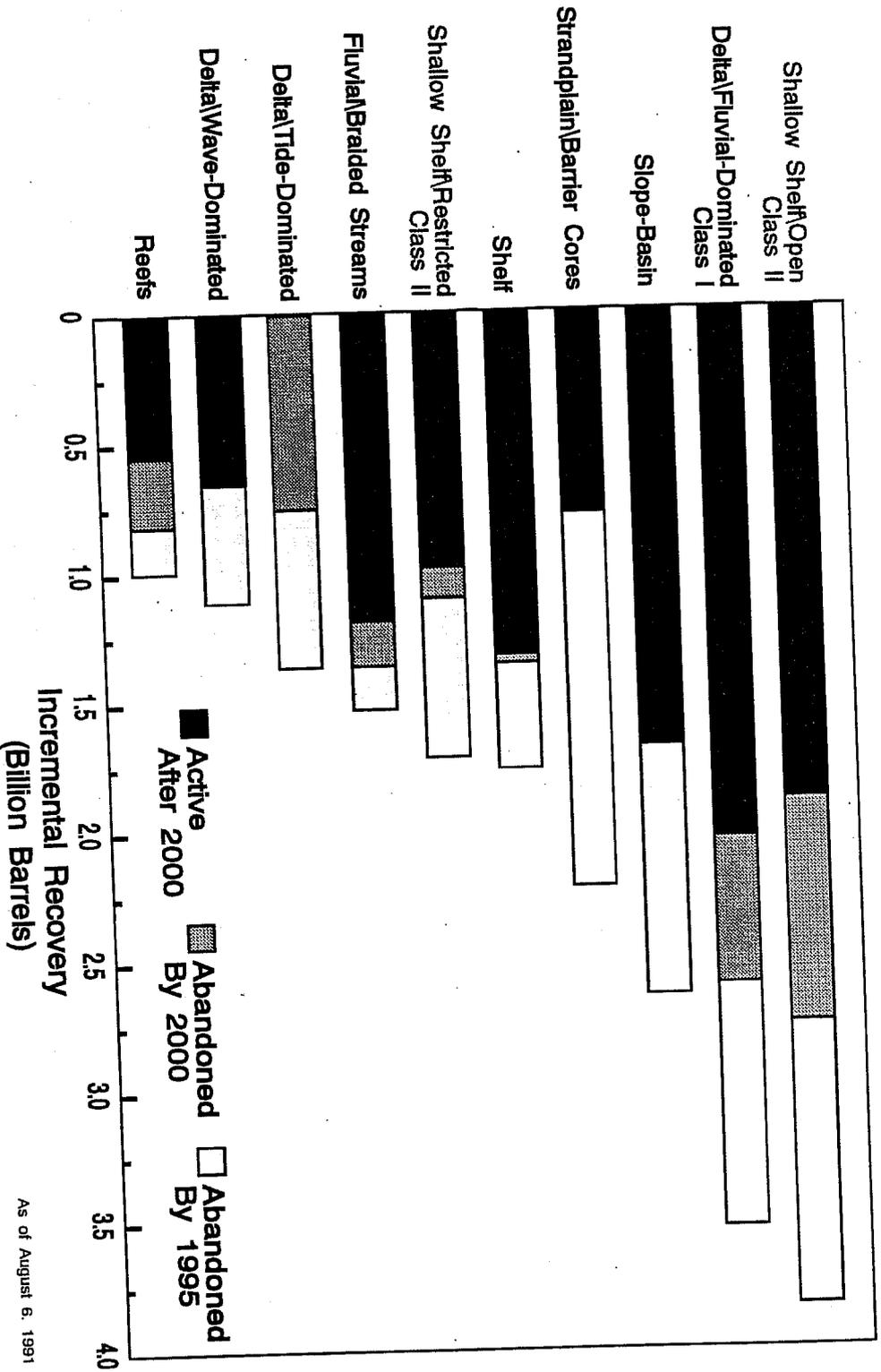
EOR Processes = CO₂ Flooding and Steam Flooding
 ASR Processes = Polymer Flooding, Profile Modification, Infill Drilling, and
 Infill Drilling In Combination with Other Processes

Near-Term Potential Abandonment Top Ten Geologic Classes



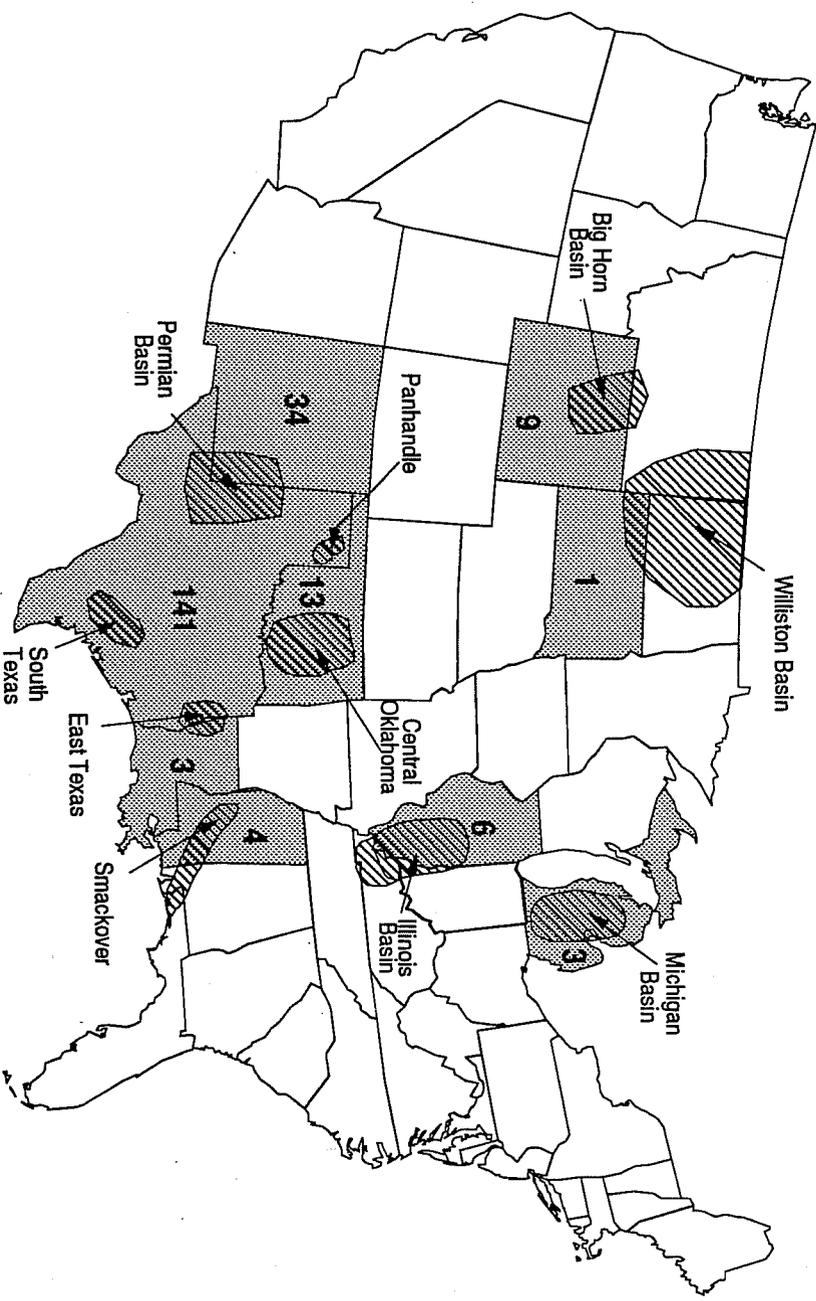
As of August 6, 1991

Mid-Term Potential Abandonment Top Ten Geologic Classes



As of August 6, 1991

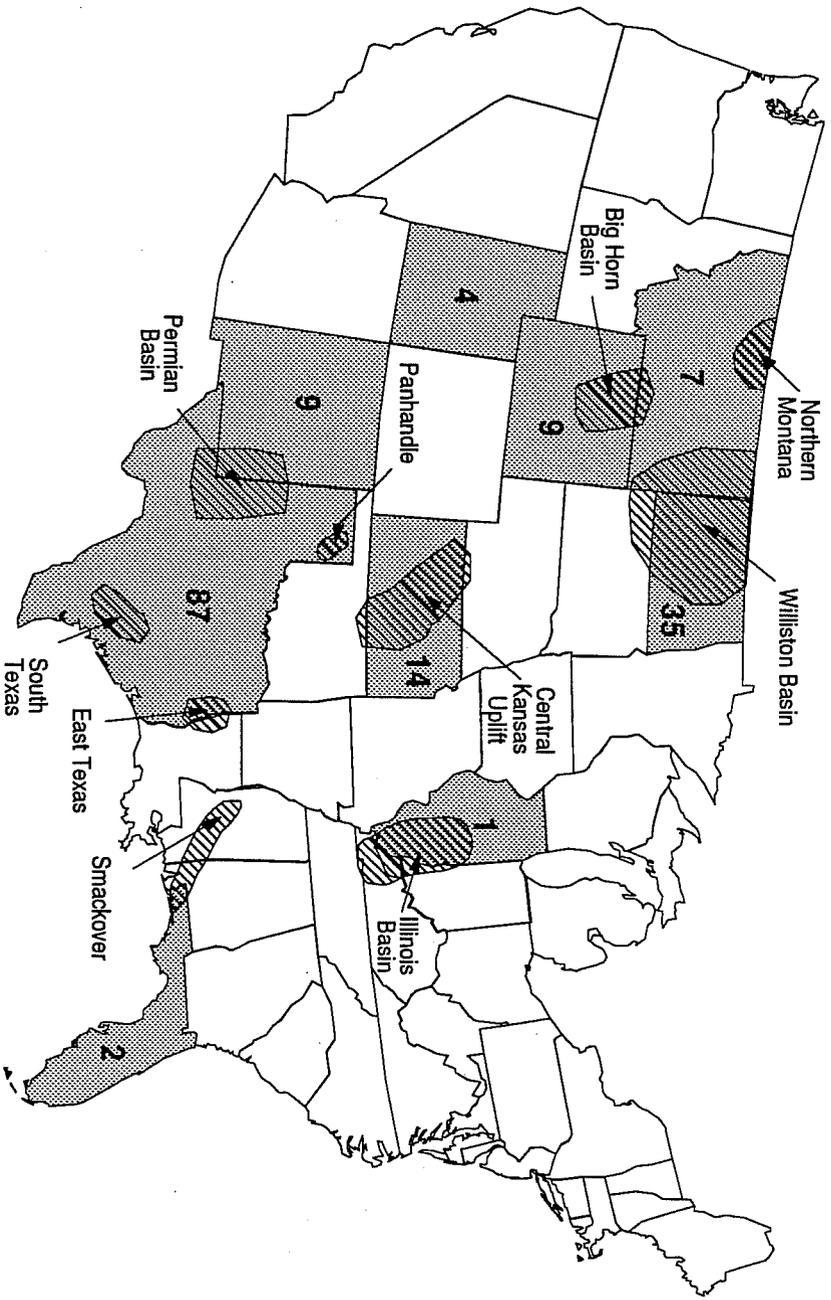
Location of Shallow Shelf/Open Carbonate Reservoirs



Source: TORIS, 7/92

Total for U.S. = 214

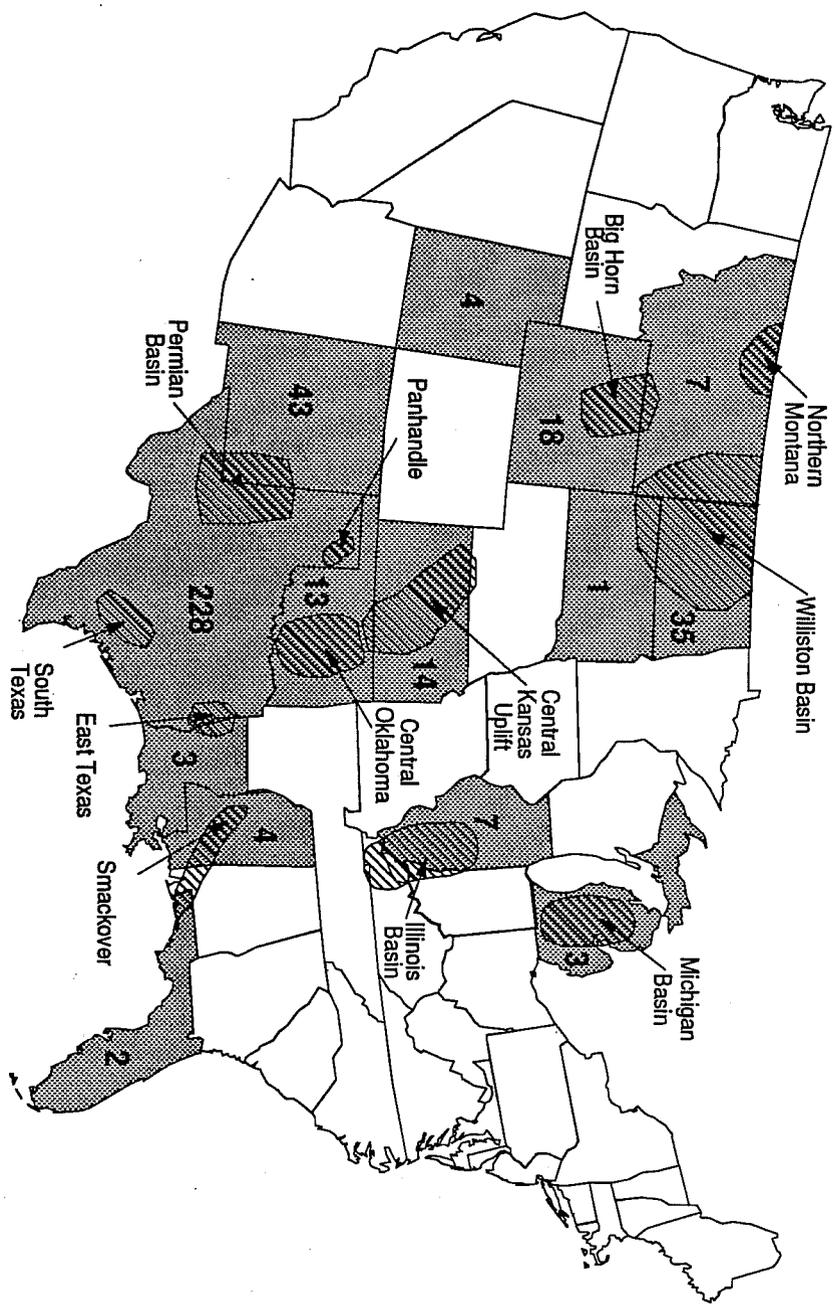
Location of Shallow Shelf/Restricted Carbonate Reservoirs



Source: TORIS, 7/92

Total for U.S. = 168

Location of Shallow Shelf Combined Carbonate Reservoirs



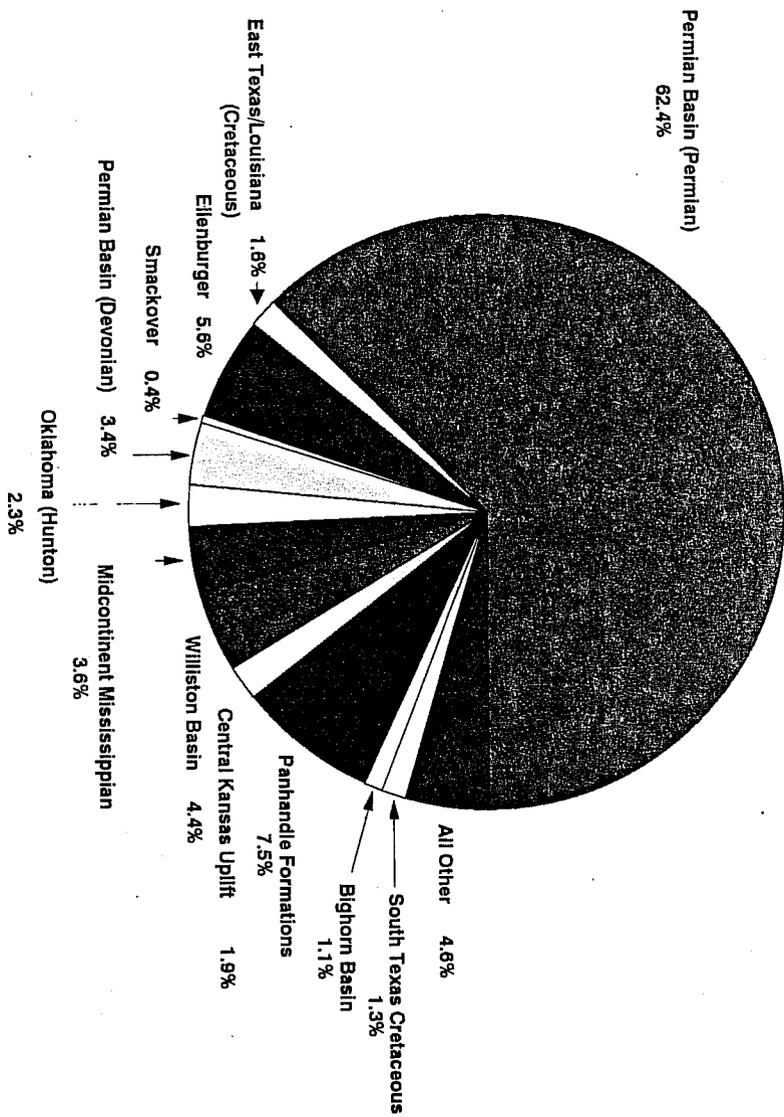
Source: TORIS, 7/92

Total for U.S. = 382

Data Analysis Support for the Oil Research Program

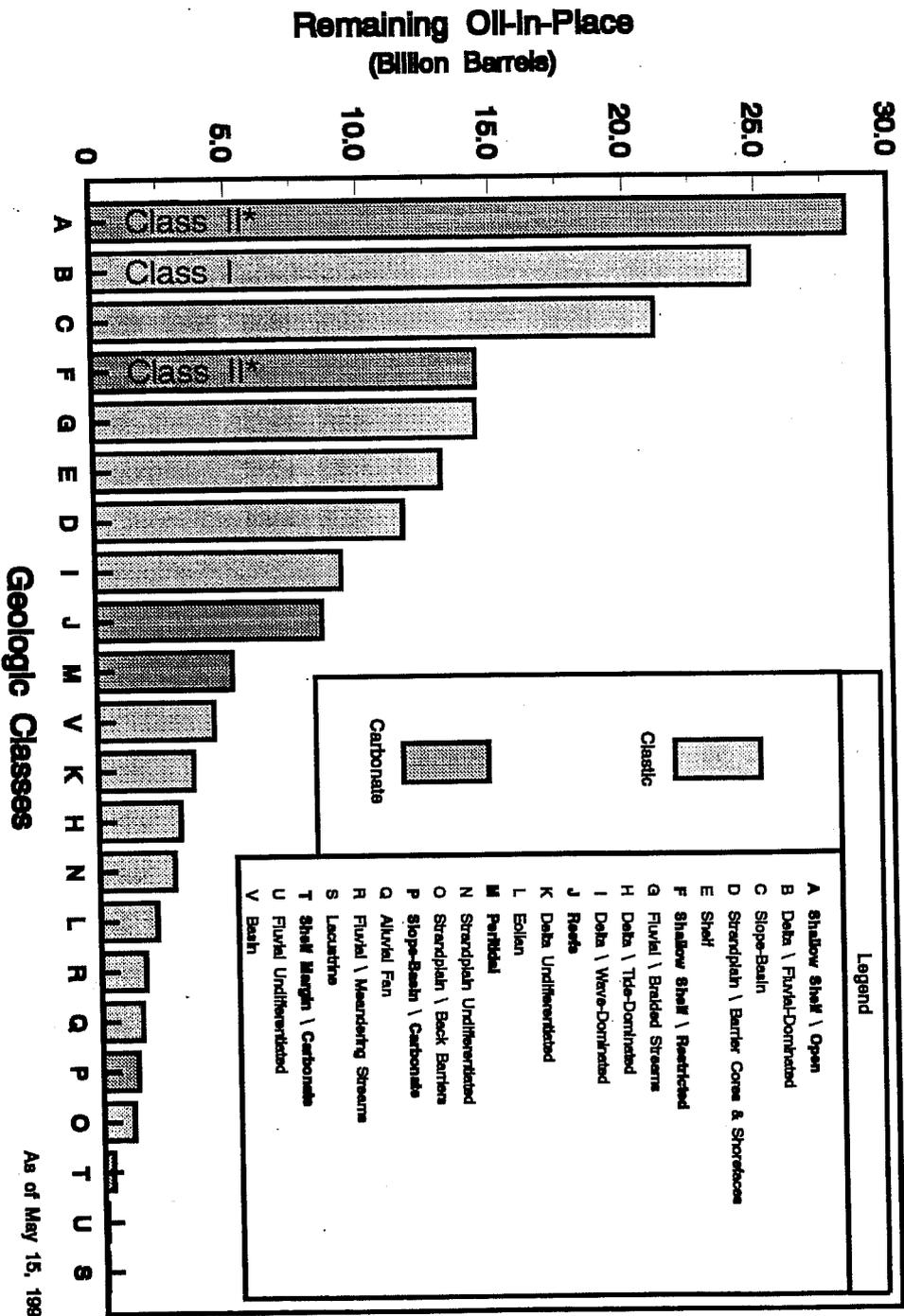
- The data and analyses to prioritize the reservoir classes are provided by the Tertiary Oil Recovery Information System (TORIS).
- TORIS is operated and maintained by the U.S. Department of Energy, Bartlesville Project Office.
- TORIS consists of engineering and evaluation models for a variety of EOR and ASR technologies.
- TORIS provides estimates of the impact of R&D successes and failures on increasing the economic producibility of the known remaining oil resources of each reservoir class.

Distribution of Class II Shallow Shelf Carbonate Reservoirs by OOIP



OOIP = 68 Billion BBL

Remaining Oil-in-Place for the 22 Geological Classes



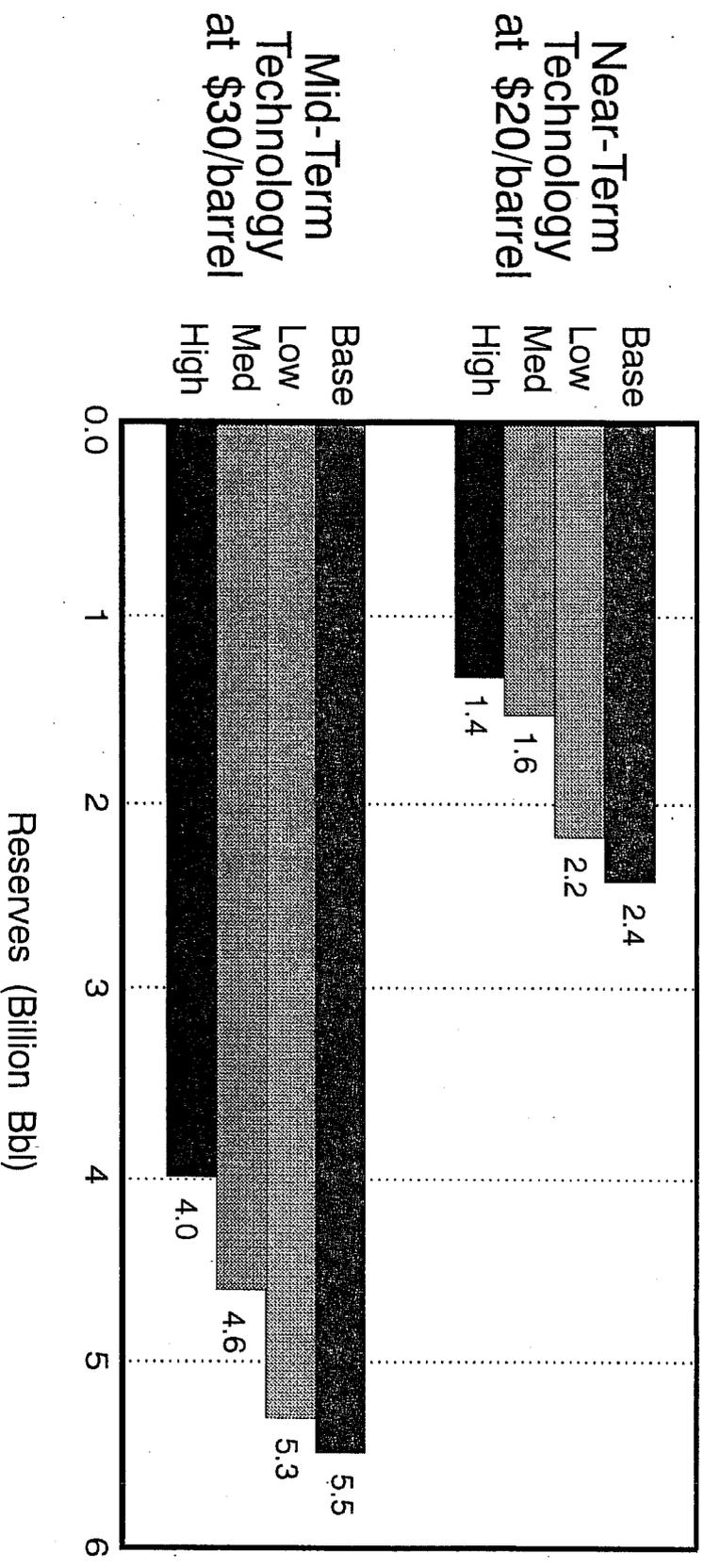
* Shallow Shelf Open & Restricted classes have been combined into one class (Class II).

CLASS II ENVIRONMENTAL INPUTS

Economic Impacts of Environmental Regulations

- **Several legislative initiatives present potential cumulative economic impacts. They include:**
 - **Resource Conservation and Recovery Act (RCRA)**
 - **Safe Drinking Water Act (SDWA)**
 - **Clean Water Act (CWA)**
 - **Clean Air Act (CAA)**
- **Estimated incremental impact on reserves is based on the likely practices required to comply with the initiatives at three levels of regulation.**

Reserve Potential and Possible Loss Due to Environmental Regulations Class II Open & Restricted



- Notes:
1. Low, medium, and high regulatory scenarios defined in Cumulative Impacts Report (CFR, 1990; SPE #20619).
 2. Reserve potentials extrapolated from Multistate resource total (IOCC, 1990)

Impacts of Environmental Regulations on Reserve Potential

Some of the remaining oil resource is vulnerable to abandonment as a result of increased environmental regulation of E&P operations.

- Current conditions (base case) reflect the resource potential accessible using currently available technology at oil prices to \$20/barrel (Near-Term technology case)
- The high scenario reflects a stringent, yet conceivable, level of regulation
- The low scenario assumes that some change in existing legislation is inevitable and will impact domestic operations
- The medium scenario is between the high and low scenarios, but does not represent a most likely case.

Primary Environmental Concerns* Associated with EOR Technologies

	STEAM INJECTION	IN SITU COMBUSTION	CHEMICAL FLOODING	CO ₂ INJECTION
AIR	<ul style="list-style-type: none"> SO₂, NO_x AND PM¹⁰ EMISSIONS FROM STEAM GENERATORS Wellhead emissions of HC 	<ul style="list-style-type: none"> HC and CO emissions from wells SO₂, NO_x, TSP emissions from air compressors 	<ul style="list-style-type: none"> Fugitive emissions from on-site manufacture of chemicals 	<ul style="list-style-type: none"> Leaks of CO₂ in process use or transport H₂S emissions from wells
WATER USE	<ul style="list-style-type: none"> SIGNIFICANT WATER DEMAND 	<ul style="list-style-type: none"> Moderate water demand in wet combustion process 	<ul style="list-style-type: none"> SIGNIFICANT WATER DEMAND 	<ul style="list-style-type: none"> SIGNIFICANT WATER DEMAND
WATER EFFLUENTS	<ul style="list-style-type: none"> DISPOSAL OF PRODUCED WATER 	<ul style="list-style-type: none"> DISPOSAL OF PRODUCED WATER Aquifer contamination from low pH water with trace metals resulting from corrosion of well casings 	<ul style="list-style-type: none"> AQUIFER CONTAMINATION FROM INJECTED CHEMICALS DISPOSAL OF PRODUCED WATER Spills/leaks of chemicals to surface waters 	<ul style="list-style-type: none"> DISPOSAL OF PRODUCED WATER Aquifer contamination from low pH water and corrosion of well casings
SOLID WASTE	<ul style="list-style-type: none"> Disposal of scrubber sludges Disposal of water treatment wastes 	<ul style="list-style-type: none"> Disposal of wastes from wellhead gas cleaning Disposal of water treatment wastes 	<ul style="list-style-type: none"> Disposal of wastes from on-site chemical manufacture Disposal of water treatment wastes 	<ul style="list-style-type: none"> Disposal of water treatment wastes

* Capital letters indicate major environmental issues; italics indicate environmental issues of lesser concern.

Source: Madden, Blatchford and Spears, 1991.

CLASS II RESERVOIR LIST

TORIS Class II Reservoirs

State	Fieldname	Reservoir	Formation
FL	BLACKJACK CREEK	SMACKOVER	SMACKOVER
FL	JAY	SMACKOVER	SMACKOVER
IL	LAWRENCE	TRENTON	GALENA
IL	LAWRENCE	SALEM	SALEM
IL	LAWRENCE	DEVONIAN	LINGLE
IL	LAWRENCE	ST. LOUIS	ST. LOUIS
IL	MAIN CONSOLIDATED	TRENTON	GALENA
IL	MAIN CONSOLIDATED	DEVONIAN	LINGLE
IL	SALEM CONSOLIDATED	DEVONIAN LIMESTONE	GRAND TOWER
KS	BARRY	LANSING-KANSAS CITY	LANSING-KANSAS CITY
KS	CHITWOOD	ALL	ALL
KS	CUNNINGHAM	LANSING-KANSAS CITY	LANSING-KANSAS CITY
KS	DAMME	ST. LOUIS	ST. LOUIS
KS	GATES	LANSING-KANSAS CITY	LANSING-KANSAS CITY
KS	GENESE	LANSING-KANSAS CITY	LANSING-KANSAS CITY
KS	GIBSON	ARBUCKLE	ARBUCKLE, ALL
KS	HALL GURNEY	LANSING-KANSAS CITY	LANSING-KANSAS CITY
KS	MOREL	LANSING-KANSAS CITY	LANSING-KANSAS CITY
KS	PLEASANT PRAIRIE	MISSISSIPPIAN (ST. LOUIS)	MISSISSIPPIAN
KS	SOLOMON	LANSING-KANSAS CITY	LANSING-KANSAS CITY
KS	SPIVEY-GRABS-BASIL	OSAGE CHERT	OSAGE
KS	TRICO UNIT	LANSING-KANSAS CITY	LANSING-KANSAS CITY
KS	VIRGIL	MISSISSIPPIAN	MISSISSIPPIAN
LA	CADDO PINE ISLAND	PETTIT	PETTIT
LA	CADDO PINE ISLAND	SLIGO	SLIGO
LA	CADDO PINE ISLAND	ANNONA CHALK	ANNONA CHALK
MI	ALBION	TRENTON-BLACK RIVER	TRENTON/BLACK RIVER
MI	SCIPIO	TRENTON-BLACK RIVER	TRENTON/BLACK RIVER
MI	WEST BRANCH	DUNDEE	DUNDEE

TORIS Class II Reservoirs

State	Fieldname	Reservoir	Formation
MS	CYPRESS CREEK, SOUTH	SMACKOVER B	UPPER SMACKOVER
MS	CYPRESS CREEK, SOUTH	SMACKOVER A	UPPER SMACKOVER
MS	PACHUTA CREEK, EAST	SMACKOVER	UPPER SMACKOVER
MS	WEST NANCY	SMACKOVER	UPPER SMACKOVER
MT	BROBSON	MADISON	MADISON GROUP
MT	CUT BANK	MADISON	MADISON GROUP
MT	KEVIN-SUNBURST	SUN RIVER DOLOMITE (INFORMAL)	MISSION CANYON
MT	MONDAK WEST	MADISON	MADISON GROUP
MT	PONDERA	SUN RIVER DOLOMITE (INFORMAL)	
MT	REAGAN	SUN RIVER DOLOMITE (INFORMAL)	
MT	VAUX	MISSION CANYON	MISSION CANYON
MT	WELDON	SAN ANDRES	SAN ANDRES
ND	ANTELOPE	MADISON	NISKU & DUPEROW
ND	ANTELOPE	NISKU & DUPEROW	CHARLES
ND	ANTLER CREEK SOUTH	MADISON-MIDALE	MISSION CANYON
ND	BEAVER LODGE	MADISON	DUPEROW
ND	BEAVER LODGE	DEVONIAN	MISSION CANYON
ND	BIG STICK FIELD	MISSION CANYON	MISSION CANYON
ND	BLACK SLOUGH	MADISON	MISSION CANYON
ND	BLUE BUTTES	MADISON	MISSION CANYON
ND	CAMEL BUTTE	DUPEROW	DUPEROW
ND	CAPA	MADISON	MISSION CANYON
ND	CHARLSON MADISON UNIT NORTH	MADISON	MISSION CANYON
ND	ELEVEN BAR	RED RIVER	RED RIVER
ND	ELKHORN RANCH	MISSION CANYON	MISSION CANYON
ND	FRYBURG	MADISON	MISSION CANYON
ND	HAAS	MADISON	MISSION CANYON
ND	HAWKEYE	MADISON	MISSION CANYON
ND	HOFFLUND	MADISON	MISSION CANYON
ND	KUROKI	MADISON	CHARLES
ND	LANDA NORTHEAST	MADISON-MISSION CANYON	MISSION CANYON

TORIS Class II Reservoirs

State	Fieldname	Reservoir	Formation
ND	LIGNITE	MADISON	MISSION CANYON
ND	LITTLE KNIFE	MISSION CANYON	MISSION CANYON
ND	MCGREGOR	MADISON	MISSION CANYON
ND	MCGREGOR NORTHWEST	MADISON	MISSION CANYON
ND	MEDORA	MADISON	
ND	NEWBURG	SPEARFISH & CHARLES	SPEARFISH & CHARLES
ND	NOONAN	MADISON	MISSION CANYON
ND	NORTH SOURIS	MADISON	MISSION CANYON
ND	NORTH WESTHOPE	MADISON-MIDALE	CHARLES
ND	RIVAL	MADISON	MISSION CANYON
ND	ROUGH RIDER	MADISON-MISSION CANYON	MISSION CANYON
ND	SCOTIA	MADISON	MISSION CANYON
ND	SHERWOOD	MISSION CANYON	MISSION CANYON
ND	TIOGA	MADISON-RIVAL	MISSION CANYON
ND	TIOGA NORTH	MADISON-MIDALE	CHARLES
ND	WILEY	MISSION CANYON	MISSION CANYON
NM	ARROWHEAD	GRAYBURG	GRAYBURG
NM	ARTESIA	QUEEN GRAYBURG SAN ANDRES	QUEEN GRAYBURG SAN ANDRES
NM	BAGLEY	SILURO-DEVONIAN	SILURO-DEVONIAN
NM	BRONCO	SILURO-DEVONIAN	SILURO-DEVONIAN
NM	CAPROCK EAST	DEVONIAN	DEVONIAN
NM	CATO	SAN ANDRES	SAN ANDRES
NM	CAVE	GRAYBURG	GRAYBURG
NM	CHAVEROO	SAN ANDRES	SAN ANDRES
NM	CROSSROADS	DEVONIAN	DEVONIAN
NM	DENTON	DEVONIAN	DEVONIAN
NM	DOLLARHIDE	ELLENBERGER	ELLENBERGER
NM	DOLLARHIDE	TUBB DRINKARD	TUBB DRINKARD
NM	DOLLARHIDE	FUSSELMAN	FUSSELMAN
NM	DRINKARD	YESO-VIVIAN	YESO-VIVIAN
NM	EAGLE CREEK	SAN ANDRES	SAN ANDRES
NM	EUNICE MONUMENT	GRAYBURG SAN ANDRES	GRAYBURG SAN ANDRES

TORIS Class II Reservoirs

State	Fieldname	Reservoir	Formation
NM	FLYING M	SAN ANDRES	UPPER YESO
NM	FOWLER	UPPER YESO	GRAYBURG-SAN ANDRES
NM	GRAYBURG-JACKSON	GRAYBURG-SAN ANDRES	BLINEBRY-YESO
NM	HOBBS	GRAYBURG-SAN ANDRES	GRAYBURG-SAN ANDRES
NM	HOBBS	FUSSELMAN	FUSSELMAN
NM	JUSTIS	ELLENBURGER	ELLENBURGER
NM	JUSTIS	BLINEBRY	BLINEBRY
NM	JUSTIS	FUSSELMAN	FUSSELMAN
NM	JUSTIS, NORTH	DEVONIAN	DEVONIAN
NM	LEA	GRAYBURG-SAN ANDRES	GRAYBURG-SAN ANDRES
NM	LOCO HILLS	PADDOCK	PADDOCK
NM	LOVINGTON	DEVONIAN	DEVONIAN
NM	LOVINGTON	SAN ANDRES	SAN ANDRES
NM	LOVINGTON	SAN ANDRES	SAN ANDRES
NM	LOVINGTON	GRAYBURG-SAN ANDRES	GRAYBURG-SAN ANDRES
NM	LOVINGTON WEST	SAN ANDRES	SAN ANDRES
NM	MALJAMAR	GRAYBURG-SAN ANDRES	GRAYBURG-SAN ANDRES
NM	MILNESAND	SAN ANDRES	SAN ANDRES
NM	MOORE	DEVONIAN	DEVONIAN
NM	PADDOCK	UPPER YESO	UPPER YESO
NM	SAWYER WEST	SAN ANDRES	SAN ANDRES
NM	SKAGGS	GRAYBURG	GRAYBURG
NM	SQUARE LAKE	GRAYBURG-SAN ANDRES	GRAYBURG-SAN ANDRES
NM	TOM TOM	SAN ANDRES	SAN ANDRES
NM	TUBB	TUBB	TUBB
NM	TWIN LAKES	SAN ANDRES	SAN ANDRES
NM	VACUUM	GRAYBURG SAN ANDRES	GRAYBURG SAN ANDRES
NM	VACUUM	GLORietta	GLORietta
OK	COYLE	HUNTON	HUNTON
OK	CUSHING	WHEELER	WHEELER
OK	EDMOND WEST	HUNTON	HUNTON
OK	FITTS	HUNTON	HUNTON
OK	GOLDEN TREND	HUNTON	HUNTON

TORIS Class II Reservoirs

State	Fieldname	Reservoir	Formation
OK	HEALDTON	ARBUCKLE	ARBUCKLE
OK	MAUD	HUNTON	HUNTON
OK	MISSION	HUNTON	HUNTON
OK	MUSTANG NORTH	HUNTON BOIS D'ARC	HUNTON BOIS D'ARC
OK	RINGWOOD	MANNING	MANNING
OK	SOONER TREND	MERAMEC	MERAMEC
OK	SOONER TREND	HUNTON	HUNTON
OK	SOONER TREND	MANNING AND CHESTER	MANNING AND CHESTER
OK	ST LOUIS	HUNTON	HUNTON
SD	BUFFALO	RED RIVER	RED RIVER
TX	ABELL	SILURIAN-MONTOYA	SILURIAN-MONTOYA
TX	ADAIR	SAN ANDRES	SAN ANDRES
TX	AMACKER TIPPETT	ELLENBURGER	ELLENBURGER
TX	AMROW	DEVONIAN	DEVONIAN
TX	ANDECTOR	ELLENBURGER	ELLENBURGER
TX	ANDREWS SOUTH	WOLFCAMP	WOLFCAMP
TX	ANDREWS WOLFCAMP	WOLFCAMP	WOLFCAMP
TX	ANDREWS, N.	DEVONIAN	DEVONIAN
TX	ANTON IRISH UNIT	CLEARFORK	CLEARFORK
TX	APCO-WARNER	ELLENBURGER	ELLENBURGER
TX	BAKKE	WOLFCAMP	WOLFCAMP
TX	BAKKE	ELLENBURGER	ELLENBURGER
TX	BAKKE	ELLENBURGER	ELLENBURGER
TX	BARNHART	GLEN ROSE 4300	GLEN ROSE 4300
TX	BETHANY	LIME 3850	LIME 3850
TX	BETHANY, NE.	SAN ANDRES	SAN ANDRES
TX	BIG LAKE	ELLENBURGER	ELLENBURGER
TX	BLOCK 12, EAST	GRAYBURG	GRAYBURG
TX	BLOCK 31	ELLENBURGER	ELLENBURGER
TX	BLOCK 31	GRAYBURG	GRAYBURG
TX	BLOCK 31	SAN ANDRES	SAN ANDRES
TX	BRAHANNEY		

TORIS Class II Reservoirs

State	Fieldname	Reservoir	Formation
TX	BREEDLOVE	DEVONIAN	DEVONIAN
TX	BRONCO	SILURIAN-DEVONIAN	SILURIAN-DEVONIAN
TX	BROWN & THORPE	CLEAR FORK	CLEAR FORK
TX	C - BAR	SAN ANDRES	SAN ANDRES
TX	CEDAR LAKE	SAN ANDRES/CLEAR FORK	SAN ANDRES/CLEAR FORK
TX	CLARA COUCH	SAN ANDRES/GRAYBURG	SAN ANDRES/GRAYBURG
TX	COLEMAN RANCH		
TX	CORAZON	SAN ANDRES	SAN ANDRES
TX	COWDEN NORTH	DEEP	DEEP
TX	COWDEN SOUTH	ELLENBURGER	ELLENBURGER
TX	COWDEN SOUTH	SAN ANDRES/GRAYBURG	SAN ANDRES/GRAYBURG
TX	CRANE COWDEN	SAN ANDRES/GRAYBURG	SAN ANDRES/GRAYBURG
TX	DILLARD, SE.	ELLENBURGER	ELLENBURGER
TX	DOLLARHIDE	ELLENBURGER	ELLENBURGER
TX	DOLLARHIDE	CLEAR FORK	CLEAR FORK
TX	DOLLARHIDE	SILURIAN	SILURIAN
TX	DOLLARHIDE	ELLENBURGER	ELLENBURGER
TX	DOLLARHIDE, EAST	SAN ANDRES/GRAYBURG	SAN ANDRES/GRAYBURG
TX	DONNELLY	DEVONIAN	DEVONIAN
TX	DORA ROBERTS	DEVONIAN	DEVONIAN
TX	DORA ROBERTS	ELLENBURGER	ELLENBURGER
TX	DORWARD		
TX	DUNE	PERMIAN-SAN ANDRES	PERMIAN-SAN ANDRES
TX	D. E. B.	WOLFCAMP	WOLFCAMP
TX	EDWARDS	SAN ANDRES/GRAYBURG	SAN ANDRES/GRAYBURG
TX	ELKHORN	ELLENBURGER	ELLENBURGER
TX	EMBAR	PERMIAN	PERMIAN
TX	EMBAR	ELLENBURGER	ELLENBURGER
TX	EMMA	SAN ANDRES	SAN ANDRES
TX	EMMA	ELLENBURGER	ELLENBURGER
TX	EMPEROR	HOLT	HOLT
TX	FAIRWAY	JAMES LIME	JAMES LIME
TX	FARMER	SAN ANDRES	SAN ANDRES
TX	FASKEN	WOLFCAMP	WOLFCAMP

TORIS Class II Reservoirs

State	Fieldname	Reservoir	Formation
TX	FLANAGAN	CLEAR FORK, UPPER	CLEAR FORK, UPPER
TX	FLANAGAN	CLEARFORK	CLEARFORK
TX	FORT CHADBOURNE	ODOM LIME	ODOM LIME
TX	FOSTER	GRAYBURG	GRAYBURG
TX	FOSTER-WITCHER A	SAN ANDRES/GRAYBURG	SAN ANDRES/GRAYBURG
TX	FUHRMAN	GLORIETA	GLORIETA
TX	FUHRMAN-MASCHO	SAN ANDRES	SAN ANDRES
TX	FULLEERTON	8500	8500
TX	FULLEERTON	SAN ANDRES	SAN ANDRES
TX	FULLEERTON	CLEARFORK	CLEARFORK
TX	FULLEERTON	ELLENBURGER	ELLENBURGER
TX	FULLEERTON, SOUTH	SAN ANDRES	SAN ANDRES
TX	G M K	SAN ANDRES	SAN ANDRES
TX	GARZA (TOTAL FIELD)	SAN ANDRES	SAN ANDRES
TX	GLASCO	DEVONIAN	DEVONIAN
TX	G-M-K, SOUTH	SAN ANDRES	SAN ANDRES
TX	GOLDSMITH	5600	5600
TX	GOLDSMITH	DEVONIAN	DEVONIAN
TX	GOLDSMITH	CLEARFORK	CLEARFORK
TX	GOLDSMITH	SAN ANDRES	SAN ANDRES
TX	GOLDSMITH	SAN ANDRES	SAN ANDRES
TX	GOLDSMITH EAST	SAN ANDRES	SAN ANDRES
TX	GOLDSMITH EAST	HOLT	HOLT
TX	GOLDSMITH NORTH	SAN ANDRES CON.	SAN ANDRES CON.
TX	GOLDSMITH NORTH	SAN ANDRES	SAN ANDRES
TX	GOLDSMITH SA UNIT	UPPER CLEARFORK	UPPER CLEARFORK
TX	GOLDSMITH WEST	SAN ANDRES	SAN ANDRES
TX	GOLDSMITH WEST	SAN ANDRES	SAN ANDRES
TX	GOLDSMITH WEST	FUSSELMAN	FUSSELMAN
TX	GOLDSMITH, WEST	SAN ANDRES	SAN ANDRES
TX	GOLDSMITH, W.	SAN ANDRES	SAN ANDRES
TX	GOOD SOUTHEAST (FUSSELMAN)	FUSSELMAN	FUSSELMAN
TX	GOOD S.E.	FUSSELMAN	FUSSELMAN
TX	HALLSVILLE, NE.	PETTIT	PETTIT
TX	HARPER	ELLENBURGER	ELLENBURGER
TX	HARPER	PERMIAN	PERMIAN
TX	HARPER	SAN ANDRES/GRAYBURG	SAN ANDRES/GRAYBURG

TORIS Class II Reservoirs

State	Fieldname	Reservoir	Formation
TX	HARPER	DEVONIAN	DEVONIAN
TX	HARRIS	GLORIETA-SAN ANGELO	GLORIETA-SAN ANGELO
TX	HEADLEE (ELLENBURGER)	ELLENBURGER	ELLENBURGER
TX	HOWARD GLASSCOCK	GRAYBURG - SAN ANDRES	GRAYBURG - SAN ANDRES
TX	HOWARD GLASSCOCK	GLORIETA	GLORIETA
TX	HOWARD GLASSCOCK	CLEARFORK MIDDLE	CLEARFORK MIDDLE
TX	HUNTLEY	GLORIETA	GLORIETA
TX	HUNTLEY	3400	3400
TX	HUNTLEY EAST	SAN ANDRES	SAN ANDRES
TX	HUNTLEY EAST	SAN ANDRES	SAN ANDRES
TX	HUNTLEY EAST	GLORIETA-CLEARFORK	GLORIETA-CLEARFORK
TX	IATAN	SAN ANDRES	SAN ANDRES
TX	IATAN	SAN ANDRES	SAN ANDRES
TX	IATAN EAST	SAN ANDRES CLEARFORK	SAN ANDRES CLEARFORK
TX	JOHNSON	GRAYBURG - SAN ANDRES	GRAYBURG - SAN ANDRES
TX	JORDAN	SAN ANDRES	SAN ANDRES
TX	JORDAN	ELLENBURGER	ELLENBURGER
TX	JORDAN UNIVERSITY	SAN ANDRES	SAN ANDRES
TX	KEYSTONE	ELLENBURGER	ELLENBURGER
TX	KEYSTONE	SILURIAN	SILURIAN
TX	KEYSTONE	HOLT	HOLT
TX	KINGDOM	ABO REEF	ABO REEF
TX	LANDON	SAN ANDRES	SAN ANDRES
TX	LANDON	SAN ANDRES	SAN ANDRES
TX	LAWSON	SAN ANDRES	SAN ANDRES
TX	LEA	SAN ANDRES	ELLENBURGER
TX	LEA	ELLENBURGER	ELLENBURGER
TX	LEE HARRISON	SAN ANDRES/CLEAR FORK	SAN ANDRES/CLEAR FORK
TX	LEVELLAND UNIT	SAN ANDRES	SAN ANDRES
TX	LONGWOOD	GOODLAND LIME	GOODLAND LIME
TX	LOWE	SILURIAN	SILURIAN
TX	LOWE	ELLENBURGER	ELLENBURGER
TX	LULING BRANYON	EDWARDS	EDWARDS
TX	LUTHER S. E.	SILURIAN - DEVONIAN	SILURIAN - DEVONIAN
TX	MABEE	SAN ANDRES	SAN ANDRES

TORIS Class II Reservoirs

State	Fieldname	Reservoir	Formation
TX	MAGUTEX	ELLENBURGER	ELLENBURGER
TX	MCCAMEY	GRAYBURG - SAN ANDRES	GRAYBURG - SAN ANDRES
TX	MCCELROY	GRAYBURG-SAN ANDRES	GRAYBURG-SAN ANDRES
TX	MCFARLAND	ELLENBURGER	ELLENBURGER
TX	MEANS	SAN ANDRES/GRAYBURG	SAN ANDRES/GRAYBURG
TX	MIDLAND FARMS	GRAYBURG	GRAYBURG
TX	MIDLAND FARMS	WOLFCAMP	WOLFCAMP
TX	MIDLAND FARMS	FUSSELMAN	FUSSELMAN
TX	MIDLAND FARMS	ELLENBURGER	ELLENBURGER
TX	MIDLAND FARMS	ELLENBURGER	ELLENBURGER
TX	MIDLAND FARMS, NE.	GRAYBURG	GRAYBURG
TX	MIDLAND FARMS, NORTH	ELLENBURGER	ELLENBURGER
TX	MIDWAY LANE	ELLENBURGER	ELLENBURGER
TX	MONAHANS	CLEAR FORK	CLEAR FORK
TX	MONAHANS	CLEARFORK	CLEARFORK
TX	MOORE	BACON LIME	BACON LIME
TX	NEW HOPE	WOLFCAMP	WOLFCAMP
TX	NOLLEY	SAN ANDRES/GRAYBURG	SAN ANDRES/GRAYBURG
TX	OLSON	SAN ANDRES	SAN ANDRES
TX	OWNBY	CLEARFORK	CLEARFORK
TX	OWNBY	GRAY	GRAY
TX	PANHANDLE	CARSON	CARSON
TX	PANHANDLE	HUTCHINSON	HUTCHINSON
TX	PANHANDLE	CARSON COUNTY	CLEARFORK
TX	PANHANDLE FIELD	CLEARFORK	CLEARFORK
TX	PAROCHIAL BADE	BEND	BEND
TX	PEGASUS	SAN ANDRES	SAN ANDRES
TX	PEGASUS	ELLENBURGER	ELLENBURGER
TX	PEGASUS	SAN ANDRES	SAN ANDRES
TX	PENWELL	GLORIETA	GLORIETA
TX	PENWELL	EDWARDS	EDWARDS
TX	PERRON	CLEARFORK 6700	CLEARFORK 6700
TX	PRENTICE	GLORIETA	GLORIETA
TX	PRENTICE		

TORIS Class II Reservoirs

State	Fieldname	Reservoir	Formation
TX	PRENTICE	GLORIETA	GLORIETA
TX	PRENTICE SOUTHWEST	GLORIETA	GLORIETA
TX	P.H.D.	GLORIETA	GLORIETA
TX	QUINDUNO	LOWER ALBANY DOLOMITE	LOWER ALBANY DOLOMITE
TX	REEVES	SAN ANDRES	SAN ANDRES
TX	REVILO	GLORIETA	GLORIETA
TX	RILEY NORTH	CLEARFORK-NORTH RILEY UNIT	CLEARFORK-NORTH RILEY UNIT
TX	ROBERTSON	CLEARFORK	CLEARFORK
TX	ROCKER-A	SAN ANDRES	SAN ANDRES
TX	ROCKER-A	GLORIETA	GLORIETA
TX	ROUGH DRAW	NOODLE CREEK	NOODLE CREEK
TX	RUSSELL	GLORIETA	GLORIETA
TX	RUSSELL	CLEARFORK	CLEARFORK
TX	RUSSELL NORTH	DEVONIAN	DEVONIAN
TX	SABLE	SAN ANDRES	SAN ANDRES
TX	SABLE	SAN ANDRES	SAN ANDRES
TX	SABLE	EDWARDS	EDWARDS
TX	SALT FLAT	TUBB	TUBB
TX	SAND HILLS	ORDOVICIAN	ORDOVICIAN
TX	SAND HILLS	MCKNIGHT	MCKNIGHT
TX	SAND HILLS	SAN ANDRES	SAN ANDRES
TX	SAND HILLS	SAN ANDRES	SAN ANDRES
TX	SEMINOLE	SAN ANGELO	SAN ANGELO
TX	SEMINOLE	SAN ANDRES	SAN ANDRES
TX	SEMINOLE WEST	SAN ANDRES	SAN ANDRES
TX	SEMINOLE, EAST	SAN ANDRES	SAN ANDRES
TX	SHAFTER LAKE	DEVONIAN	DEVONIAN
TX	SHAFTER LAKE	ELLENBURGER	ELLENBURGER
TX	SHAFTER LAKE	SAN ANDRES	SAN ANDRES
TX	SHAFTER LAKE	WOLFCAMP	WOLFCAMP
TX	SHANNON	SAN ANDRES	SAN ANDRES
TX	SHARON RIDGE	1700	1700
TX	SHARON RIDGE	2400	2400
TX	SHILOH		
TX	SHILOH	PETTIT, UPPER	PETTIT, UPPER

TORIS Class II Reservoirs

State	Fieldname	Reservoir	Formation
TX	SHIOUH	PETTIT UPPER	PETTIT UPPER
TX	SLAUGHTER	SAN ANDRES	SAN ANDRES
TX	SNYDER		
TX	TATUM	PETTIT, LOWER	PETTIT, LOWER
TX	TEX HAMON	FUSSELMAN	FUSSELMAN
TX	TEX-SIN	DEVONIAN	DEVONIAN
TX	TODD-DEEP	CRINOIDAL	CRINOIDAL
TX	TODD-DEEP	ELLENBURGER	ELLENBURGER
TX	TURNER-GREGORY	CLEAR FORK	CLEAR FORK
TX	TXL	ELLENBURGER	ELLENBURGER
TX	TXL	TUBB	TUBB
TX	TXL	SAN ANDRES	SAN ANDRES
TX	TXL	5600' - GOLDSMITH/TUBB	5600' - GOLDSMITH/TUBB
TX	UNION - WITCHER A	SAN ANDRES	SAN ANDRES
TX	UNIVERSITY BLOCK 9	SAN ANDRES	SAN ANDRES
TX	VAREL	WOLFCAMP	WOLFCAMP
TX	VAUGHN	SAN ANDRES	SAN ANDRES
TX	VIREY	SAN ANDRES/GRAYBURG	SAN ANDRES/GRAYBURG
TX	WADDELL	ELLENBURGER	ELLENBURGER
TX	WASSON	SAN ANDRES	SAN ANDRES
TX	WASSON 72	WICHITA ALBANY	WICHITA ALBANY
TX	WASSON-GAINS	SAN ANDRES/CLEAR FORK	SAN ANDRES/CLEAR FORK
TX	WASSON N.E.	CLEARFORK	CLEARFORK
TX	WASSON SAN ANDRES (BENNETT R	CLEARFORK	CLEARFORK
TX	WASSON SAN ANDRES (ODC)	SAN ANDRES	SAN ANDRES
TX	WASSON SAN ANDRES (ROBERTS)	SAN ANDRES	SAN ANDRES
TX	WASSON SOUTH	CLEARFORK	CLEARFORK
TX	WASSON (CORNELL UNIT)	SAN ANDRES	SAN ANDRES
TX	WASSON (DENVER UNIT)	SAN ANDRES	SAN ANDRES
TX	WASSON (WILLARD UNIT)	ALL OTHER	ALL OTHER
TX	WASSON, NORTHEAST	WICHITA-ALBANY	WICHITA-ALBANY
TX	WELCH	SAN ANDRES	SAN ANDRES
TX	WEST	DEVONIAN	DEVONIAN

TORIS Class II Reservoirs

State	Fieldname	Reservoir	Formation
TX	WHEELER	ELLENBURGER	ELLENBURGER
TX	WILSHIRE	ELLENBURGER	ELLENBURGER
TX	WORLD	SAN ANDRES	SAN ANDRES
TX	WORLD WEST	SAN ANDRES	SAN ANDRES
TX	YARBROUGH & ALLEN	ELLENBURGER	ELLENBURGER
TX	YELLOWHOUSE	SAN ANDRES	SAN ANDRES
TX	YOAKUM WASSON	CLEARFORK	CLEARFORK
UT	LISBON	LEADVILLE	LEADVILLE
UT	PINEVIEW	TWIN CREEK	TWIN CREEK
UT	SALT WASH	LEADVILLE	LEADVILLE
UT	UPPER VALLEY	KAIBAB	KAIBAB
WY	BEAVER CREEK	MADISON	MADISON LIMESTONE
WY	BYRON	AMSDEN	AMSDEN
WY	CIRCLE RIDGE	OVERTHRUST EMBAR	PHOSPHORIA
WY	ELK BASIN	BIGHORN	BIGHORN DOLOMITE
WY	GARLAND	MADISON	MADISON LIMESTONE
WY	GEBBO	EMBAR	PHOSPHORIA
WY	GOLDEN EAGLE	PHOSPHORIA	PHOSPHORIA
WY	GRASS CREEK	PHOSPHORIA	PHOSPHORIA
WY	GRASS CREEK	MADISON	PHOSPHORIA
WY	LOST SOLDIER	MADISON	MADISON
WY	MAVERICK SPRINGS	EMBAR	MADISON LIMESTONE
WY	OREGON BASIN	SOUTH EMBAR	PHOSPHORIA
WY	OREGON BASIN	NORTH MADISON	PHOSPHORIA
WY	OREGON BASIN	NORTH EMBAR	MADISON LIMESTONE
WY	OREGON BASIN	SOUTH MADISON	PHOSPHORIA
WY	SPRING CREEK	PHOSPHORIA	PHOSPHORIA
WY	STEAMBOAT BUTTE	PHOSPHORIA	PHOSPHORIA
WY	WERTZ	MADISON	MADISON LIMESTONE