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ENHANCEMENT OF THE TORIS DATA BASE OF APPALACHIAN BASIN OIL FIELDS

FINAL REPORT

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INTRODUCTION

The Tertiary Oil Recovery Information System, or TORIS, was developed by the Department of Energy in the early 1980s with a goal of accounting for 70 percent of the nation's original oil in place (OOIP). More than 3700 oil reservoirs were included in TORIS, but coverage in the Appalachian basin was poor. Fewer than 25 Appalachian oil fields (out of more than 3,000) were originally included in TORIS, and only one state, West Virginia, was represented by enough fields to meet the 70 percent OOIP goal. Reasons for this original under-representation include the paucity of good reservoir data for large fields developed in the late 1800s and early 1900s, the lack of participation by major producers in the basin, and the fact that in their original study (1984) the National Petroleum Council included only those fields with greater than 50 million barrels OOIP.

Not only was the Appalachian basin under-represented with regard to the number of fields in TORIS, but the data in TORIS were incomplete, and in some cases, incorrect. Therefore, the Department of Energy (DOE) and the Appalachian Oil and Natural Gas Research Consortium (AONGRC) reached an agreement to enhance the TORIS data base for the Appalachian basin. This TORIS enhancement project has two main objectives: to increase the coverage of oil fields in the Appalachian basin; and to evaluate data for reservoirs currently in TORIS, and to add, change or delete data as necessary.

Both of these objectives have been accomplished. The geological surveys in Kentucky, Ohio, Pennsylvania and West Virginia have identified 113 fields in the Appalachian basin to be included in TORIS that collectively contained 80 percent of the original oil in place in the basin. Furthermore, data in TORIS at the outset of the project was checked and additional data were added to the original 20 TORIS oil fields.

This final report is organized into four main sections: reservoir selection; evaluation of data already in TORIS; industry assistance; and data base creation and validation. Throughout the report the terms pool and reservoir may be used in reference to a single zone of oil accumulation and production within a field. Thus, a field is composed of one or more pools at various stratigraphic levels. These pools or reservoirs also are referred to as pay sands that may be individually named sandstones within a formation or group.

RESERVOIR SELECTION

Fields selected in five states (Kentucky, New York, Ohio, Pennsylvania and West Virginia) to meet the contractual obligation of 80 percent original oil in place (OOIP) in the basin were

identified in a topical report submitted to DOE in 1993 as a deliverable under this contract. The submitted list was developed by ranking oil fields in each state by original oil in place, calculating the percentage of each state's original oil in place within each field, and tabulating the cumulative percentage of original oil in place until 80 percent was achieved. All oil fields above the 80 percent cutoff were considered to be candidates to be included in TORIS. The list was then modified to include all oil fields believed to be already in TORIS, even if they fell below the 80 percent OOIP cutoff. This was accomplished by substituting some smaller fields for larger fields in several states. As a result, 133 fields and 341 pools were nominated to be included in TORIS, of which only one pool in each of 29 fields were assumed to already be in TORIS.

Fields nominated in Topical Report #1 submitted in 1993 under this contract are listed by state in Tables 1 through 5. The OOIP in these 133 fields was estimated to be 8,557 million barrels (Table 6) at the time the report was written. However, when that list was prepared and submitted it was assumed that 29 fields on the list already were in TORIS, and that these fields must be retained. Subsequently, when an official list of fields in TORIS was received during the second phase of the project, "Evaluation of Data In TORIS," it was discovered that only 20 fields already were in TORIS, 18 in West Virginia and two in Pennsylvania. Therefore, it was necessary for each state to revise their list of candidate fields, selecting the largest fields whenever possible and dropping smaller fields not in TORIS that were on the original list. The final lists of fields that have been included in the data base created under this contract are included in Tables 7 through 11 in this report.

The final list of oil fields for which data have been collected to be added to DOE's TORIS data base includes 113 fields and 311 pools. Fewer fields and pools were necessary than previously thought because larger fields could be substituted for several smaller fields thought already to be in TORIS when the first topical report was written and submitted.

During the past two years of this project, data have been collected from oil producers in the basin as well as survey files and the literature, allowing the Consortium research team to recalculate OOIP for each of the 113 fields and their 311 pools. The result was a significant increase (119%) in the OOIP within the fields that are now being entered into the TORIS data base, up from 8,557 million barrels to 18,722 million barrels (Table 6).

The increase (or decrease) in OOIP for individual fields in each state is shown in Tables 7-11. OOIP values that have been submitted to be entered into TORIS are listed under the column heading "Revised OOIP (MMbbl)." Because these tables contain some fields not listed in Tables 1-5, the columns labeled "Earlier Est OOIP (MMbbl)" do not necessarily add up to the same state totals as the estimates shown in Tables 1-5. State totals shown in Table 6 compare what is proposed to be entered in TORIS now ("OOIP FINAL") to what was proposed in our initial topical report ("OOIP IN TR#1").

Oil reservoirs in these 113 fields are present in numerous stratigraphic units ranging from Pennsylvanian to Cambrian. Important pay sands include the Lower Silurian Clinton (Medina) in Ohio, the Mississippian Weir (in Kentucky) and Big Injun (in West Virginia) sandstones, several Devonian sandstones in Pennsylvania and West Virginia, and numerous intervals in Ordovician

carbonate formations in Kentucky and Ohio. Consequently, Mississippian reservoirs are important in Kentucky and West Virginia; Devonian reservoirs are important in Pennsylvania and West Virginia; Silurian reservoirs dominate oil occurrence in Ohio; and older Ordovician and Cambrian reservoirs are confined to the western side of the basin in Ohio and Kentucky.

Oil-producing reservoirs in the Appalachian basin can be grouped together into common oil plays, or groups of geologically-similar drilling prospects having basically the same source-reservoir-trap controls of oil generation, migration, accumulation and storage. Thus, they share some common elements of risk relating to the possible occurrence of oil. Plays are commonly designated by their reservoir facies, e.g., the Oriskany Sandstone Play, by trap type, e.g., the Oriskany Structural Play, or other geologic features, e.g., the Knox Unconformity Play. Oil reservoirs recommended to be included in TORIS can be organized into the following oil plays:

- Pennsylvanian Fluvial-Deltaic Sandstones
- Pennsylvanian Deltaic Sandstones
- Lower and Middle Pennsylvanian Fluvial Sandstones
- Mississippian Deltaic Sandstones
- Upper Mississippian Fluvial Sandstones
- Upper Mississippian Greenbrier-Newman Shelf Carbonates
- Middle Mississippian Dolomitic Shelf Sandstones
- Pocono Deltaic Sandstones
- Lower Mississippian Weir Turbidite Sandstones
- Berea Channel Sandstones
- Berea Deltaic Sandstones
- Berea Shelf Sandstones
- Second Berea Deltaic Sandstones
- Venango Group Strandplain Bar and Beach Sandstones
- Upper Devonian Deltaic Sandstones
- Bradford Group Shelf Sandstones
- Devonian Oriskany Stratigraphic Pinchout Sandstones
- Silurian-Devonian "Corniferous" Unconformity-Bounded Carbonates
- Silurian "Clinton"-Medina Sandstones
- Trenton-Black River Limestones
- Lower Ordovician Knox Fractured Carbonates
- Cambrian Rose Run Shallow Marine/Tidal Flat Sandstones
- Cambrian "Krysik" Sandstone
- Cambrian Copper Ridge Structural Related/Unconformity-Bounded Carbonates

EVALUATION OF DATA IN TORIS

Data in TORIS reside in approximately 60 data fields that can be divided into Original Reservoir Conditions, Current Reservoir Conditions, Fluid Data, Geologic Information, Production or Development Data, and Reservoir Performance Data. The second phase of this project was to evaluate the amount and accuracy of the data that were in these data fields at the outset of the project.

Data had been entered into the TORIS data base for only 20 Appalachian basin oil fields, 18 in West Virginia and two in Pennsylvania. Therefore, only the West Virginia and Pennsylvania Geological Surveys participated in this phase of the project.

Based on data provided to us by BDM-Oklahoma, space for 56 data elements was available for each oil field, but only one oil reservoir had been included for each oil field. Of the 18 West Virginia oil fields in TORIS, data were present for more than 75 percent of the 56 data elements in 13 fields. The other five oil fields contained approximately 30 percent of the desired data. Data elements missing in 100 percent of the oil fields included total wells, initial and current gas saturation, production rate, and recovery efficiency. In addition, data for the number of producing and injection wells, injection water salinity and clay content percent were missing for 17 of the 18 oil fields. Conversely, data for proven acreage, well spacing, gross thickness, net pay thickness, initial and current oil and water saturations, depth, porosity and permeability, reservoir temperature and pressure, oil gravity and viscosity, original oil in place, cumulative production and years, and primary recovery and years were available for most of the 18 oil fields.

An evaluation of the data in TORIS for the 18 West Virginia oil fields indicated that nearly 80 percent of the data were accurate and did not need to be replaced. However, approximately 150 entries were changed, mostly in oil fields where recent detailed research projects had developed a more current data base. In addition, more than 100 data elements were added, filling approximately one third of the blank data fields. Also, data were entered for 10 additional data elements required by TORIS data preparation guidelines provided by BDM. Once this phase of the project had been completed, more than 80 percent of the 66 data elements required in each of the 18 oil fields had been entered.

After the data in TORIS at the beginning of the project were checked for completeness and accuracy, potential sources were identified for the missing data, and for all data that would need to be added for new oil fields that would be added to TORIS in all five states. Sources included existing geologic survey digital data bases, publications, data that could be derived from log calculations, Underground Injection Control permit applications, core data, and company reports and files. The survey data bases were the best sources for data such as acreage, total wells, producing wells, injection wells, well spacing, reservoir depth, pay thickness, geologic age, and initial pressure. Porosity and saturation data were calculated from logs in the libraries of the various surveys. Other data were available for most of the selected oil fields in publications or company files. A prime objective was to obtain as much data as possible from non-company sources before preparing a data-still-missing list for each oil field to be used when approaching industry.

INDUSTRY ASSISTANCE

After the short versions of the data-still-missing lists were prepared, each of the four geological surveys contacted oil companies in their state that had an interest in each of the oil fields selected to be included in TORIS. Although nearly 200 different companies were contacted by the surveys, fewer than 10 percent were able to supply useful information within the time period of this project. However, those companies that did respond were very helpful. For example, in Kentucky

industry sources provided data for nearly 50 percent of the data elements desired. In Ohio, operators provided geologic and reservoir data, and nearly 42,000 annual production records for individual wells.

After each of the surveys had evaluated the response from industry and estimated the amount of data that could be generated from their own well-specific data bases and collected from the literature, estimates were made of the probable success in collecting each of the required data elements for each oil field. With few exceptions, each of the surveys believed that they would be able to find most of the data elements for at least a few oil fields, and at least half of the data elements would be found for approximately 70 percent of the oil fields.

In many cases data were duplicated between various sources, and a decision was made as to which numbers to use when the numbers were different. Data bases were often merged to identify overlap and duplication of records. Also, data were contributed in various forms, including paper copies that had to be manually entered into digital data bases.

The Consortium gratefully acknowledges the assistance of the companies listed in the Appendix in supplying data for this project. Others also provided data but preferred not to be listed.

THE ENHANCED TORIS DATA BASE

Geologic, reservoir and production data collected by the four geological surveys for each of the 113 fields and 311 pools targeted for this project were entered into a data base format using guidelines provided by BDM-Oklahoma. The result is a greatly expanded data base of Appalachian basin field and pool data.

Although each of the state geological surveys experienced some difficulty with the rigid TORIS format provided by BDM-Oklahoma, this rigidity made the data manager's task considerably easier because it forced the surveys to supply truly standardized data. More importantly, it forced individual states to reconcile idiosyncratic data recording practices, data definitions, and terminology to a single standard, even if the individual surveys did not view this standard as perfect. Ultimately, it forced the state surveys to acknowledge these idiosyncracies simply by being exposed to practices of their neighbors in the Appalachian basin. The result is a greatly expanded, accurate and standardized data base for Appalachian basin oil fields and reservoirs.

The original TORIS data base provided to us for 18 West Virginia and two Pennsylvania oil fields contained information only at the field level. However, data were collected in this effort for each of the main reservoirs within a field and these data were entered by reservoir. In West Virginia, for example, the 18 original oil fields in TORIS now include entries for 36 reservoirs. Eight of the oil fields have only one reservoir, whereas the other 10 oil fields have 28 total reservoirs, ranging from two to four per oil field. Thus, for those 10 oil fields, one set of data was entered for each of the 28 reservoirs. The result is that sets of data now are present in TORIS for 36 oil fields and reservoirs, rather than just 18 reservoirs in the original data base. Data were available for

approximately two thirds of the total field and pool data elements for these original 18 TORIS oil fields.

This same procedure was followed for new oil fields entered into TORIS. For fields with only one reservoir, one set of field/reservoir data was entered. However, for fields with multiple reservoirs, data were entered for multiple sets of reservoir data.

In general, a higher percentage of data elements are present in the expanded TORIS data base for the 18 original West Virginia oil fields and their 36 reservoirs than for the 9 oil fields and their 18 reservoirs that were added during this project. At least 40 percent of the data elements have been added for each new oil field/pool combination, but no new field/pool combination has more than 70 percent of the data elements in place.

The four geological surveys experienced varying degrees of success in obtaining required field and reservoir data, but each survey was successful in providing each of the critical data elements that allowed each field and pool to pass successfully through BDM's TORISCHK program.

Evaluation of Data Elements

Values for various data fields listed as critical elements were often difficult to obtain, especially for the older fields of historical interest. These data elements include initial oil, gas and water saturations, initial oil formation volume factor, permeability, oil gravity and viscosity, formation salinity, original oil in place and cumulative production. However, according to the manual for data preparation guidelines it was necessary to complete the critical elements for each oil field. Otherwise, if any of the critical elements were missing the data would not pass through the BDM screens and all data for this oil reservoir would be eliminated from the TORIS data base. In some cases only one or two of the critical elements were missing, but good data were available for many other data fields. Thus, it was necessary to assume or estimate a value for some of these critical elements to satisfy the model developed by BDM-Oklahoma.

A major problem also was encountered due to the way the TORIS production data file is constructed. According to the data preparation guidelines annual oil, gas and water production all are critical elements. If any of these data are absent for a particular oil field, the data for that field will not pass through the model and that oil field will be eliminated from the TORIS data base.

The problem with this input format is that there are few wells in the Appalachian basin which have a complete annual production history that includes gas, oil and water production. Water production generally is not reported to state agencies in any of the states, and is difficult to obtain. While much of the oil and gas annual production figures are submitted in the various states, there are still gaps in annual records for most of the wells. Therefore, the production data file could not be completed because of the constraints in the data base design. This is unfortunate because much production data are available for many of the oil fields. An extensive and thorough search was made to collect production data from oil and gas operators. These data were entered into electronic data

bases at each of the surveys and used for the TORIS project along with data that reside in production data bases in other state agencies, such as the Ohio Division of Oil and Gas.

Quality Assurance (TORISCHK Program)

Difficulties were experienced in using the quality assurance program designed to locate errors and check for inconsistencies in the data. The TORISCHK program was designed by BDM-Oklahoma, Inc. to locate potential errors and eliminate TORIS oil fields which do not conform to these checks. Checks for potential errors using the TORISCHK program revealed problems with some reservoirs in the Appalachian basin. For example, if the porosity of the reservoir was less than seven percent, or if the current gas-to-oil ration (GOR) was greater than 5,000 scf/bbl, an error would be generated in the TORISCHK program. These individual error messages could omit an entire oil field from the TORIS data base.

In the Appalachian basin there are numerous significant oil fields such as those in the Clinton sandstone, which have average porosities in the five to seven percent range. These average porosities had to be increased to seven percent for these oil fields to remain in the data base. The average GOR for many Clinton fields is often higher than 5,000 scf/bbl because many of these oil producing reservoirs are in a gas-dominated area. In spite of these high GOR's, there is significant oil production in addition to the gas produced from many of these reservoirs.

Many of the warning messages produced by TORISCHK confused the surveys and appeared to be contradictory, but for the most part these warnings did not prohibit the acceptance of the field entry data because they applied primarily to non-critical values. Although program documentation regarding this past point was poor and generated additional confusion within the surveys, conversations with BDM and subsequent memos to the surveys eventually clarified the matter.

The Enhanced TORIS Data Base

The submitted version of the enhanced TORIS data base contains current data on 113 fields and 311 reservoirs in the Appalachian basin, of which only 20 fields and 20 reservoirs were in the original version of TORIS. Data originally in TORIS for 20 oil fields were checked for accuracy, and approximately 20 percent of the data entries were changed to reflect more current information. In addition, nearly one third of the data elements that were missing in original entries were added during this project. In the final enhanced TORIS version, more than 80 percent of the data are present for the original 20 oil fields and their reservoirs.

Enough oil fields were added to the enhanced TORIS data base to meet our primary goal of attaining 80 percent coverage as measured by original oil in place in the basin. Locating data for the 93 new oil fields and 291 new oil reservoirs was met with varying degrees of success by the various state geological surveys. An estimated 60 percent of the data elements were entered for the fields and reservoirs in the expanded TORIS data base. A major contribution of this project is the addition of 93 new oil fields to the enhanced TORIS data base, and the collection and input of data at the reservoir level for all oil fields, original and new, instead of just the field level as in the original data base.

TABLE 1. Nominated TORIS Oil Fields in Kentucky (From Topical Report #1)

<u>Field Name</u>	<u>Estimated OOIP (MMbbls)</u>	<u>Percent of State OOIP</u>	<u>Cumulative Percent</u>	<u>Pools In TORIS</u>
Keaton-Mazie Cons	413.56	27.6	27.6	0/10
Walker Creek Cons	147.41	9.8	37.4	0/9
Oil Springs Cons	143.59	9.6	47.0	0/12
Big Sinking	140.68	9.4	56.4	0/8
Martha	73.29	4.9	61.3	0/6
Lee Chapel	31.16	2.1	63.4	0/13
Mine Fork	29.42	2.0	65.4	0/7
Bull Creek Cons	28.78	1.9	67.3	0/2
Isonville Cons	25.34	1.7	69.0	0/10
Ivyton	19.59	1.3	70.3	0/5
Concord Cons	18.14	1.2	71.5	0/10
Ida Cons	16.81	1.1	72.6	0/9
Ashley	16.78	1.1	73.7	0/3
Highland	13.53	0.9	74.6	0/4
Irvine-Furnace Cons	13.35	0.9	75.5	0/4
Cutshin DBS*	10.85	0.7	76.2	0/2
Tram DBS	10.42	0.7	76.9	0/6
Daley DBS	10.13	0.7	77.6	0/2
Fallsburg Cons	9.47	0.6	78.2	0/1
Naples	8.06	0.5	78.7	0/1
Petty Knob	7.62	0.5	79.2	0/4
Elna	7.42	0.5	79.7	0/2
Albany North	6.75	0.5	80.2	0/5
Total (23 fields)	1202.15			0/135

This ranking is arbitrary. It is based on relative field sizes and an assumed barrels per acre-foot. It is intended for use in targeting candidate fields for further study and does not represent actual reserves.

* DBS refers to a District of Big Sandy field.

TABLE 2. Nominated TORIS Oil Fields in New York (From Topical Report #1)

<u>Field Name</u>	<u>Estimated OOIP (MMbbl)</u>	<u>Percent of State OOIP</u>	<u>Cumulative Percent</u>	<u>Pools in TORIS</u>
Allegany	650.0	58.0	58.0	No
N. Bradford	460.0	41.1	99.1	No
Bass Islands	6.0	0.5	99.6	No
Busti	4.0	0.4	100.0	No
Total (4 fields)	1,120.0			

TABLE 3. Nominated TORIS Oil Fields in Ohio (From Topical Report #1)

<u>Field Name</u>	<u>Estimated OOIP (MMbbl)</u>	<u>Percent of State OOIP</u>	<u>Cumulative Percent</u>	<u>Pools in TORIS</u>
East Canton	640.00	21.0	21.0	0/1
Morrow	400.00	13.2	34.2	0/1
Brinkhaven	200.00	6.6	40.8	0/1
New Straitsville	190.00	6.3	47.1	0/1
Junction City	140.00	4.6	51.7	0/1
Clayton	130.00	4.3	56.0	0/1
Logan	80.00	2.6	58.6	0/1
Gratiot	50.00	1.7	60.3	0/1
Chatham	50.00	1.7	62.0	0/1
Canaan-Wayne	45.00	1.5	63.5	0/2
Carey	45.00	1.5	65.0	0/1
Bremen	40.00	1.3	66.3	0/1
Corning	35.00	1.2	67.5	0/1
Chesterhill	35.00	1.2	68.7	0/1
Bath	34.00	1.1	69.8	0/1
Sharon	31.00	1.0	70.8	0/1
Moreland	30.00	1.0	71.8	0/2
Redhaw	30.00	1.0	72.8	0/1
Deerfield	24.00	0.8	73.6	0/1
Island Creek	22.00	0.7	74.3	0/1
Macksburg	20.00	0.7	75.0	0/3
Newport	19.00	0.6	75.6	0/2
S. Birmingham	15.00	0.5	76.1	0/1
Sistersville	15.00	0.5	76.6	0/2

TABLE 3. Nominated TORIS Oil Fields in Ohio (From Topical Report #1)

<u>Field Name</u>	<u>Estimated OOIP (MMbbl)</u>	<u>Percent of State OOIP</u>	<u>Cumulative Percent</u>	<u>Pools in TORIS</u>
Scio	12.00	0.4	77.0	0/1
Brush Creek	12.00	0.4	77.4	0/1
Moores Junction	10.00	0.3	77.7	0/1
Philo	10.00	0.3	78.0	0/1
Clay	9.00	0.3	78.3	0/1
Brunswick	8.00	0.2	78.5	0/1
Rainbow Creek	6.00	0.2	78.7	0/1
Newark	6.00	0.2	78.9	0/3
Otsego	6.00	0.2	79.1	0/1
Somerset	5.00	0.1	79.2	0/1
Mill Creek	5.00	0.1	79.3	0/2
Kill Buck	5.00	0.1	79.4	0/2
Rushville	3.60	0.1	79.5	0/1
Greasy Ridge	3.00	0.1	79.6	0/2
Thornville	2.80	0.1	79.7	0/1
Lowell	2.00	0.1	79.8	0/1
Addison-Cheshire	2.00	0.1	79.9	0/2
Hemlock Grove	1.00	0.05	79.95	0/1
New England	1.00	0.05	80.00	0/1
Total (43 fields)	2429.4			0/55

TABLE 4. Nominated TORIS Oil Fields in Pennsylvania (From Topical Report #1)

<u>Field Name</u>	<u>Estimated OOIP (MMbbl)</u>	<u>Percent of State OOIP</u>	<u>Cumulative Percent</u>	<u>Pools in TORIS</u>
Bradford	692.06	24.9	24.9	0/1
Oil City-Rouseville	113.36	4.1	29.0	0/3
Clarendon	97.00	3.5	32.5	0/1
Foster-Reno	85.03	3.1	35.6	1/3
Bullion-Clintonville	82.87	3.0	38.6	0/2
Pleasantville	82.61	3.0	41.6	0/4
Parker	69.41	2.5	44.1	0/4
Colorado-Goodwill	68.72	2.5	46.6	0/3
Cranberry-Rockland	67.43	2.4	49.0	0/4
Cooper	61.56	2.2	51.2	0/3
Franklin-Oak Forest	55.00	2.0	53.2	0/1
Burning Well	54.45	2.0	55.2	0/1
Church Run	53.75	1.9	57.1	0/3
Elk City-Knox	52.82	1.9	59.0	0/4
Raymilton	49.40	1.8	60.8	0/1
Washington-Taylorstown	49.17	1.8	62.6	0/6
Guffey	49.00	1.8	64.4	0/1
Butler Cross Belt	47.72	1.7	66.1	0/2
Hooker	47.53	1.7	67.8	0/2
Shinglehouse	47.04	1.7	69.5	0/1
Petroleum Center-Pioneer	45.00	1.6	71.1	0/3
McDonald-McCurdy	40.56	1.4	72.5	0/4
Pithole-Cashup	39.60	1.4	73.9	0/3
Hampton-Strong	37.92	1.4	75.3	0/4
Glade	30.57	1.1	76.4	0/2
Tidioute	30.37	1.1	77.5	0/5
Shamburg	25.00	0.9	78.4	0/1
Emlenton-Richey Run	23.70	0.8	79.2	0/2
West Hickory	21.80	0.7	79.9	0/7
Kane	21.14	0.7	80.6	1/1
Total (30 fields)	2,241.64			2/83

TABLE 5. Nominated TORIS Oil Fields in West Virginia (From Topical Report #1)

<u>Field Name</u>	<u>Estimated OOIP (MMbbl)</u>	<u>Percent of State OOIP</u>	<u>Cumulative Percent</u>	<u>Pools in TORIS</u>
Salem-Wallace	242.440	12.7	12.7	1/1
Mannington	127.617	6.7	19.4	1/4
Cairo	119.112	6.3	25.7	0/3
Jacksonburg-S'twn	88.469	4.7	30.4	1/1
Smithfield	83.392	4.4	34.8	1/3
Griffithsville	74.043	3.9	38.7	1/1
Blue Creek	69.016	3.6	42.3	1/2
Wolf Summit	68.916	3.6	45.9	1/3
Sistersville	58.986	3.1	49.0	0/1
Hendershot	56.218	3.0	52.0	1/2
Walton	54.165	2.9	54.9	1/1
Centerpoint	51.920	2.7	57.6	1/1
Boaz	44.799	2.4	60.0	1/4
St. Marys	40.832	2.2	62.2	0/4
Shiloh-Wick	40.775	2.1	64.3	0/1
Porto Rico	36.315	1.9	66.2	1/2
Cabin Creek	32.704	1.7	67.9	0/1
Campbell Run	30.965	1.6	69.5	1/4
Burning Springs	26.316	1.4	70.9	1/7
Cameron-Garner	25.160	1.3	72.2	1/1
Dents Run	21.912	1.2	73.4	1/1
Yellow Creek	21.654	1.1	74.5	1/3
Fink Creek	20.784	1.1	75.6	1/2
Bonds Creek	19.757	1.1	76.7	1/4
Granny Creek	16.818	0.9	77.6	0/1
Rouzer	14.898	0.8	78.4	1/2
Greenwood	13.518	0.7	79.1	1/2
Newburne	13.007	0.7	79.8	1/2
Shinnston	10.800	0.6	80.4	1/1
Mooreville	10.496	0.6	81.0	1/2
Volcano	10.126	0.5	81.5	1/1
Turkeyfoot	9.177	0.5	82.0	1/1
Silver Run	8.986	0.5	82.5	1/1
Total (33 fields)	1,564.093			27/68

**TABLE 6. COMPARING OOIP BY STATES IN TOPICAL REPORT #1 VERSUS
THE FINAL TORIS DATA BASE**

<u>STATE</u>	<u>OOIP IN TR#1</u>	<u>FLDS/POOLS</u>		<u>OOIP FINAL</u>	<u>FLDS/POOLS</u>	
Kentucky	1,202.150	23	135	1,282.150	23	23
New York	1,120.000	4	7	1,083.152	4	7
Ohio	2,429.400	43	55	5,738.403	30	32
Penn	2,241.642	30	74	8,231.362	30	83
W Va	1,564.093	33	70	2,387.019	26	54
Totals	8,557.285	133	341	18,722.086	113	311

TABLE 7. Kentucky Oil Fields Submitted To Be In TORIS

<u>Field Name</u>	<u>Revised OOIP (MMbbl)</u>	<u>No. of Pools</u>	<u>Earlier Est OOIP (MMbbl)</u>	<u>Pools in TORIS</u>
Keaton-Mazie Cons	258.840	10	413.560	1/10
Walker Creek Cons	150.000	9	147.410	1/9
Oil Springs Cons	197.870	12	143.590	1/12
Big Sinking	201.720	8	140.680	1/8
Martha	40.560	6	73.290	1/6
Lee Chapel	24.070	13	31.160	1/13
Mine Fork	21.550	7	29.420	1/7
Bull Creek Cons	28.700	2	28.780	1/2
Isonville Cons	36.650	10	25.340	1/10
Ivyton	40.780	5	19.590	1/5
Concord Cons	8.476	10	18.140	1/10
Ida Cons	6.729	9	16.810	1/9
Ashley	21.290	3	16.780	1/3
Highland	11.820	4	13.530	1/4
Irvine-Furnace Cons	63.150	4	13.350	1/4
Cutshin DBS*	16.900	2	10.850	1/2
Tram DBS		6	10.420	0/6
Bulan	21.674			1/
Daley DBS	18.020	2	10.130	1/2
Fallsburg Cons	29.260	1	9.470	1/1
Naples	12.630	1	8.060	1/1
Petty Knob	1.525	4	7.620	1/4
Elna	14.630	2	7.420	1/2
Albany North	2.185	5	6.746	1/5
Totals (23 fields)	1,282.150	126	1,202.150	23/135

* DBS refers to a District of Big Sandy field

TABLE 8. New York Oil Fields Submitted To Be In TORIS

<u>Field Name</u>	<u>Revised OOIP (MMbbl)</u>	<u>No. of Pools</u>	<u>Earlier Est OOIP (MMbbl)</u>	<u>Pools in TORIS</u>
N. Bradford	333.152	1	460.000	1/1
Richburg	750.000	1	650.000	1/1
Totals (2 fields)	1,083.152		1,110.000	

TABLE 9. Ohio Oil Fields Submitted To Be in TORIS

<u>Field Name</u>	<u>Revised OOIP (MMbbl)</u>	<u>No. of Pools</u>	<u>Earlier Est OOIP (MMbbl)</u>	<u>Pools in TORIS</u>
East Canton Cons	1,537.300	1	640.000	1/1
Ravenna Best	958.470	1	24.000	1/1
Gratiot-Newcastle	575.020	1	250.000	1/1
Philo Cons	325.840	1	16.000	1/1
Chatham	282.102	1	5.000	1/1
Monroe-Coshocton Con	232.160	1	5.000	1/1
Gore Cons	218.516	1	190.000	1/1
Clayton Cons	197.003	1	135.000	1/1
Cheshire	179.488	1	4.000	1/1
Morrow Cons	177.000	1	400.000	1/1
Sistersville	150.000	1	15.000	1/1
Breman-New Lexington	105.220	1	183.600	1/1
Baltic	98.915	1		1/1
Union Furnace	88.916	1	80.000	1/1
Carey	87.000	1	45.000	1/1
Moreland-Wooster	86.900	1	30.000	1/1
Granger	67.960	1	34.000	1/1
Corning	61.126	1	35.000	1/1
Mill Creek	56.351	2	5.000	1/2
Canaan Wayne	56.180	1	45.000	1/1
Macksburg	54.700	1	20.000	1/1
Sharon	50.500	1	31.000	1/1
Cow Run Cons	27.930	2	19.000	1/2
Chesterhill	21.381	1	35.000	1/1
Buck Run	14.047	1	13.000	1/1
Perry-Ashland	11.230	1	30.000	1/1
Brunswick East	5.710	1	8.000	1/1
Clay Cons	5.415	1	9.000	1/1
Greasy Ridge	3.130	1	3.000	1/1
Birmingham-Erie	2.850	1	15.000	1/1
Total (30 fields)	5,738.403	32	2,324.600	30/32

TABLE 10. Pennsylvania Oil Fields Submitted To Be in TORIS

<u>Field Name</u>	<u>Revised OOIP (MMbbls)</u>	<u>No. of Pools</u>	<u>OOIP in TOP RPT</u>	<u>Pools in TORIS</u>
Bradford	6,311.684	1	692.064	1/1
McDonald-McCurdy	208.716	4	40.569	4/4
West Hickory	159.522	7	21.800	7/7
Oil City-Rouseville	113.360	3	113.360	3/3
Elk City-Knox	105.153	4	52.820	4/4
Clarendon	97.000	1	97.000	1/1
Foster-Reno	85.030	3	85.030	3/3
Church Run	83.886	3	53.750	3/3
Bullion-Clintonville	82.870	2	82.870	2/2
Colorado & Goodwill Hill-Grand Valley	69.920	3	68.720	3/3
Cranberry-Rockland	67.430	4	67.430	4/4
Hampton-Strong	64.464	4	37.926	4/4
Pleasantville	62.615	4	82.615	4/4
Cooper	61.210	3	61.560	3/3
Parker	57.320	4	69.410	4/4
Franklin-Oak Forest	55.000	1	55.000	1/1
Burning Well	54.450	1	54.450	1/1
Washington-Taylorstown	54.046	6	49.176	6/6
Hooker	52.696	2	47.530	2/2
Guffey	49.000	1	49.000	1/1
Butler Cross Belt	47.724	2	47.724	2/2
Shinglehouse	47.040	1	47.040	1/1
Petroleum Cntr-Pioneer	45.000	3	45.000	3/3
Emlenton-Richey Run	42.429	2	23.700	2/2
Pithole-Cashup	39.600	3	39.600	3/3
Glade	30.579	2	30.579	2/2
Tidioute	30.375	5	30.375	5/5
Shamburg	25.000	1	25.000	1/1
Kane	21.144	1	21.144	1/1
Raymilton	7.100	1	49.400	1/1
Total (30 flds)	8,231.362	83	2,241.642	83/83

TABLE 11. West Virginia Oil Fields Submitted To Be In TORIS

<u>Field Name</u>	<u>Revised OOIP (Mmbbl)</u>	<u>No. of Pools</u>	<u>Orig. Est OOIP</u>	<u>Pools in TORIS</u>
Cairo	326.049	2	119.112	2/2
Blue Creek	212.192	3	69.016	3/3
Burning Springs	201.614	4	26.316	4/4
Salem-Wallace	173.893	1	242.440	1/1
Walton	139.600	1	54.165	1/1
Mannington	129.966	3	127.617	3/3
Griffithsville	127.669	1	74.043	1/1
Campbell Run-Miracle Run	96.598	4	30.965	4/4
Jacksonburg- Stringtown	89.905	1	88.469	1/1
Smithfield	89.144	3	83.392	3/3
Granny Creek	87.255	1	16.818	1/1
Cabin Creek	86.332	1	32.704	1/1
Wolf Summit	77.348	3	68.916	3/3
St. Marys	74.026	4	40.832	4/4
Boaz	73.603	2	44.799	2/2
Hendershot	68.269	2	56.218	2/2
Centerpoint	59.936	1	51.920	1/1
Condit-Ragtown	58.680	4	34.830	4/4
Shiloh-Wick	57.238	4	40.775	4/4
Sistersville	38.350	1	58.986	1/1
Fink Creek	28.770	2	20.784	2/2
Porto Rico	23.321	2	36.315	2/2
Yellow Creek	22.481	1	21.654	1/1
Dents Run	21.372	1	21.912	1/1
Cameron-Garner	13.039	1	25.160	1/1
Pine Grove	10.366	1	32.910	1/1
Total (26 fields)	2,387.019	54	1,521.068	54/54

APPENDIX

LIST OF COMPANIES SUPPLYING DATA

Ashland Exploration, Inc.
Belden and Blake Corporation
Earl Bevins
BoCor Producing
Bretagne Corp.
Carson Associates
Columbia Natural Resources, Inc.
Fritz Dutro, Consultant
Equitable Resources Exploration, Inc.
Ronald A. Gibson and Associates
Hall and Associates
Horton and Huffman Petroleum Geologist, Inc.
Jesse Kincheloe, Consultant
Chuck Lowe, Consultant
Magnum Drilling, Inc.
Messer Oil
MB Operating Company, Inc.
Mitchell Energy Corporation
Northwood Energy Corporation
Ohio Kentucky Oil Company
Ohio Oil and Gas Association
Ohio Oil Gathering Corporations
Oryx Energy
Oxford Oil Company
Penn Virginia Resources Corp.
Pennzoil
Professional Petroleum Services, Inc.
Quaker State Refining
Jimmy Reliford Drilling Company
Rexplore Drilling Inc.
Robo Enterprises
Sipple Oil Company
Unocal Corporation
Luq Yacub, Consultant
The Wiser Oil Company

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