Providing Solutions To Energy and Environmental Problems

**Quarterly Report
January 1 - March 31, 1997**

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Work Performed Under Contract No.: DE-FC21-93MC30127

For
U.S. Department of Energy
Office of Fossil Energy
Federal Energy Technology Center
Morgantown Site
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Morgantown, West Virginia 26507-0880

MASTER

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Cumulative JSRP Funding Summarized by Technology Area

Nearly \$16.8 million for energy programs emphasizing enhanced oil recovery, coal beneficiation and upgrading, coalbed methane recovery and renewable energy resources

\$3.8 million for technology enhancement activities encompassing resource characterization studies, improved environmental monitors and sensors, and improved dispersion modeling techniques

\$4.9 million for technology to clean underground oily wastes, mitigate acid mine drainage, and demonstrate uses for CCT and PFBC waste solids

Cooperative Agreement DE-FC21-93MC30127
Status of Total Approved Projects on October 1, 1996

***WRI's JSR Program is Focused on Technology Development
to Meet National and Regional Needs***

Goals of WRI's Jointly Sponsored Research Program

Increase the production of U.S. and western energy resources: low-sulfur coal, natural gas, oil, and renewable energy resources

Enhance the competitiveness of U.S. and western energy technologies in international markets and assist in technology transfer

Reduce the nation's dependence upon foreign energy supplies and strengthen the U.S. and regional economies

Minimize the impact of energy production and utilization on the environment

SUMMARY
OF
APPROPRIATIONS,
OBLIGATIONS
&
EXPENDITURES
BY
TASK

Executive Summary

Jointly Sponsored Research Program

The Jointly Sponsored Research Program emphasizes technology commercialization and continues to be highly successful and supported strongly and enthusiastically by WRI's industrial clientele. All of the available Department of Energy (USDOE) funding for each of the first six years has been committed to projects. All available FY 96 funding was obligated in April 1996, however, a reduced commitment by one of our sponsors left an additional \$381,000 to reobligate. Two new tasks, 20 and 21, were funded with a portion of this money and a Task 22 proposal has been submitted to obligate the remaining funds. The demand for funds continues to outstrip available monies and an additional \$3 million per year in USDOE funding could easily be accommodated. As summarized in Table 1, since the program's inception in 1990, \$17,090,000 in USDOE funds have been obligated and \$17,044,541 of these have been committed against an industrial match of \$21,690,285.

Table 1
Summary of JSRP Funding for FY 1990-96

Fiscal Year	Funds Available	Funds Committed	No. of Projects	No. of New Starts
1996	2,220,000	2,174,541	20	2
1995	2,800,000	2,800,000	18	1
1994	2,411,000	2,411,000	17	3
1993	2,437,000	2,437,000	14	9
1992	2,442,000	2,442,000	17	10
1991	2,489,000	2,489,000	11	5
1990	2,291,000	2,291,000	14	14
Total	\$17,090,000	\$17,044,541		

Since entering into a new JSRP cooperative agreement with the Department of Energy on March 26, 1993 (Cooperative Agreement DE-FC21-93MC30127), WRI has put into place projects utilizing a total of \$10,986,264 in USDOE funds. These funds have been matched against \$14,586,209 in industrial funds to produce a program valued at \$25,572,473. Letters of commitment have already been obtained which envision utilizing more than \$5 million in FY 98 funds. As a result of this strong demand for program participation, unless additional funding is available, WRI may not be able to work in a significant fashion with any new JSRP participants until FY 98 or beyond. In fact, we estimate that \$6.5 million would be needed in FY 98 to adequately meet present demand. As Table 1 clearly indicates, new program participants can only be added in those instances where existing money can be reobligated.

Table 2
Tasks Approved for Funding Through Fiscal Year 1996

Task	Project	Previous Commitments			FY 96 Commitment			Total Commitment		
		USDOE	Sponsor	Total	USDOE	Sponsor	Total	USDOE	Sponsor	Total
		Energy Programs								
1	Electric Downhole Steam Generator	912,785	945,200	1,857,985	370,000	370,000	740,000	1,282,785	1,315,200	2,745,985
2	Wetting Behavior of Crude Oil/Brine/Rock Systems	1,132,356	1,220,793	2,353,149				1,132,356	1,220,793	2,353,149
3	Kerr Coal Product Market Study	57,039	60,000	117,039				57,039	60,000	117,039
7	Optimization of FMC Carbonizer	48,418	45,000	93,418				48,418	45,000	93,418
9	Demonstration of the "Series C" Process	1,456,205	1,588,800	3,045,005	1,000,000	1,000,000	2,000,000	2,456,205	2,588,800	5,045,005
14	"Series B" Pilot Plant Tests	8,668	10,092	18,760				8,668	10,092	18,760
6	Enhanced Recovery of Coalbed Methane	1,135,900	1,716,270	2,852,170				1,135,900	1,716,270	2,852,170
16	Demonstration of a Wood-Fired Gas Turbine System	1,416,234	2,303,984	3,720,218				1,416,234	2,303,984	3,720,218
Subtotal Energy Programs		6,167,605	7,840,139	14,007,744	1,370,000	1,370,000	2,740,000	7,537,605	9,210,139	16,747,744

Table 2 (Continued)
Tasks Approved for Funding Through Fiscal Year 1996

		Previous Commitments			FY 96 Commitment			Total Commitment		
Task	Project	USDOE	Sponsor	Total	USDOE	Sponsor	Total	USDOE	Sponsor	Total
Technology Enhancement Programs										
8	Chemical Sensor and Field Screening Technology	630,900	583,375	1,214,275	119,000	166,525	285,525	749,900	749,900	1,499,800
10	Remote Chemical Sensor Development	355,000	232,081	587,081				355,000	232,081	587,081
12	NMR Analysis of Matured Kerogens	30,192	15,000	45,192				30,192	15,000	45,192
17	NMR Analysis of Mowry Formation Shales	60,064	60,000	120,064				60,064	60,000	120,064
19	PERF Phase II Demonstration	502,124	945,330	1,447,454				502,124	945,330	1,447,454
21	Validation of a New VOC Sampler				50,541	62,500	113,041	50,541	62,500	113,041
Subtotal Technology Enhancement										
		1,578,280	1,835,786	3,414,066	169,541	229,025	398,566	1,747,821	2,064,811	3,812,632

Table 2 (Continued)
Tasks Approved for Funding Through Fiscal Year 1996

Task	Project	Previous Commitments			FY 96 Commitment			Total Commitment		
		USDOE	Sponsor	Total	USDOE	Sponsor	Total	USDOE	Sponsor	Total
Environmental Programs										
4	Impact of CCT Waste Leachate on the Stability of Clay Liners	231,043	259,580	490,623				231,043	259,580	490,623
11	Market Assessment Study of PFBC Ash Use	247,638	403,500	651,138	200,000	200,000	400,000	447,638	603,500	1,051,138
13	CROW Field Demonstration Bell Lumber and Pole	90,800	457,396	548,196	30,000	84,000	114,000	120,800	541,396	662,196
15	In Situ Treatment of MPG Contaminated Soils	285,289	1,234,072	1,519,361	120,000	126,451	246,451	405,289	1,360,523	1,765,812
18	Acid-Mine Drainage Prevention and Control	211,068	210,845	421,913				211,068	210,845	421,913
20	Field Testing of the TaBoRR Process Using the Asphalt and Dry Bottoms Configurations				285,000	285,415	570,415	285,000	285,415	570,415
Subtotal Environmental Programs		1,065,838	2,565,393	3,631,231	635,000	695,866	1,330,866	1,700,838	3,261,259	4,962,097
Total All Programs		8,811,723	12,291,318	21,103,041	2,174,541	2,294,891	4,469,432	10,986,264	14,586,209	25,572,473

Current Expenditures

Table 3
Expenditures on Contract DE-FC21-93MC30127

Task	Budget*	Expended Prior Periods	January 1997	February 1997	March 1997	Total
1	\$1,282,785	\$1,173,776		Completed		\$1,270,742
2	1,132,356	1,137,913		Completed		1,161,421
3	57,039	56,989		Completed		56,989
4	231,043	232,574		Completed		232,574
5				Withdrawn		
6	1,135,900	895,695	6,701	20,355	26,095	948,847
7	48,418	36,974		Completed		36,974
8	749,900	683,365	8,447	9,498	9,828	711,139
9	2,456,205	1,869,599	74,494	30,411	126,081	2,100,585
10	355,000	354,182		Completed		354,182
11	447,638	372,668	9,364	11,740	8,428	402,201
12	30,192	30,780		Completed		30,780
13	120,800	105,760	1,765	2,058	1,411	110,994
14	8,668	8,668		Completed		8,668
15	405,289	381,416		Completed		389,195
16	1,416,234	1,281,984	29			1,282,013
17	60,064	50,731	3,271			54,003
18	211,068	166,324	1,190	1,287	3,877	172,677
19	502,124	513,995				513,995
20	285,000	517,175	64,738	90,285	298,854	971,051
21	50,541	14,260	6,045	9,129	8,258	37,693
Total	\$10,986,264	\$9,884,830	\$226,692	\$212,218	\$522,982	\$10,846,722

* \$45,459 remains in unobligated funding. A proposal for this amount has been submitted.

Technical Highlights

On Task 008 presentations describing the use of the new soil test kit for detecting fuel contamination in soils at a railroad site and describing practical deviations from Henry's law for volatile organic compound analysis were made at the EPA Field Screening Symposium in January 1997.

Shakedown activities for the KFx 500,000 tpy commercial plant (Task 009) were resumed in late February following a fire on December 24 when heat transfer fluid leaking from the system was ignited. The fire resulted in the loss of one of the two fired heaters in the plant. Plant activities are limited to 50% of design capacity until the heater is replaced in early summer.

A manuscript for presentation at the 14th International Conference on Fluidized Bed Combustion to be held in Vancouver, BC May 11-14, 1997 was prepared and accepted for publication. (Task 011) The paper is entitled "Hydration Reaction Chemistry Associated with Management of Pressurized Fluidized Bed Combustion Ash" and is co-authored by A. E. Bland and T. H. Brown of WRI. The paper summarizes the hydration reaction chemistry associated with the management of PFBC ashes from the Foster Wheeler Energia Oy circulating PFBC and the AEP Tidd bubbling bed PFBC.

On Task 013, the phase-one, full-scale remediation at the Bell Lumber and Pole Site in New Brighton, Minnesota is operating with over 20,000 gal of organics recovered. This is nearly 10 times higher than the projected pump-n-treat volume. A new heat exchanger, ordered but not yet received, to produce the hot-injection water will permit higher injection and production rates.

Operation of the Pennsylvania Power and Light's Brodhead Creek Site at Stroudsburg, Pennsylvania (Task 015) was terminated in early June 1996 when EPA treatment criteria had been met. The project is awaiting official closure approval by the EPA, however, the CROW facilities have been decommissioned. The property owner estimated that the CROW process reduced the cost of remediation of the site by over \$1.3 million dollars. The final report is ready for submission to DOE.

On Task 020, plant shakedown activities have continued and nearly all of the 340 barrels of material obtained from Pease Oil Field Services has been processed. Modifications to the flash system have provided better control and near-flawless operation. Approximately 236 barrels of high water content material have arrived from Wallace Energy, Inc. and this material is now being processed. The pyrolyzer has arrived on-site and is undergoing shakedown.

The new draft practice entitled "Standard Practice for Using a Coring Tube for Sampling and Storing Soil for Volatile Organic Analysis" was written. (Task 021) Data on the integrity of volatile organic compounds in spiked soil samples over various times will be added before the practice is submitted to ASTM for balloting.

**SUMMARY
OF
OBJECTIVES
&
ACCOMPLISHMENTS
BY
TASK**

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Task
2

**Wetting Behavior of Selected
Crude Oil/Brine/Rock Systems**

Status
Completed

Sponsors

ARCO, British Petroleum, Chevron, Conoco, Dagang (China), ELF (France), Exxon, Marathon, Mobil, NorskHydro (Norway), Phillips, Shell (The Netherlands), Statoil (Norway), and the University of Wyoming

Reporting Period: January 1 through March 31, 1997

Background

Fluid distribution and the displacement of oil by water or other fluids in an oil reservoir are governed by the fluid-solid interactions (wettability) of that system. Wettability governs interface shapes, which determine the mechanisms and efficiency of oil displacement from reservoir rocks. Because water flooding accounts for more than half of the oil production in the United States, understanding the effect of wettability on oil recovery is of great importance. To this end, WRI has undertaken a study of crude oil/brine/rock interactions for several selected crude oils, including oil from Prudhoe Bay. Special attention is being given to the possibility of increasing the efficiency of waterfloods through selection or adjustment of the composition of the injected brine.

Status

The project has been completed.

Task 3	Coal Gasification, Power Generation, and Product Market Study	Status Completed
Sponsor Kerr Coal Company		
Reporting Period: January 1 through March 31, 1997		
Background <i>The primary use of western low-sulfur coal is for power generation. Other potential uses of this coal need to be evaluated. This study is to perform a market survey of potential products and alternate technologies that may produce high-value products from coal obtained from the Kerr Company coal mine in Walden, Colorado.</i>		
Status <i>The project has been completed.</i>		

**Task
4**

***The Impact of Leachate from Clean Coal Technology
Waste on the Stability of Clay Liners***

**Status
Completed**

**Sponsor
Public Service Company of Colorado**

Reporting Period: January 1 through March 31, 1997

Background

Wastes generated from clean coal technologies have much different physical and chemical characteristics than the wastes generated from conventional power plants. These wastes can have significantly different impacts on the permeability of a clay liner, which can affect the active lifetime of the liner. This study is evaluating the influence that clean coal technology waste materials will have on the stability of clay liners. Specifically, an understanding of the chemical and physical interactions will be determined between clay liners and waste leachates. The findings of the study will provide industry with valuable information for the management of wastes generated by the implementation of clean coal technology programs.

Status

The project has been completed.

**Task
5**

**Investigation of Coprocessing Heavy Oil,
Automobile Shredder Residue, and Coal**

**Status
Withdrawn**

**Sponsor
Environmental Recovery Systems, Inc.**

Reporting Period: January 1 through March 31, 1997

Background

A major environmental problem today is the disposal of automobile shredder residue (ASR). This residue is composed of plastic, rubber, foam rubber, wood, glass, dirt, oil, and other fluids. WRI is developing a low-temperature coprocessing concept for conversion of ASR, heavy oils, and coal into gasoline and diesel fuel distillates. This concept is being explored to alleviate the problems associated with ASR disposal and to generate useful product streams.

Status

This project was withdrawn due to the sponsor's inability to provide matching funds.

**Task
6**

**Injection into Coal Seams for Simultaneous CO₂ Mitigation
and Enhanced Recovery of Coalbed Methane**

**Status
Ongoing**

Sponsors

**Amoco, Conoco, Resource Enterprises Inc., and
New Mexico Petroleum Recovery Research Center**

Reporting Period: January 1 through March 31, 1997

Background

This study is evaluating the technical feasibility of injecting CO₂, a byproduct of methane recovery from some coalbeds, into the coalbeds as both a technique of mitigating the level of CO₂ emissions from the production of methane from the coalbeds and as a technique for enhancing the recovery of methane from the coalbeds. The evaluation will be based on the operation and results of a two-well field pilot test in northwestern New Mexico.

Task Objectives

The overall objective of this task is to test the technical viability of injecting CO₂ into the Fruitland Coal to displace methane from the coal and to mitigate CO₂ emissions which are a consequence of primary coalbed methane production from surrounding wells in the area. To evaluate this technical viability, a field test was conducted and the test is being interpreted using data measured in WRI's laboratory, as well as using Amoco's state-of-the art coalbed methane simulator. Also, a second pilot of the process is being evaluated using the simulator. Ultimately, the technology developed will be applied to a Wyoming coal. The task is divided into five subtasks:

- Subtask 6.1: Two-Well Pilot Test of CO₂ Injection
- Subtask 6.2: CO₂/N₂ Laboratory Tests in the Fruitland Coal
- Subtask 6.3: Modeling of Two-Well Pilot Test
- Subtask 6.4: Allison Unit CO₂ Pilot Study and
- Subtask 6.5: CO₂/N₂ Laboratory Tests in Wyoming Coals.

Quarter Objectives

- To finalize and bind the documents for the first three subtasks.
- To complete history matching of the Allison Unit and to prepare a document describing the results of the modeling effort.

Accomplishments

Subtask 6.1-Two-Well Pilot Test of CO₂ Injection

Comments made by Amoco regarding the draft final report entitled "Two-Well Pilot Test" were addressed by WRI and suggestions were made to Amoco how the document might be changed to address Amoco's concerns. Amoco reviewed these suggestions. It was decided that where differences of technical opinion remain, both Amoco's and WRI's viewpoints will be included in the final document.

Subtask 6.2-CO₂/N₂ Laboratory Tests in the Fruitland Coal

No significant work was accomplished on this subtask.

Subtask 6.3-Modeling of Two-Well Pilot Test

No significant work was accomplished on this subtask.

Subtask 6.4-Design of Phase II CO₂ Injection

History matching of the primary performance of the Allison Unit Pilot was completed using Amoco's coalbed methane simulator and a long-range prediction was made for operation under CO₂ injection. An outline of what was proposed to be in the final documentation of the project was written by WRI and given to Amoco for review. Subsequently, highlights of the study were presented on March 5 at a meeting in Denver. Personnel from Amoco's Exploration and Technology Group from Tulsa attended the meeting. WRI also presented expected economics under different operating scenarios for an idealized quarter-of-a-five-spot pattern. These economics were generated with a program called PEEP (Petroleum Economics Evaluation Program) lent to WRI by Amoco. In developing the grid of thickness data, WRI had very little geological control on thickness data in the model study area. Also, WRI had inadvertently used the wrong density cutoff on some logs. WRI suggested that the history matching be revised. Amoco agreed

and also provided additional thickness control for the model study area. The history match has since been revised, new predictions have been made and new five-spot economics have been prepared using more current data. A new outline of the draft document has been provided to Amoco.

Subtask 6.5 CO₂/N₂ Laboratory Tests in Wyoming Coals

No significant work was accomplished on this subtask.

Activities for Next Quarter

- Present the results of the Allison Unit modeling study to Amoco and Burlington Resources early in the quarter. To prepare a final document on the Allison Unit study.
- Revise, finalize and bind the document on subtask 1.
- Bind the documents on subtasks 2 and 3.

Program/Project Identification No. DE-FC21-93MC30127	Program/Project Title TASK 006 INJECTION INTO COAL SEAMS FOR SIMULTANEOUS CO ₂ MITIGATION AND ENHANCED RECOVERY OF COALBED METHANE	Reporting Period 1/1/97 through 3/31/97
Name and Address WESTERN RESEARCH INSTITUTE 365 NORTH NINTH STREET LARAMIE, WYOMING 82070		Program/Project Start Date MARCH 26, 1993
		Completion Date MARCH 25, 1997

	USDOE	SPONSOR(s)
FY 1993 FUNDING	812,639	1,701,789
FY 1994 FUNDING		
FY 1995 FUNDING	323,261	14,481
FY 1996 FUNDING		
FY 1997 FUNDING		
PROJECT FUNDING TO DATE	1,135,900	1,716,270
TOTAL PROJECT VALUE \$2,852,170

COSPONSOR FUNDING IN FY 95 CONSISTED OF \$14,481 CASH
 COSPONSOR FUNDING IN FY 93 CONSISTED OF \$41,389 CASH AND \$1,660,400 IN-KIND

Signature of Recipient and Date <i>Lee E. Bradley</i> 4/28/97	Signature of USDOE Reviewing Representative and Date
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**Task
7**

**Optimization of Carbonizer Operations
in the FMC Coke Process**

**Status
Completed**

**Sponsor
University of Wyoming Western Coal Consortium**

Reporting Period: January 1 through March 31, 1997

Background

Operation of the FMC coking process to date has resulted in insufficient production of heavy tar materials that serve as the binder in the coke production. Laboratory tests were conducted by WRI, in conjunction with the University of Wyoming, to develop the optimum operating conditions for the carbonizer to maximize the amount of tar produced for binder and to investigate the applicability of the process to other western coals.

Status

The project has been completed.

Task 8	Chemical Sensor and Field Screening Technology Development	Status Ongoing
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**Sponsor
In-Situ Incorporated**

Reporting Period: January 1 through March 31, 1997

Background

The determination or screening of environmental contaminants in the field using portable analytical methodologies or down-hole real time in-situ measurements is an area of great interest in the environmental industry. WRI is expanding its efforts into new technology areas for the development and commercialization of these technologies.

Task Objectives

Western Research Institute is expanding its effort with a corporate sponsor, In-Situ Inc. (ISI) to develop additional methodology and prototype devices for down-hole or field applications using various technologies for monitoring chemical species of environmental importance.

Quarter Objectives

Soil Fuel Test Kit

- Continue to assist the corporate co-sponsor towards the goal of releasing the soil fuel test kit to manufacturing.
- Make a poster presentation on the use of the soil test kit at a railroad site at the EPA Field Screening Symposium in January, 1997.

VOC Probes

- Continue support work towards down-hole PID probe development.
- Make a poster presentation on practical deviations from Henry's law for VOC analysis at the EPA Field Screening Symposium in January 1997.

Other Probes and Sensors

- Assist the corporate co-sponsor in evaluating chemical monitoring probes, such as for pH and conductivity, as requested.

Accomplishments

Soil Fuel Test Kit

- A soil test kit prototype is being used by Dr. Seth Frisbie at the Johnson Company in Vermont, at his request. He is eager to buy final kits when they are available from In-Situ, Inc. The Johnson Company is using the capability of providing rapid soil analyses with the test kit method in their marketing literature.
- A soil test kit prototype was received back from ENSR. ENSR will provide data on the use of the kit at a transformer oil site, and intends to present this information.
- Work was initiated towards gaining EPA acceptance of the soil test kit method for an upcoming revision of the RCRA SW-846 methods compendium. Reports describing the method development and validation work, and ASTM approval were sent to Barry Lesnik, EPA Office of Solid

Waste. He is in charge of the organics methods sections in SW-846.

- A poster session presentation on the use of the soil test kit at a railroad site was presented at the EPA Field Screening Symposium in January 1997.
- An article describing the first use of a prototype test kit in the field appeared in the February/March 1997 issue of the trade journal Environmental Lab. The primary author is Eric Butler of Gradient Corp. The article states that 64 samples were analyzed within a 2-day period, defining the contamination profile of a diesel contaminated railroad site. The article states that "this new method provides a rapid, inexpensive and accurate way of measuring environmental petroleum". Reprints of the article were ordered for future marketing purposes.

VOC Probes

- The remaining calibration curves for VOCs in water were obtained using an electrooptical probe and laboratory sparger apparatus.
- A poster session describing deviations from Henry's law partitioning of VOCs was presented at the EPA Field Screening

Symposium in January, 1997.

Other Probes and Sensors

- Information on the methods and uses of ion selective electrodes for measuring nitrate and ammonium in water was gathered and provided to the corporate co-sponsor at their request.

Activities for Next Quarter

Soil Fuel Test Kit

- Continue to assist the corporate co-sponsor towards the goal of releasing the soil fuel test kit to manufacturing. Pursue EPA acceptance of the method as a new RCRA SW-846 method.

VOC Probes

- Compile the response curve data generated for a series of VOC standards.

Other Probes and Sensors

- Assist the corporate co-sponsor in evaluating chemical monitoring probes such as for pH and conductivity.

Program/Project Identification No. DE-FC21-93MC30127	Program/Project Title TASK 008 CHEMICAL SENSOR AND FIELD SCREENING TECHNOLOGY DEVELOPMENT	Reporting Period 1/1/97 through 3/31/97
Name and Address WESTERN RESEARCH INSTITUTE 365 NORTH NINTH STREET LARAMIE, WYOMING 82070		Program/Project Start Date MARCH 26, 1993
		Completion Date MARCH 25, 1997

	USDOE	SPONSOR(s)
FY 1993 FUNDING	196,396	217,217
FY 1994 FUNDING	186,743	151,806
FY 1995 FUNDING	247,761	214,352
FY 1996 FUNDING	119,000	166,525
FY 1997 FUNDING		
PROJECT FUNDING TO DATE	749,900	749,900
TOTAL PROJECT VALUE \$1,499,800

COSPONSOR FUNDING IN FY 96 CONSISTED OF \$73,153 CASH AND \$93,372 IN-KIND
 COSPONSOR FUNDING IN FY 95 CONSISTED OF \$3,709 CASH AND \$210,643 IN-KIND
 COSPONSOR FUNDING IN FY 94 CONSISTED OF \$49,394 CASH AND \$102,412 IN-KIND
 COSPONSOR FUNDING IN FY 93 CONSISTED OF \$23,744 CASH AND \$193,473 IN-KIND

SIGNATURE OF RECIPIENT AND DATE <i>Lee E. Bradley 4/28/97</i>	SIGNATURE OF USDOE REVIEWING REPRESENTATIVE AND DATE
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**Task
9**

**Demonstration of the Koppelman "Series C" Process
Using a Batch Test Unit with Powder River Basin Coal as Feed**

**Status
Ongoing**

**Sponsor
K-Fuel Incorporated**

Reporting Period: January 1 through March 31, 1997

Background

Although having the desirable characteristic of being low in sulfur, most western coals are comparatively low in heating value. Bench-scale tests have been successfully conducted using the Koppelman "Series C" process in which subbituminous Powder River Basin coal has been converted to a higher value product having the characteristics of a low-sulfur bituminous coal. WRI is working with K-Fuel Inc. to construct and operate a large-scale batch unit that will provide the design basis for a commercial plant and to evaluate the product samples and process emissions from the unit.

Task Objectives

- (Phase I) Demonstrate the feasibility of the Koppelman Series C process by constructing a 1,000 lb. batch test unit; conducting tests to further develop the design basis for a commercial plant; and producing samples of the product for testing and evaluation.
- (Phase II) Improve the process economics by designing, constructing and testing a low-cost, high-efficiency version of the processor.
- Characterize the gaseous and water emissions from the process by determining the quantity and composition of those respective emissions.
- (Phase III) Support the design and operation of the 500,000 ton per year commercial plant now being constructed by KFx and Thermo Ecotek.
- Expand the market for the products by testing high sulfur U.S. coals and foreign coals.
- Increase the product density by developing an extrusion system, and

- Reduce the costs of future plants using the Koppelman Series C process by developing a feed-coal preheater along with an inverted processor.

Quarter Objective

The objectives for this quarter were to continue to support the startup activities for the KFx-Thermo Ecotek 500,000 ton per day commercial plant. We will also continue bench-scale testing of foreign coal and are prepared to conduct pilot plant tests as needed.

Accomplishments

This quarter we continued to support KFx and Thermo Ecotek with the startup activities for the commercial plant by observing operations and collecting data to measure performance of individual units. We also continued bench-scale testing of foreign and domestic coal. We also continued our study of the NOx emissions to be expected by burning product from the Series C tests in utility boilers.

Activities for Next Quarter

Top priority is to continue to support the startup activities of the commercial plant. We will also continue bench-scale testing and will conduct tests

using the Series C pilot plant. We will complete the NOx emissions study and will prepare an annual technical report describing activities during the first year of Phase III.

Program/Project Identification No. DE-FC21-93MC30127	Program/Project Title TASK 009 DEMONSTRATION OF THE KOPPELMAN "SERIES C" PROCESS USING A BATCH TEST UNIT WITH POWDER RIVER BASIN COAL AS FEED	Reporting Period 1/1/97 through 3/31/97
Name and Address WESTERN RESEARCH INSTITUTE 365 NORTH NINTH STREET LARAMIE, WYOMING 82070		Program/Project Start Date MARCH 26, 1993
		Completion Date MARCH 25, 1997

	USDOE	SPONSOR(S)
FY 1993 FUNDING	604,999	634,200
FY 1994 FUNDING	851,206	954,600
FY 1995 FUNDING		
FY 1996 FUNDING	1,000,000	1,000,000
FY 1997 FUNDING		
PROJECT FUNDING TO DATE	2,456,205	2,588,800
TOTAL PROJECT VALUE \$5,045,005

COSPONSOR FUNDING IN FY 96 CONSISTED OF \$250,000 CASH AND \$750,000 IN-KIND
 COSPONSOR FUNDING IN FY 94 CONSISTED OF \$175,000 CASH AND \$779,600 IN-KIND
 COSPONSOR FUNDING IN FY 93 CONSISTED OF \$634,200 IN-KIND

Signature of Recipient and Date LEE E BIEDL 4/28/97	Signature of USDOE Reviewing Representative and Date
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**Task
10
(Old
5.25)**

Remote Chemical Sensor Development

**Status
Completed**

**Sponsor
In-Situ Incorporated**

Reporting Period: January 1 through March 31, 1997

Background

The detection and monitoring of groundwater and soil contaminants is essential to environmental mitigation efforts. WRI is continuing work begun under the earlier cooperative agreement on the development of needed instruments for accurate measurements of chemical materials with easy-to-use, portable equipment and for in-situ, real-time monitoring. This includes development of a new field test kit for measurement of diesel and other fuels in soils and a downhole monitoring device for volatile organic compounds. The work involves optimizing soil extraction chemistry, exploring optimal design and configuration of the fuel test kit photometer, and constructing prototype instruments for downhole VOC monitoring.

Status

The project has been completed.

Footnote

This task completed work begun as Task 5.25 under the previous cooperative agreement. Total USDOE and cosponsor funding was \$575,000 each for a project total of \$1,150,000.

**Task
11**

**Market Assessment and Technical Feasibility
Study of PFBC Ash Use**

**Status
Ongoing**

**Sponsor
Electric Power Research Institute**

Reporting Period: January 1 through March 31, 1997

Background

Disposal or use of ash from coal combustion systems are of continuing environmental concern. The chemical characteristics of pressurized fluidized bed combustion (PFBC) ash are quite different from other Clean Coal Technology (CCT) ashes. These characteristics may make the PFBC ash more amenable to options for its use than other CCT ashes. This study is to make a market assessment of potential uses of PFBC ash, evaluate the technical feasibility of these uses, and develop plans for full-scale demonstrations of the most promising options.

Task Objective

The objective of this task is to determine the market and technical use options for PFBC ash.

Quarter Objectives

- Continue geotechnical testing as related to structural fill and soil stabilization applications.
- Prepare for synthetic aggregate production testing of the ash blend.
- Initiate soil amendment testing via greenhouse studies.

Accomplishments

- WRI prepared and submitted a manuscript for presentation at the 14th International Conference on Fluidized Bed Combustion to be held in Vancouver, BC May 11-14, 1997. The paper is entitled "Hydration Reaction Chemistry Associated with Management of Pressurized Fluidized Bed Combustion Ash" co-authored by A. E. Bland and T. H. Brown of WRI. The paper summarizes the hydration reaction chemistry associated with the management of PFBC ashes

from Foster Wheeler Energia Oy circulating PFBC and AEP Tidd bubbling bed PFBC. The paper was accepted and will be presented next quarter. Dr. Bland will also be chairing the session on ash behavior

- WRI was invited to present a status of the project to U. S. DOE at the Advanced Coal-Based Power and Environmental Systems '97 Conference to be held in July 22-24, 1997. The presentation will focus on the geotechnical properties of the PFBC ash as related to construction and soil amendment applications. The presentation will address the high and low sulfur derived circulating PFBC ash from the Foster Wheeler Energia Oy pilot facility in Karhula Finland, as well as the AEP Tidd bubbling bed PFBC ash from Brilliant, Ohio.
- Geotechnical testing continued on the ash from pilot circulating PFBC tests at the Foster Wheeler Energia Oy facility in Karhula Finland. Hydration phase analysis composition determination as a function of curing conditions are nearing completion. Plans for the soil amendment greenhouse study and the synthetic aggregate production testing were

finalized, but testing was postponed until next quarter. The testing and results should be available for inclusion in the U. S. DOE Annual Contractors meeting mentioned above.

Activities for Next Quarter

- Finish geotechnical testing as related to structural fill and soil stabilization applications.
- Conduct synthetic aggregate production testing of the ash blend.
- Conduct soil amendment testing via greenhouse studies.
- Present paper at the 14th International Conference on Fluidized Bed Combustion in Vancouver, B.C.
- Prepare manuscript and presentation on the geotechnical properties of PFBC ash as related to ash use in construction and soil amendment applications to the Advanced Coal-Based Power and Environmental Systems '97 Conference.
- Initiate the preparation of the final report. The continuation of the project with Foster Wheeler Energy International, Inc. related to the MacIntosh PFBC project in Florida was not selected for JSR funding by WRI.

Program/Project Identification No. DE-FC2 I-93MC30 I 27	Program/Project Title TASK O I I MARKET ASSESSMENT AND TECHNICAL FEASIBILITY STUDY OF PFBC ASH USE	Reporting Period 1/1/97 through 3/31/97
Name and Address WESTERN RESEARCH INSTITUTE 365 NORTH NINTH STREET LARAMIE, WYOMING 82070		Program/Project Start Date MARCH 26, 1993
		Completion Date MARCH 25, 1997

	USDOE	SPONSOR(S)
FY 1993 FUNDING	99,998	100,000
FY 1994 FUNDING		
FY 1995 FUNDING	147,640	303,500
FY 1996 FUNDING	200,000	200,000
FY 1997 FUNDING		
PROJECT FUNDING TO DATE	447,638	603,500
TOTAL PROJECT VALUE \$1,051,138

COSPONSOR FUNDING IN FY 96 CONSISTED OF \$200,000 IN-KIND
 COSPONSOR FUNDING IN FY 95 CONSISTED OF \$303,500 IN-KIND
 COSPONSOR FUNDING IN FY 93 CONSISTED OF \$100,000 IN-KIND

Signature of Recipient and Date Lee E. Bland 4/28/97	Signature of USDOE Reviewing Representative and Date
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**Task
12**

**Solid State Nuclear Magnetic Resonance (NMR) Analysis
of Naturally and Artificially Matured Kerogens**

**Status
Completed**

**Sponsor
University of Wyoming--EPSCoR**

Reporting Period: January 1 through March 31, 1997

Background

As part of the University of Wyoming research project to develop new approaches and supporting technology for oil and gas exploration in the United States, pressure compartmentalization is being modeled. To do so, fundamental data are required on the natural and artificial maturation of petroleum source rocks. WRI is performing solid-state NMR measurements to provide a significant part of the required data.

Status

The project has been completed.

Task
13
(Old 5.6)

Contained Recovery of Oily Wastes (CROW™)
Field Demonstration with Bell Lumber and Pole

Status
Ongoing

Sponsor
Bell Lumber and Pole

Reporting Period: January 1 through March 31, 1997

Background

Operation of a pole and tie treatment plant in New Brighton, Minnesota for a number of years resulted in contamination of soils at the site with organic materials. WRI is using the CROW process to demonstrate remediation of the site. The process displaces and recovers part of the contaminating materials. This is followed by in-situ bioremediation of the residual oily substances.

Footnote

This task completes work begun as Task 5.6 under the previous cooperative agreement. Total USDOE funding is \$587,644 and total cosponsor funding is \$2,024,955 for a project total of \$2,612,599.

Task Objectives

The objective of this task is to design, construct, and operate a field demonstration of the CROW™ process technology to treat a site contaminated with organic wastes from the wood treatment process.

Quarter Objective

Continue the phase-one, full-scale field demonstration.

Accomplishments

Since February 26, 1996 the operation of the CROW system has been an on/off proposition because of different mechanical problems of the cosponsors equipment. From February through December 1996, approximately 4.3 volumes of water had been injected and over 20,000 gallons of oil have been recovered. Bell Lumber and Pole continues to use a portion of the recovered product in their pole treatment operation. Maximum hot-water injection temperature have averaged 180°F, however, failures of the hot-water heat exchanger has resulted in non-continuous hot

water injection. Between hot water injection times, 70°F water is injected.

A new heat exchanger to produce the heated injection fluid was identified and ordered. The heater was scheduled to be installed in the January - February time frame, however, the heat exchanger delivery has been delayed until April.

Activities for Next Quarter

Operation of the phase-one, full-scale remediation will continue next quarter. Replacement of the existing hot-water heat exchanger will be a high priority item.

Program/Project Identification No. DE-FC21-93MC30127	Program/Project Title TASK 013 CONTAINED RECOVERY OF OILY WASTES (CROW™) FIELD DEMONSTRATION WITH BELL LUMBER AND POLE	Reporting Period 1/1/97 through 3/31/97
Name and Address WESTERN RESEARCH INSTITUTE 365 NORTH NINTH STREET LARAMIE, WYOMING 82070		Program/Project Start Date MARCH 26, 1993
		Completion Date MARCH 25, 1997

	USDOE	SPONSOR(S)
FY 1993 FUNDING	90,800	
FY 1994 FUNDING		207,396
FY 1995 FUNDING		250,000
FY 1996 FUNDING	30,000	84,000
FY 1997 FUNDING		
PROJECT FUNDING TO DATE	120,800	541,396
TOTAL PROJECT VALUE \$662,196

THE PROJECT COSPONSOR HAS ADDED AN ADDITIONAL \$541,396 CASH TO THE PROJECT RAISING THEIR TOTAL CONTRIBUTION FROM \$1,940,955 TO \$2,482,351

Signature of Recipient and Date Lee E. Brady 4/28/97	Signature of USDOE Reviewing Representative and Date
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**Task
14**

**"B Series"
Pilot Plant Tests**

**Status
Completed**

**Sponsor
Heartland Fuels Corporation**

Reporting Period: January 1 through March 31, 1997

Background

In a previous JSRP task, WRI participated with Heartland Fuels Corporation in conducting pilot-scale tests of the "B" series process using three different coals. The present study determined the characteristics of the process condensate when operated at lower temperatures than previously tested. Seven tests were conducted in the pilot plant and samples of the condensate were collected and analyzed.

Status

The project has been completed.

**Task
15
(Old 5.26)**

**In Situ Treatment
of Manufactured Gas Plant Contaminated Soils
Demonstration Program**

**Status
Complete**

Sponsors

**Pennsylvania Power and Light, US Environmental Protection Agency, Gas Research Institute,
and Electric Power Research Institute**

Reporting Period: January 1 through March 31, 1997

Background

The process of manufacturing gas from coal years ago resulted in the contamination of soils with carcinogenic materials. One such site that is presently being cleaned is the Brodhead Creek Site in Stroudsburg, Pennsylvania. WRI is using its CROW process in conjunction with in-situ biotreatment to demonstrate remediation of the site. The overall steps in the study are to design the application of the CROW process to the site, obtain permits, construct and operate the field demonstration test and evaluate the results.

Footnote

This task completes work begun as Task 5.26 under the previous cooperative agreement. Total USDOE funding is \$518,689 and total cosponsor funding is \$1,360,523 for a project total of \$1,879,212.

Status

The project has been completed.

**Task
16**

**Development and Demonstration
of a Wood-Fired Gas Turbine System**

**Status
On Stand-by**

Sponsors
**Power Generating Inc. and Office of Conservation and Renewable Energy,
US Department of Energy**

Reporting Period: January 1 through March 31, 1997

Background

Development of a means to use inexpensive solid fuels for electrical power generation and thermal energy has the double benefit of providing low-cost energy and utilization of an otherwise possibly unused resource. Power Generating Inc. has patented a unique, direct-fired gas turbine power system that could be operated on such fuels. The system is expected to operate at thermal efficiencies in excess of 70% through full utilization of the electrical and thermal energy generated. Problems generally inherent in such systems are overcome by the unique design of this system and by close control of fuel specifications and operating procedures. WRI is working on the detailed design of a demonstration unit. When designed, a 425 kilowatt power system will be constructed and tested on a clean wood fuel. Immediately following the wood testing, the system will be reconfigured and operated on a low-ash coal.

Task Objectives

The goal of this project is to confirm the technical and economic viability of operating a direct-fired gas turbine power system on solid fuel. Specific objectives are:

- Refine and finalize the engineering design for the prototype PGI Power System.
- Prove the conceptual and technical feasibility of operating a direct-fired gas turbine power system on solid fuels.
- Confirm the operating characteristics of the PGI Power System.
- Verify the efficiency and economic potential of the PGI Power System.
- Evaluate the potential environmental impact of the PGI Power System.

- Develop recommendations for additional R&D work on the use of solid fuels in direct-fired gas turbine power systems.

Quarter Objective

Maintain the plant in cold standby until PGI can secure funds for continuation of the project.

Accomplishments

The plant is being kept in cold standby while the industrial partner is attempting to raise the funds for continuation of the project.

Activities for Next Quarter

When required funds are made available, the plant will be restarted and testing will resume.

Program/Project Identification No. DE-FC21-93MC30127	Program/Project Title TASK 016 DEVELOPMENT AND DEMONSTRATION OF A WOOD-FIRED GAS TURBINE SYSTEM	Reporting Period 1/1/97 through 3/31/97
Name and Address WESTERN RESEARCH INSTITUTE 365 NORTH NINTH STREET LARAMIE, WYOMING 82070		Program/Project Start Date MARCH 26, 1993
		Completion Date MARCH 25, 1997

	USDOE	SPONSOR(S)
FY 1993 FUNDING		
FY 1994 FUNDING	673,434	1,313,584
FY 1995 FUNDING	742,800	990,400
FY 1996 FUNDING		
FY 1997 FUNDING		
PROJECT FUNDING TO DATE	1,416,234	2,303,984
TOTAL PROJECT VALUE \$3,720,218

COSPONSOR FUNDING IN FY 95 CONSISTED OF \$840,200 CASH AND \$150,200 IN-KIND
 COSPONSOR FUNDING IN FY 94 CONSISTED OF \$832,584 CASH AND \$481,000 IN-KIND

Signature of Recipient and Date Lee E. Bradley 4/28/97	Signature of USDOE Reviewing Representative and Date
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**Task
17**

**Solid State NMR Analysis of Mowry Formation Shale
from Different Sedimentary Basins**

**Status
Completed**

**Sponsors
University of Wyoming and Gas Research Institute**

Reporting Period: January 1 through March 31, 1997

Background

New approaches and supporting technology are needed to reverse the diminishing returns from oil and gas exploration in the United States. The discovery of subsurface fluid or pressure chambers has the potential to delineate a new class of hydrocarbon traps, thereby revitalizing interest in domestic exploration. The University of Wyoming has a research project to develop a conceptual model of the formation, distribution, and destruction of pressure chambers and seals in sedimentary basins. A key to understanding the diagenetic and maturational behavior is knowledge of the organic carbon structure of the kerogen in petroleum source rocks and how the kerogen structure changed during petroleum generation. As a part of this project, WRI is performing solid-state NMR measurements to provide information on the diagenesis and maturation of petroleum source rocks. The material being studied in this task is Mowry Formation shale from sedimentary basins.

Status

The project has been completed.

Task 18	<i>Acid-Mine Drainage Prevention, Control, and Treatment Development for the Stockett/Sand Coulee Area</i>	<i>Status Ongoing</i>
<p align="center">Sponsor <i>Montana Bureau of Mines and Geology</i></p>		
<p align="center">Reporting Period: January 1 through March 31, 1997</p>		
<p align="center">Background</p> <p><i>Extremely acidic water is continually discharging from abandoned coal mines in the Stockett/Sand Coulee area in Montana. The water is unusable and contaminates other waters in the area. Considerable money has been spent trying to remediate the acid-mine drainage that is occurring and in replacing other water supplies that have been contaminated by the drainage water. Techniques applied to the problem so far have focused on managing and containing the mine waters, with little success. This study is identifying the geologic, hydrologic, and chemical factors that control the production of the acid-mine drainage. Once the mechanisms are identified, potential treatment techniques will be evaluated. The most promising techniques will be modeled using a series of laboratory studies. Results of the study will be used to design a field demonstration project for the amelioration of drainage water at a specific site in the problem area.</i></p>		

Task Objective

The task objective is to evaluate the methods available and to develop methods to control or eliminate the production of acid in the Stockett/Sand Coulee mine area.

Quarter Objectives

Investigations concerning the establishment of coatings on the acid forming materials will continue. A selected number of the core samples will be analyzed to determine the extent of the acid-forming reaction zone in the Number 6 mine. The monitoring program will continue at the mine site.

Accomplishments

On-site water monitoring is on-going. A column study showing the impact of underground placement of acid-neutralizing materials on acid mine drainage is ongoing. The work concerning the development of pyrite coatings using the Soxhlet system and core sample analysis was not conducted during this quarter.

Activities for Next Quarter

A selected number of the core samples will be analyzed to determine the extent of the acid-forming reaction zone in the Number 6 mine. Column studies evaluating the impact of acid neutralizing materials on acid mine drainage are ongoing. The monitoring program will continue at the mine site. The work concerning the establishment of coatings on the acid forming materials will continue.

Program/Project Identification No. DE-FC2 I-93MC30 I 27	Program/Project Title TASK O I 8 ACID-MINE DRAINAGE PREVENTION, CONTROL, AND TREATMENT DEVELOPMENT FOR THE STOCKETT/SAND COULEE AREA	Reporting Period 1/1/97 through 3/31/97
Name and Address WESTERN RESEARCH INSTITUTE 365 NORTH NINTH STREET LARAMIE, WYOMING 82070		Program/Project Start Date MARCH 26, 1993
		Completion Date MARCH 25, 1997

	USDOE	SPONSOR(S)
FY 1993 FUNDING		
FY 1994 FUNDING	110,665	120,000
FY 1995 FUNDING	91,403	90,845
FY 1996 FUNDING		
FY 1997 FUNDING		
PROJECT FUNDING TO DATE	211,068	210,845
TOTAL PROJECT VALUE \$421,913

COSPONSOR FUNDING IN FY 95 CONSISTED OF \$90,845 IN-KIND
COSPONSOR FUNDING IN FY 94 CONSISTED OF \$120,000 IN-KIND

Signature of Recipient and Date Lee E Brechler 4/28/97	Signature of USDOE Reviewing Representative and Date
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**Task
19**

**PERF Dispersion Modeling Project
Phase 2
Major Field Demonstration**

**Status
On-hold**

Sponsor
Petroleum Environmental Research Forum
(Allied Signal Corporation, Amoco Corporation, Chevron Research and Technology Co., CITGO Petroleum Corporation, Clark Oil and Refining Co., Exxon Research and Engineering Co., Marathon Corporation, Mobil Research and Development Co., Phillips Petroleum Co., and Shell Research and Development Company)

Reporting Period: January 1 through March 31, 1997

Background

WRI and Petroleum Environmental Research Forum (93-16) are assessing the application of newly developed mathematical models for predicting dense gas dispersion by testing the models against the experimental results of large scale field simulations of chemical spills. The PERF and WRI are conducting field scale tests of dense gas dispersion in order to validate the models and to provide the hydrocarbon and chemical industries with information needed to conduct risk management assessments. Major components of the tests are; source emissions release system, meteorology data analyses and meteorology instrumentation, and the array configuration. The WRI 1993 HAZMAT spill test results, wind tunnel tests, and model results were used to aid in the design of the dispersion grid dimensions, sensor location, and test operation.

Task Objective

Implement and conduct the PERF 93-16 tests to the design specification and collect data for gas releases in the simulated petroleum refinery/tank farm under neutral and stable atmospheric conditions

Quarter Objectives

This quarter's primary objective has been to arrange funding from EPA and the PERF to support the data processing and analysis of the acquired data sets.

Accomplishments

No funding has been provided with which to complete the technical work.

Activities for Next Quarter

Quality assurance for the test operations is completed. The final report will be prepared upon receipt of the remaining funding from EPA and the PERF.

Program/Project Identification No. DE-FC21-93MC30127	Program/Project Title TASK 019 PERF DISPERSION MODELING PROJECT PHASE 2 MAJOR FIELD DEMONSTRATION	Reporting Period 1/1/97 through 3/31/97
Name and Address WESTERN RESEARCH INSTITUTE 365 NORTH NINTH STREET LARAMIE, WYOMING 82070	Program/Project Start Date MARCH 26, 1993	
	Completion Date MARCH 25, 1997	

	USDOE	SPONSOR(S)
FY 1993 FUNDING		
FY 1994 FUNDING		
FY 1995 FUNDING	502,124	945,330
FY 1996 FUNDING		
FY 1997 FUNDING		
PROJECT FUNDING TO DATE	502,124	945,330
TOTAL PROJECT VALUE \$1,447,454

COSPONSOR FUNDING IN FY 95 CONSISTED OF \$315,000 CASH AND \$630,330 IN-KIND

Signature of Recipient and Date LEE E BRECHER 4/28/97	Signature of USDOE Reviewing Representative and Date
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**Task
20**

**Field Testing of the TaBoRR
Process Using the Asphalt
and Dry Bottoms Configurations**

**Status
Ongoing**

Sponsors
**Naval Petroleum Reserve -3, Pease Oil Field Equipment
and the Rocky Mountain Oilfield Testing Center**

Reporting Period: January 1 through March 31, 1997

Background

Tank bottom wastes are emulsions composed of crude oil, water and solids that are produced from various depths. The crude oil composition is dependent on the source rock and reservoir maturation and consists of a wide range of hydrocarbons that include alkanes, naphthenes and aromatic compounds. These compounds have a wide range of emulsion characteristics that prevent the effective use of any current technology. Although the TaBoRR process was conceptually designed to handle this wide range of emulsified material, further testing is required to verify this experimentally. This project addresses the issues of processing a variety of different feed materials from many sources as well as modifying the process to handle a wider range of oil, water and solid concentrations.

Task Objectives

The task objectives are to:

- Perform modifications to the process to allow for handling larger water concentrations and larger solid sizes present in the feed material;
- Test and operate the unit using a variety of feed materials;
- Determine the feasibility of using the bottoms material as a road material;
- Perform modifications to the process to convert the bottoms into solid material and use the gaseous hydrocarbons as a fuel source for the process; and
- Test and operate the unit to ensure environmental compliance and verify process economics

Quarter Objectives

Complete product characterization of Pease Oil Field Equipment Company material. Procure material from a different source and continue plant testing.

Accomplishments

Plant shakedown activities were continued using the 340 barrels obtained from Pease Oil Field Equipment Company. The product and bottoms created from this feedstock were analyzed.

Modifications to the flash system performed during last quarter provided better control and flawless operations. Mass balances indicated that 26 percent of the material (water and light hydrocarbons) was consumed in the flash system.

Two process improvements to achieve higher product yields in the stripper were identified. The first improvement was the installation of a continuous feed system from the flash tank bottoms. The second modification will be the

installation of continuous bottoms withdrawal from the stripper.

A problem associated with the product recovery system was identified. This problem was created from an increased heat load caused by the removal of the feed preheater from this circuit. Modifications will be undertaken next quarter to remedy this deficiency.

During shakedown operations, an average product recovery in the stripper of 38 percent was achieved. Recoveries as high as 65 percent were achieved during individual operational test periods.

Approximately 236 barrels of feed material were received from Wallace Energy, Incorporated. Analyses of the material indicated a water content of 54 percent and a solids content of 13 percent.

Materials from Wallace Energy, Inc. were processed by employing a strategy to remove the majority of the water in a single flash operation. Erosive wear of the flash valve resulting from larger solids concentration was identified as a durability issue. Remedies based on materials of construction and modified designs are being explored with the equipment manufacturer to correct this deficiency.

Activities for Next Quarter

Complete mass and energy balances for the stripper and carbonizer. Modify and test the flash system. Finish modifications and test stripper operation. Modify and test the product recovery system. Shakedown and operate the carbonizer. Characterize materials created from the pyrolyzer. Procure and test material from different sources.

Program/Project Identification No. DE-FC21-93MC30127	Program/Project Title TASK O2O FIELD TESTING OF THE TABORR PROCESS USING THE ASPHALT AND DRY BOTTOMS CONFIGURATIONS	Reporting Period 1/1/97 through 3/31/97
Name and Address WESTERN RESEARCH INSTITUTE 365 NORTH NINTH STREET LARAMIE, WYOMING 82070		Program/Project Start Date MARCH 26, 1993
		Completion Date MARCH 25, 1997

	USDOE	SPONSOR(s)
FY 1993 FUNDING		
FY 1994 FUNDING		
FY 1995 FUNDING		
FY 1996 FUNDING	285,000	285,415
FY 1997 FUNDING		
PROJECT FUNDING TO DATE	285,000	285,415
TOTAL PROJECT VALUE \$570,415

COSPONSOR FUNDING IN FY 96 CONSISTED OF \$285,415 IN-KIND

Signature of Recipient and Date <i>Lee E. Bradley</i> 4/28/97	Signature of USDOE Reviewing Representative and Date
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**Task
21**

**Validation of a New
Soil VOC Sampler**

**Status
Ongoing**

**Sponsor
En Chem Incorporated**

Reporting Period: January 1 through March 31, 1997

Background

WRI is providing technical support directed at achieving national acceptance for the EnCore sampling device to enhance its market acceptance by both the regulatory community and environmental contract firms that are responsible for the evaluation of VOC contamination at sites throughout the country. One version of the EnCore sampler is accepted for use by the state of Wisconsin. It is a stainless steel device that requires cleaning after use. En Chem is developing a disposable version of the sampler which will lower the cost of use and enhance its acceptance. WRI is evaluating the operation of the stainless steel device. Following successful evaluation, WRI will approach the American Society for Testing and Materials (ASTM) to initiate a process for method preparation and approval in ASTM format. The ASTM approval process will be initiated with the goal of providing national acceptance of the EnCore samplers. WRI will also provide technical support to En Chem in the development of a disposable plastic version of the EnCore sampler.

Task Objective

Western Research Institute is facilitating national acceptance of the EnCore™ soil volatile organic compound (VOC) sampling device by conducting product tests, method development, and method validation activities.

Quarter Objectives

- Write a draft of the new ASTM practice for using the sampling device.
- Perform experiments to verify the performance of the stainless steel prototype EnCore sampling devices. Incorporate the results in to the new practice draft.

Accomplishments

- The sampling devices were discussed with the corporate co-sponsor at the EPA Field Screening Conference in Las Vegas in January. One of the 5-gram disposable sampler prototypes was provided to WRI.

- The new draft practice entitled "Standard Practice for Using a Coring Tube for Sampling and Storing Soil for Volatile Organic Analysis" was written. Data on the integrity of the soil samples over various times will be added before the practice is submitted to ASTM for balloting. An ASTM publicity request describing the development and validation of the new draft practice was prepared. It will be sent to ASTM next quarter, for publication in ASTM's Standardization News and release to related trade journals.
- The tests required for the development of the new ASTM practice were discussed with En Chem, Inc. personnel. A set of tests was begun by En Chem, Inc. using the 5-g stainless steel prototypes. The first run was terminated due to excessive losses of VOCs from the sandy soil used. A second run was begun using a sandy soil with 15% clay added to better hold the spiked VOC standards. The time zero data showed that this soil mixture retained

the VOCs adequately during the time involved in collecting the multiple samples. A problem with the o-rings was noted for the longer duration samples. The sampling was put on hold until the new disposable RTP polymer samplers are received from the manufacturer. Future work will be performed with the disposable devices and not the stainless steel prototypes.

- WRI reviewed the revision of ASTM D-4547, "Standard Practice for Sampling Waste and Soils for Volatile Organics". Revision of this method in conjunction with development of the new practice will be ideal because the new practice can be referenced in D-4547. The revision of D-4547 is part of the EPA/ASTM Accelerated Standards Program. WRI voted negative on the initial draft of the revised practice because it has wording in one section that seems to preclude the

use of a device such as the EnCore sampler, and because it did not provide for duplicate samples to be taken, one for determining if the VOC content is high or low prior to analysis of the other.

- A topical report for FY 96 for this task which was due in March 1997 was written.

Activities for Next Quarter

- Attend the meeting of ASTM committee D-34 on Waste management in St Louis in April and discuss the new draft practice and revision of ASTM D-4547.
- Work with the corporate co-sponsor to perform experiments to verify the performance of the disposable plastic prototype EnCore sampling devices. Incorporate the results into the new draft practice.

Program/Project Identification No. DE-FC21-93MC30127	Program/Project Title TASK 021 VALIDATION OF A NEW SOIL VOC SAMPLER	Reporting Period 1/1/97 through 3/31/97
Name and Address WESTERN RESEARCH INSTITUTE 365 NORTH NINTH STREET LARAMIE, WYOMING 82070		Program/Project Start Date MARCH 26, 1993
		Completion Date MARCH 25, 1997

PROJECT FUNDING HISTORY		
	USDOE	SPONSOR(s)
FY 1993 FUNDING		
FY 1994 FUNDING		
FY 1995 FUNDING		
FY 1996 FUNDING	50,541	62,500
FY 1997 FUNDING		
PROJECT FUNDING TO DATE	50,541	62,500
TOTAL PROJECT VALUE \$113,041

COSPONSOR FUNDING IN FY 96 CONSISTED OF \$12,500 CASH AND \$50,000 IN-KIND

Signature of Recipient and Date Lee E. Breck 4/28/97	Signature of USDOE Reviewing Representative and Date
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