2000/2001 Annual Report

Petroleum Technology Research Centre

PTRC

Petroleum Technology Research Centre

Inside

2000/2001 Highlights

- **Major funding secured for the IEA Weyburn CO_2 Monitoring Project including USDOE support as well as support from the European Union**
- **The collaborative Vapex project oversubscribed by industry**
- **PTRC moved into its new research building on the Regina campus in July 2000 with the official opening on October 2, 2000**
- **17 new U of R and SRC projects have been launched in the last year**
- **CFI equipment received and set up in the U of R research facilities**
- **Completed study on how to make petroleum research available to small oil companies**

Key Challenges for 2001-2002

- **Implement a renewal plan for the SRC Petroleum Branch**
- **Fill the Wascana U of R endowed research chair**
- **Execute research projects with high quality and in a timely manner**
- **Develop a high impact research portfolio**
- **Provide a strong marketing campaign**
- **Increase industry funding**
- **Create synergy between SRC and U of R researchers**
- **Improve the overall working environment**
- **Execute IEA Weyburn CO_2 Monitoring Project**
- **Execute the collaborative Vapex research project**

Major Research Areas

Reservoir Efficiency and Life Extension

Primary	Cold Production
Secondary	Enhanced waterfloods; design & optimization; mobility control
Tertiary	Thermal - SAGD & SAGP Non - Thermal - chemical flooding Co_2 flooding, vapex and gas drives

Facility Efficiency and Life Extension

Wellbore	Sand clean out
Surface	Improved surface treating/equipment/processes
Environmental	Treatment of produced fluids Remediation technologies Greenhouse gas mitigation
Other	Expert system applications

Frank Proto
Chairman

Message From The Chair

This past year was the first full year of operation of the PTRC. We have made progress in many areas and learned many things regarding the challenges to build a world recognized petroleum institute starting with a narrow base.

In brief we have learned:

There is a need for increased petroleum research. Petroleum resources are becoming much more expensive and any methods that can be developed to enhance recovery and sustain production create strong interest from the petroleum industry.

The petroleum industry has many ideas that can be pursued by a research institute. Also the petroleum companies are very willing to co-operate and sponsor projects that could be of benefit to the entire industry.

The increased emphasis on environmental issues has created an entirely new area of potential research involving the development of methods to produce hydrocarbons with a minimum of impact on the environment.

The commitment from our founding partners is very strong.

Recruiting new faculty and researchers for the U of R and the SRC with petroleum experience has been difficult. Established institutions are currently expanding and renewing their staff making it difficult to compete. Clearly it will take longer to build up our research capacity than we anticipated.

Without a large core staff to conduct research it is hard to undertake all of the approved projects.

The challenge for the next year is to recruit additional staff for the U of R and researchers for the SRC.

Many things have been accomplished. The successful launch of the IEA Weyburn CO_2 Monitoring Project which is attracting international attention- and financing- was very important to a new research institute. The new building is world class and will assist us in our recruitment activities.

We will develop an internationally recognized research institute in Saskatchewan. It will take more time than we initially had thought but progress is being made.

Finally, I wish to thank our Board of Directors, Roland Moberg, the General Manager of the PTRC and our founding partners for their continued support.

Frank Proto

Roland Moberg
General Manager

Message From the GM

This is the third year of the initial 5-year funding period for PTRC. During the last year, we moved into a new state of the art building at the Campus of the University of Regina and we launched two major new projects: the IEA Weyburn CO_2 Monitoring Project and the Vapex III project.

Our vision to establish a world-class petroleum research centre in Regina is decidedly a very ambitious and worthwhile goal to pursue for Saskatchewan. The conceptual model for building this research organization around the new U of R Petroleum Systems Engineering Program and the Petroleum Branch of the SRC is fundamentally sound.

The business plan we developed for PTRC had ambitious goals of an organization truly committed to the common goal of making the PTRC a successful venture.

Considerable effort is required to make significant progress towards our vision. To be successful we must develop a way to build on each other's expertise and knowledge to create the desired synergy between fundamental and applied research.

In order to strengthen the SRC Petroleum Branch, an initiative to develop a 5-year growth and development plan for the Petroleum Branch is being undertaken.

On the University side, the U of R has not yet been able to fill the Wascana chair. The need for a senior academic with experience in petroleum research who can provide quality mentoring for the less experienced professors is crucial for the long-term success of this program and their contribution to the goal of PTRC. As well during the last year, much effort was dedicated to establish and teach the new curriculum for Petroleum Systems Engineering by these new professors as well as plan their research, acquire funding and recruit graduate students, leaving less time for actually doing research for PTRC. Furthermore, our recruitment is occurring at a time when every major petroleum research institute and faculty in North America is also undertaking major recruitment drives to replace retiring staff.

The following business concept has evolved over the last 2 years; a research stool with the following three legs:
1. SRC Petroleum Branch, which will provide research in niche areas as well as in collaboration with other research organizations such as Alberta Research Council with core funding from the Saskatchewan Government, PTRC and industry.

2. U of R Petroleum Systems Engineering Program will focus on more fundamental research with funding from both PTRC and NSERC and if possible from the industry.

3. The third leg of the stool is made up of PTRC initiated and led projects involving other researchers and SRC and U of R wherever possible. Two examples of these are: the Weyburn CO_2 Monitoring Project and the Vapex III project. Consultants in Calgary manage both of these projects and non-PTRC researchers carry out much of the research. We believe that the IEA Weyburn CO_2 Monitoring Project has the potential to put PTRC on the world map of research.

Creating a high performing petroleum research organization in Regina, will likely take 5 to 10 years of dedicated effort and support from both industry and the two levels of Government. Only with the strong contributions from both the Petroleum Branch and the U of R, can we realize the power and the full potential of the PTRC business model.

So what will it take to be successful?

1. We need to find more effective ways for the PTRC to act as the true focal point for petroleum research in Saskatchewan
2. We must create a highly innovative and well resourced research centre to attract quality people
3. We must achieve a critical mass of at least 30 key researchers between the U of R and SRC Petroleum Branch
4. We must secure sufficient long term Government funding for building this organization and for a significant portion of the ongoing operating costs
5. We must reinvest in more modern research equipment for the SRC Petroleum Branch and the University of Regina
6. We must do quality research that attracts significant funding and support from the petroleum industry

With the collective will and commitment of all the parties, we can create and add value for all the stakeholders in PTRC.

I would like to thank our Board of Directors, the Management Committee and the Technical Advisory Committee for their ongoing support and dedication to the PTRC.

Sponsored Projects

Project	Project Objective	PTRC Funding	Type of Research	Results/Status
Fine Solids	Characterize/identify fine solids responsible for emulsion stability in produced fluids	40,000	I	$15,000 additional for drop size equipment-delays due to equipment delivery, soliciting industry support, scope change to reflect industry support.
AI Water/oil treater	Develop AI system for heater/treater control	25,000	I	Project delayed due to requirement of participation of treater manufacturer and student availability. Project to be expanded PRECARN funding will be applied for in May 01.
IEA Weyburn CO_2 Monitoring Project	To demonstrate that long term storage of carbon dioxide in geologic formations is a safe and secure technology	75,000	I	Funding for phase I secured. Baseline data gathered. NRCan and SEM funding committed. USDOE funding forthcoming. Alberta funding being sought. 2001 research program being kicked off. European Researchers have raised about $3.0 million for their part of the project.
Characterization of Carbonate Reservoir Systems	Determine the factors that control spatial distribution, porosity and permeability of Ordovician	60,000	I	Preliminary results are being presented at a number of different forums.
Expert system for remediation technologies	Development of an expert system for supporting industries' decisions in remediating petroleum-contaminated sites	55,000	I	A prototype system has been developed that aids users to select the appropriate remediation technology given different conditions in contaminants and media. Incorporation of more technologies is ongoing.
CO_2 foam for mobility control	Screen different surfactants and study CO2-foam for improving CO2 mobility in Weyburn	109,000	I	Literature search complete. Surfactants tested. High pressure flow experiments set up under construction.
Development of biological technologies for remediation	Development of innovative technologies for media and species enhancement in the remediation of petroleum-contaminated sites	65,000	I	The developed technologies are being pilot tested under various environmental conditions.
Methane pressure cycling (MPC) with horizontal wells II	Study economics of MPC and see if flue gas can be used	75,000	I	Simulations for economic analysis done; CO_2 assisted MPC investigation completed.
Effect of gas in SAGD process	To investigate the effect of gas on the SAGD process in a 3D physical model	75,000	I	Progress has been slower than expected with laboratory difficulties.
Application of intelligent systems in Saskatchewan petroleum production	1) Assist Saskatchewan petroleum producers in identifying opportunities for the application of AI systems; 2) Implement AI demonstration systems leading to improved petroleum production and energy efficiency in the sector; 3) Develop services for the Saskatchewan petroleum sector and for marketing Saskatchewan petroleum expertise in Alberta and North America.	75,000	I	In consultation with industry, six potential applications were identified and reviewed. Monitoring and control of PCP wells was chosen as it had a high priority with industry and a big potential impact. Analysis of PCP data including downhole measurements was completed and an interim report outlining results was submitted. Work will continue on analyzing surface data and developing the system. Plan extended to Sept 30, 2001 due to delays in receiving data.
A knowledge based expert system for oil battery	Develop an expert system for monitoring a battery facility through internet	84,000	I	The domain of knowledge has been completed for the battery and analysis of internet accessed production data is ongoing.
Application of gels for CO_2 conformance control	Study the application of in-depth gel placement for CO_2 conformance control in Weyburn	31,000	I	Initial gelation time tests have been done. The high pressure core flood apparatus is under construction.
Mobility control under bottom water conditions	To model the use of CO_2 and gels as mobility control and blocking agents	86,000	I	2 Graduate students are working on this project. 50% of literature search done.

Type of Research

I	Incremental projects are evolutionary projects that are about improving process and production technologies that are already in use. These projects are typically cost shared with partners on at least a 50/50 basis.
II	Breakthrough projects are about creating new opportunities in the market place or new general knowledge. By their nature they are novel, exploratory, high risk and longer term. Often these projects will be 100 percent funded by the PTRC.

NOTE: PTRC Funding Is Approved Project Funding
Funding By PTRC On Average Is 50% Of Project Funding

Sponsored Projects Cont'd

Project	Project Objective	PTRC Funding	Type of Research	Results/Status
CO_2 storage monitoring through Material Balance Equation	1. To apply the material balance equation to CO_2 storage 2. To predict the future CO_2 storage performance 3. To determine the effects of phase and formation compressibilities on the CO_2 storage	37,000	I	Preparation for data collection underway.
Effects of CO_2 injection on the wettability of the oil-water rock systems	(1). To measure the interfacial tensions of some typical reservoir oils with dissolution of CO_2 (2). To measure the interfacial tensions of reservoir brines with dissolution of CO_2 (3). To study the effects of dissolution of liquid CO_2 on the interfacial tensions between the oil and water (4). To determine the wettability of oil phases on the reservoir rocks in different aqueous solutions	39,000	II	A research associate has been recruited. Required equipment will be ordered soon.
Electromagnetic heating as means of wax depositions inhibition/ remediation	Develop a lab scale EMH system for studying the effect of EMH on preventing wax deposition	104,000	II	Literature search has begun. Graduate student is being recruited.
Study the mechanism of selective permeability reduction with polyacrylamide polymers	Testing the effect of polyacrylamide on the relative permeability of water and oil in core samples from Saskatchewan reservoirs	74,000	I	Literature search is underway. Core plugs being acquired from SEM core lab.
Vapex III	Advance process for Lloydminster heavy oil to decision on field pilot.	50,000	I	Funding in place. Strong industry support - oversubscribed. Numerical modeling is underway and the physical model is being set up. Specific reservoirs have been chosen.
Developing and underground sonar radar for monitoring CO_2 flooding	Building and testing a lab scale sonar system to study flow of different phases in porous media	78,000	II	A graduate student is being recruited.
ASP flood for SW Saskatchewan medium oil reservoirs	1. Extend first-phase research results to field test design 2. Devise general ASP formula for SW Saskatchewan mediumoil reservoirs	85,000	II	Project started April 1. Attempting to get access to field performance data from Talisman.
Immisicible gas injection	1. Promote rapid progress to industry-operated immiscible gas field pilot. Use low-cost flue gas first, then try produced gas, CO_2 etc.	70,000	I	Project will start May 1.
Detection and recycling of chemicals	(1). To identify the major chemicals and characterize the injection liquids and the produced liquids in typical ASP-flood operations (2). To develop method(s) for detecting each chemical (3). To test the detection technique(s) for an individual chemical and a mixture of chemicals (4). To apply the developed techniques to a field case	73,000	I	Project will start May 1.
Coalescer column	Track I - develop a coalescer column capable of improving treatment of produced wellhead emulsions. Track II - determine the physical and chemical characteristics necessary to predict column performance and to aid in the design of future columns	75,000	I+II	Track I started 04/01 Track II under review.
Water treatment	Review current water treating practices and	50,000	I	Proposal will be revised to reflect level of funding.

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2000-2001 Results & Discussion

The IEA Weyburn CO_2 Monitoring Project (SRC/U of R et al)

The purpose of this initiative is to demonstrate that the storage of greenhouse gases such as carbon dioxide can be safely and securely carried out in geologic formations such as depleted oil and gas reservoirs. The 4-year research program is undertaken with the corporate support of PanCanadian Resources, who is the operator of the Weyburn Unit in Southeastern Saskatchewan. The research is piggybacking on a carbon dioxide miscible flood project that was started in the fall of 2000 at that unit. This international research project was officially launched in Regina in July 2000 with the announcement of sufficient funding to carry out the pre-injection baseline surveys and data gathering. This work was carried out in the fall and the results are of high quality. Key funding parties for this and subsequent phases of this project are Natural Resources Canada and the Saskatchewan Energy and Mines as well as several industry participants.
A project director was hired for the project in July 2000 and several project meetings have been held with the overall project team, which represents researchers from both the US, Canada and Europe.

Our second attempt at getting funding from the USDOE has been fruitful and detailed negotiations will take place in the summer of 2001. This brings the secured cash funding level to $19 million including $3 million that has been raised in Europe.

Vapex III Project

Vapex is a non-thermal recovery method that uses gaseous solvents to increase oil recovery by reducing the viscosity, in situ upgrading and pressure control. Our research project builds on previous work carried out by the Petroleum Recovery Institute. The project is conducting detailed analysis of Vapex recovery for 2 possibly 3 specific reservoirs that were selected by the 9 industry participants. Other sponsors are the Alberta Government and NRCan as well as PTRC.

The scope of the research project includes a combination of laboratory physical model work, fluid properties laboratory analysis and numerical simulation. The results of this work carried out by SRC and ARC will provide the basis for facility design, well design and supply cost economics for potential field pilots in the most promising locations.

Monthly meetings are being held in Calgary with the attendance of all the industry participants and the researchers.

Scoping study of environmental issues in the petroleum industry (SRC)

This study comprised a literature and website search, as well as a telephone survey of 37 contacts in the petroleum industry. The contacts were asked about which environmental issues they perceived to be most significant. Site remediation and oily waste management, two areas of expertise of PTRC scientists and engineers, were emphasized in the interview questions.

Industry contacts relayed that site remediation of fresh oil spills was routine. However, studies, which address specific problems identified by the industry, will attract funding. These include research in the areas of hydrocarbon contamination in high-clay soils; aged hydrocarbon contamination below surface; flare pit or ecology pit clean up; heavy oil contamination in high-salt soils; and remediating salt-contaminated soils.

Emulsions/chemical enhanced recovery for heavy oil (SRC)

SRC undertook this multiclient project to determine the suitability of three Saskatchewan heavy oil reservoirs for a chemical/emulsions enhanced oil recovery field demonstration program. The project was motivated by the success of a field test of the process in southwest Saskatchewan in late 1996. Aside from expanding the technique's applicability to a wider range of reservoirs, a major aim was to identify and optimize promising chemical agents. The ultimate goal is to develop a process that could displace waterflooding as the standard for post-primary production.

Three reservoirs were chosen by the project clients as potential targets. Large quantities of produced oil/water/solids were collected and prepared for laboratory tests.

After a large number of rapid modified core screening tests, it was possible to formulate a chemical mixture for the field which proved to be the best candidate. In tests, the highest incremental oil recovery of about 30% IOIP -- was achieved at production costs of $6.25 per barrel of additional oil, well below the industry target of less than $10/bbl. This recovery method has been advanced to the point of field test readiness. The final report was presented to clients.

2000-2001 Results & Discussion Cont'd

Heavy Oil Upgrading with Supercritical Water (SRC)

The Saskatchewan Research Council (SRC) recognized the opportunity in field-scale upgrading for the heavy oil producer and has been working on the technology since the early 1990's. The focus is on a technology that reacts crude with water at supercritical conditions. Earlier tests achieved a product with pipeline-specification viscosity while suppressing coke formation; however, the partially upgraded oil was still classified as heavy oil. More recent testing has evaluated additive and catalysts to improve hydrogen transfer, thus substantially reducing viscosity and improving product density.

Using Ionic Liquids to Upgrade Heavy Oil (U of R/SRC)

Ionic liquids could potentially provide a novel upgrading technology, which would add value to heavy oil. This process would be a low temperature and a low-pressure operation. This year progress was made in demonstrating the application of ionic liquids to heavy oil upgrading. Work in the coming year will focus on separating reaction products from the ionic liquid.

Alkaline/surfactant/polymer flooding (SRC)

In this preliminary project, SRC assessed the suitability of ASP flooding in southwest Saskatchewan medium oil reservoirs. A comprehensive approach was taken to study the interaction of the ASP system and a typical medium oil from the region. This included fundamental measurements of interfacial tension (IFT) between the oil and water phases and of the viscosity of polymer solution in formation water, as well as a series of coreflood tests. The results obtained in this project indicated that alkaline/surfactant/polymer flooding is a suitable method for southwest Saskatchewan medium oil reservoirs.

The existing data and reservoir information were collected for the southwest Saskatchewan oil reservoirs. On the basis of screening criteria in the literature, the region's reservoir conditions, except for some of the formation types, are favorable to ASP flooding. If only sandstone formations are considered for this process, about 49% of the pools (64 of 134 producing horizons) in the region are good candidates for ASP flooding.

Laboratory core tests recovered significant residual oil from waterflooded cores. As well, the chemical formulation used in SRC's tests exhibited strong synergy, enhancing the process, and led to ultra-low interfacial tension. Overall, this feasibility project was completed with very positive results.

Methane Pressure Cycling (SRC)

The methane pressure cycling process involves the use of infill horizontal production wells located between existing vertical wells. The latter would be used for the injection of methane (or produced gas) and water on an appropriate schedule to pressure up the depleted reservoir. This pressure cycling is repeated until additional economic recovery is no longer feasible. The technique incorporating horizontal wells offers low operating costs with considerably improved sweep efficiency than is offered by vertical well operation.

Because of the price rise for methane, numerical simulation shifted to investigating the effects of co-injecting small amounts of carbon dioxide and flue gas. Data is being used as input for economic analysis by CERI, Calgary.

Effect of Gas in Steam-Assisted Gravity Drainage (SRC)

This highly focused, rapid project has the goal of improving the efficiency of the SAGD process through gas co-injection to reduce operating costs and emissions. Recent natural gas price hikes have jeopardized many proposed SAGD projects unless their efficiency (oil-steam ratios) can be improved to allow economic operation. Favourable results may extend applicability of the SAGD process beyond reservoirs presently considered economic and increase the recoverable resource base. A more efficient SAGD operation would offer consequent environmental benefits of reduced greenhouse gas emissions and water usage.

SRC is using large scaled 3-D models to investigate the effect of non-condensible gas on the SAGD process. This will be complemented by numerical simulation to model the work at field scale. This year, base-case SAGD runs were carried out in the physical model representing a channel-sand heavy oil reservoir.

Fine Solids in Oilfield Production (SRC)

This project's aim is to develop a site-specific heavy oil-solids separation process. Fine solids are responsible for many troublesome emulsions that need to be recycled through treaters, and slop oils and sludges that must be disposed. These treatment/disposal costs can easily reach $190,000 per year at some batteries. In addition, fine solids consume chemicals added for treating, or for emulsification in pipeline transportation. Studies will help to determine the causes of difficulty in separating a given oil-water-solids mixture by characterizing produced fluids and fine solids. As well, SRC will try to determine the reasons for past success or failure of oil-water-solids separation processes that companies have tried on an ad hoc, and use this information for designing cost-effective separation techniques.

This year, samples spanning the upstream to downstream gamut were collected, and oil/solids/water wastes were extracted in the laboratory. Analysis is underway.

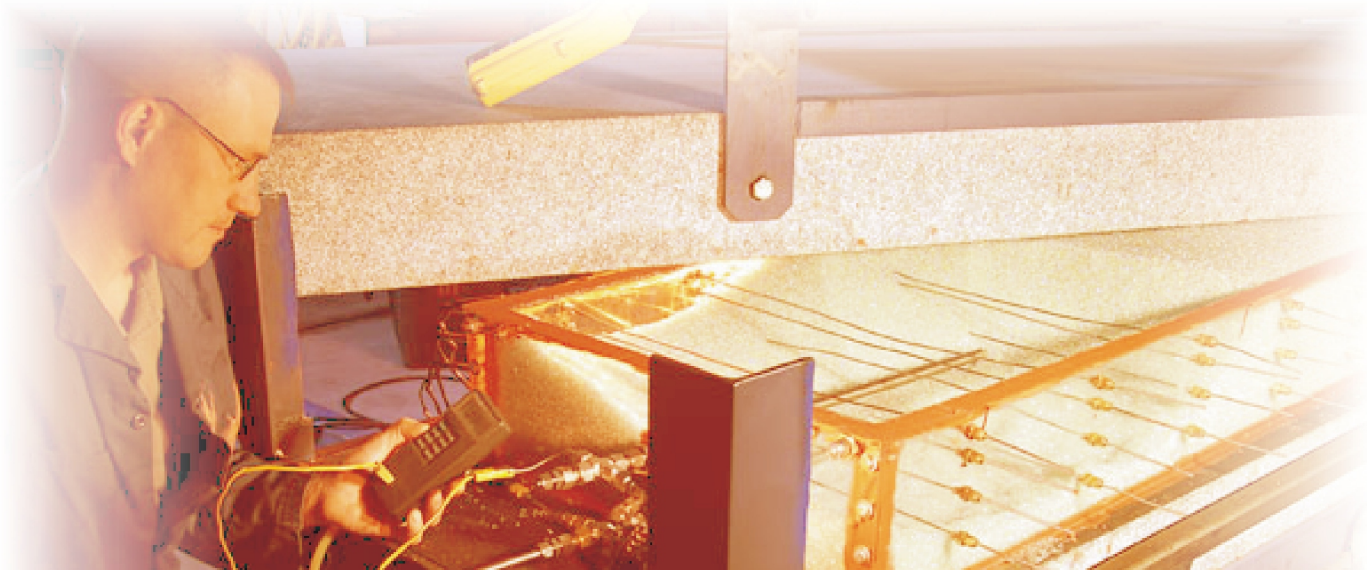
Variable Frequency Microwave: Oilfield Applications (SRC)

This project examined the use of variable frequency microwave energy in two very different oilfield applications: 1) treating slop oils; and 2) upgrading crude oil. Microwave treatment should in theory be ideal for these applications but this promise has not been borne out in practice. Previous research has been limited to two discrete frequencies (915 and 2450 MHz only), likely due to the limited availability of variable frequency microwaves (estimated at 16 worldwide). Experiments were conducted at a U.S. facility featuring one of these variable frequency units.

Positive results were obtained despite experimental constraints. Researchers found that microwave treatment could achieve an upgraded oil meeting pipeline specifications, and that it could detach some oil from a slop oil sample. Researchers recommended the purchase of a variable frequency microwave to allow follow-up of these promising results.

Note: Almost all SRC projects are conducted under an agreed format of client confidentiality. This is a period of two years for multiclient projects and is perpetual for single-client projects. The listing of publication titles must be approved by the clients. No non-confidential publications resulted from work completed in 2000-2001 PTRC-sponsored projects conducted by SRC.

* Many photos in this Annual Report provided courtesy of the SRC



CORPORATE DIRECTORY

Board of Directors

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Management Committee

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Natural Resources Canada

Malcolm Wilson
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Roland Moberg
Petroleum Technology Research Centre

Management Discussion and Analysis

Financial statements:

Statement A shows that PTRC had total current assets at the end of fiscal year 2000/2001 of $5,401,377 and current liabilities of $5,310,590. A restricted fund of $1,000,000 has been set up for purchase of new research equipment.

As can be seen in statement B, the annual program funding was $250,000 from Saskatchewan Energy and Mines and $980,000 from Natural Resources Canada. Specific project funding provided by Saskatchewan Energy and Mines and Natural Resources Canada amounted to $2,655,688. General and administration costs totaled $406,344 compared to $536,918 for the year ended March 31, 2000. A payout of $400,000 was made to SOCO as part of the PTRC commitment to the new building cost. New equipment was purchased for $205,022 equally split between the University of Regina and the Saskatchewan Research Council. Furthermore, Saskatchewan Energy and Mines has contributed $85,000 that has been earmarked for future equipment purchases.

Statement E shows that $5,063,420 was allocated to various research projects during the year with overall expenditures of $3,764,433, leaving unexpended funds of $1,409,549.

Statement F shows that a total of $375,000 was raised from both industry and Governments for the Vapex III project. At year end a total of $112,996 had been spent on this project leaving an unexpended amount of $262,004.

Statement G shows that we raised $3,753,782 for the pre-injection phase of the Weyburn CO_2 Monitoring Project. Cumulative expenditures at year-end were $2,781,533 leaving an unexpended amount of $972,249.

Statement H shows that the overall generated revenue were $5,433,017 with the industry funding of $846,062.

Measures of success:

The success of the PTRC will be gauged annually through an assessment of the effects of its activities in the following six areas:

1. Program Reach The reach of the PTRC into the petroleum industry and research community is important. Success in achieving expected reach would be measured by setting annual targets for such indicators as number of paying clients and research collaborators.
2. External Revenue-The long-term viability of the PTRC will depend on the ability of the organization to attract funding for its work beyond NRCan and SEM. Annual targets will be set for external funding for research carried out by SRC and U of R and for research coordinated by PTRC and carried out by other research institutions.
3. Impact of Completed Projects- Objectives will be set to measure the technical, economic, and environmental impact of completed PTRC projects.
4. Client satisfaction Client satisfaction with PTRC projects will be determined annually.
5. PTRC Recognition and Credibility Recognition and credibility of work sponsored by the PTRC will be measured by setting objectives for publications, invited presentations, awards, testimonials, licenses, patent royalties and NSERC industrial funds.
6. Learning Culture Objectives will be set to determine the continuous improvement in the expertise, capability and skills of the researchers involved in PTRC related projects.

No reporting has been done against the above measures of success during the last year. It is our plan to gradually introduce these measures as the PTRC partnership develops and matures.

AUDITORS' REPORT

To the Members of Petroleum Technology Research Centre Inc.

We have audited the balance sheet of Petroleum Technology Research Centre Inc. as at March 31, 2001 and the statements of operations, members' equity and cash flow for the year then ended. These financial statements are the responsibility of the Centre's management. Our responsibility is to express an opinion on these financial statements based on our audit.

We conducted our audit in accordance with generally accepted auditing standards. Those standards require that we plan and perform an audit to obtain reasonable assurance whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation.

In our opinion, these financial statements present fairly, in all material respects, the financial position of the centre as at March 31, 2001 and the results of its operations and changes in its cash flow for the year then ended in accordance with generally accepted accounting principles.

REGINA, Saskatchewan
July 3, 2001

Mintz & Wallace
Chartered Accountants

PETROLEUM TECHNOLOGY RESEARCH CENTRE INC.
BALANCE SHEET
AS AT MARCH 31, 2001

Statement A

	Capital Fund	Operating Fund	2001 Total	2000 Total
ASSETS				
CURRENT ASSETS				
Cash	$ -	$ 738,512	$ 738,512	$ 39,665
Accounts receivable	-	3,428,601	3,428,601	668,071
Temporary investments	1,000,000	231,333	1,231,333	1,088,085
Prepaid expenses	-	2,931	2,931	503
	1,000,000	4,401,377	5,401,377	1,796,324
CAPITAL ASSETS – Note 2	-	17,761	17,761	9,121
	$ 1,000,000	$ 4,419,138	$ 5,419,138	$ 1,805,445
LIABILITIES AND MEMBERS' EQUITY				
CURRENT LIABILITIES				
Accounts payable	$ -	$ 2,901,041	$ 2,901,041	$ 149,588
Deferred revenue – Note 1	1,000,000	1,409,549	2,409,549	1,510,562
	1,000,000	4,310,590	5,310,590	1,660,150
CONTINGENT LIABILITY – Note 3				
MEMBERS' EQUITY (DEFICIT)				
Unrestricted – Statement C	-	108,548	108,548	145,295
Restricted fund – Statement C	-	-	-	-
	-	108,548	108,548	145,295
	$ 1,000,000	$ 4,419,138	$ 5,419,138	$ 1,805,445

Approved on behalf of the Members'

_____ Director

_____ Director

See accompanying notes

PETROLEUM TECHNOLOGY RESEARCH CENTRE INC.
STATEMENT OF OPERATIONS
FOR THE YEAR ENDED MARCH 31, 2001

Statement B

	Capital Fund	Operating Fund	2001 Total	2000 Total
REVENUE				
GRANTS - ANNUAL FUNDING				
- Saskatchewan Energy & Mines	$ -	$ 250,000	$ 250,000	$250,000
- Natural Resources Canada	-	980,000	980,000	829,000
GRANTS - PROJECT FUNDING				
- Saskatchewan Energy & Mines	-	55,000	55,000	50,000
- Natural Resources Canada	-	1,017,708	1,017,708	-
- SPRI	-	1,582,980	1,582,980	-
- Province of Saskatchewan	400,000	-	400,000	1,600,000
- Interest income	-	86,527	86,527	25,717
INDUSTRY FUNDING	-	51,253	51,253	139,438
	400,000	4,023,468	4,423,468	2,849,155
EXPENSES				
ADMINISTRATION				
Advertising and promotion	-	10,999	10,999	14,670
Amortization	-	4,028	4,028	1,610
Bank charges and interest	-	906	906	314
Conferences	-	2,756	2,756	10,171
Consulting fees	-	42,997	42,997	85,142
Dues and subscriptions	-	1,022	1,022	4,794
Executive search	-	-	-	546
Insurance	-	2,792	2,792	4,500
Legal and accounting	-	24,728	24,728	28,735
Miscellaneous	-	14,560	14,560	31,796
Office	-	11,544	11,544	2,199
Relocation expenses	-	-	-	51,618
Rent		44,484	44,484	-
Research building & equipment	400,000	-	400,000	1,600,000
Salaries and benefits	-	215,686	215,686	135,506
Start-up costs (SRC)	-	-	-	103,978
Supplies -	7,169	7,169	46,813	
Travel	-	22,673	22,673	14,529
RESEARCH COSTS – Statement E				
Incubation projects	-	31,557	31,557	76,540
Innovation projects	-	3,417,292	3,417,292	626,916
Equipment projects	-	205,022	205,022	-
	400,000	4,060,215	4,460,215	2,840,377
EXCESS REVENUE (EXPENDITURES)	-	(36,747)	(36,747)	8,778

See accompanying notes

PETROLEUM TECHNOLOGY RESEARCH CENTRE INC.
STATEMENT OF MEMBERS' EQUITY
FOR THE YEAR ENDED MARCH 31, 2001

Statement C

	Capital Fund	Operating Fund	2001 Total	2000 Total
MEMBERS' EQUITY – beginning	$ -	$ 145,295	$ 145,295	$ 136,517
EXCESS REVENUE (EXPENDITURES)	-	(36,747)	(36,747)	8,778
MEMBERS' EQUITY -ending	$ -	$ 108,548	$ 108,548	$ 145,295

PETROLEUM TECHNOLOGY RESEARCH CENTRE INC.
STATEMENT OF CASH FLOW
FOR THE YEAR ENDED MARCH 31, 2001

	2001	Statement D 2000
OPERATING ACTIVITIES		
Excess of revenues over expenses	$ (36,747)	$ 8,778
Item not affecting cash:		
- amortization	4,028	1,610
	32,719	10,388
Net change in non-cash working capital items:	1,144,234	1,640,008
Net cash from operating activities	1,111,515	1,650,396
INVESTING ACTIVITIES		
Capital expenditure – building and equipment	(400,000)	(1,600,000)
Purchase of capital assets	(12,668)	(10,731)
Net cash used for investing activities	(412,668)	(1,610,731)
INCREASE IN CASH	698,847	39,665
CASH – beginning	39,665	-
CASH – ending	$ 738,512	$ 39,665

See accompanying notes

PETROLEUM TECHNOLOGY RESEARCH CENTRE INC.
STATEMENT OF PROJECTS AND EXPENDITURES & UNEXPENDED FUNDS
FOR THE YEAR ENDED MARCH 31, 2001

	Unexpended Funds 2000	Funds Allocated	Expenditures	Statement E Unexpended Funds 2001
INNOVATION PROJECTS – 2001				
Fine Solids	$ 32,000	$ 15,265	$ 47,265	$ -
Olephilic Membrane	8,711	(8,711)	-	-
Al Water/oil treater	21,000	735	21,735	-
Air Oxygen Injection	10,000	-	10,000	-
Weyburn CO_2 project	34,621	3,673,782	2,736,154	972,249
Carbonate Reservoir	-	30,000	10,000	20,000
Expert System for remediation	-	42,936	42,936	-
CO_2 Foam for mobility control	-	61,291	61,291	-
Bio-technologies	-	39,000	39,000	-
Methane pressure cycling	-	108,675	108,675	-
SAGD process	-	108,675	108,675	-
Intelligent systems in Saskatchewan	-	88,608	87,939	669
Knowledge based expert system	-	21,951	21,951	-
CO_2 Conformance control	-	35,000	22,010	12,990
Mobility control	-	22,203	22,203	-
CO_2 Storage	-	27,800	27,800	-
Electromagnetic heating	-	39,745	39,745	-
Selective permeability	-	10,200	3,249	6,951
Vapex III	-	375,000	112,996	262,004
	106,332	4,692,155	3,523,624	1,274,863
INCUBATION PROJECTS				
Gel Sand Control	1,620	-	-	1,620
Leaking O & G remediation	2,610	-	2,610	-
Chemical laboratory scoping	-	11,023	11,023	-
Bioprospecting phase II	-	14,800	5,590	9,210
Productivity of vertical wells	-	3,720	2,807	913
Asphaltene project	-	18,900	1,757	17,143
Microbials in concrete	-	14,800	-	14,800
3D visualizations	-	6,000	-	6,000
Unplugging oil wells	-	12,000	12,000	-
	4,230	81,243	35,787	49,686
EQUIPMENT PROJECTS	-	290,022	205,022	85,000
Total	$ 110,562	$ 5,063,420	$ 3,764,433	$ 1,409,549

PETROLEUM TECHNOLOGY RESEARCH CENTRE INC.
SCHEDULE OF CUMULATIVE DETAILS BY SELECTED PROJECTS
FOR THE YEAR ENDED MARCH 31, 2001

Statement F

	Actual	Budget
Vapex III		
Funders		
Mobil	$ 25,000	$ 25,000
Chevron	25,000	25,000
Anadarko	25,000	25,000
Crestar	25,000	25,000
Husky	25,000	25,000
Marathon	25,000	25,000
Petrovera	25,000	25,000
Wascana	25,000	25,000
AEC	25,000	25,000
NCUT	50,000	50,000
AERI	50,000	50,000
PTRC	50,000	50,000
	375,000	375,000
Providers		
ARC	-	85,000
Arkil	26,930	50,000
CMG	-	-
Nordic	-	20,000
NCUT	10,341	10,000
SRC	56,975	105,000
Fractional Solutions	12,380	15,000
CERI	-	25,000
Other	6,370	5,000
	112,996	315,000
Unexpended funds	$ 262,004	$ 60,000

PETROLEUM TECHNOLOGY RESEARCH CENTRE INC.
SCHEDULE OF CUMULATIVE DETAILS BY SELECTED PROJECTS
FOR THE YEAR ENDED MARCH 31, 2001

Statement G

	Actual	Budget
IEA Weyburn CO_2		
Funders		
PTRC	$ 105,000	$ -
SEM	105,000	-
NRCAN	1,000,000	-
PanCanadian	100,000	-
SaskPower	75,000	-
Amoco	79,186	-
Transalta	75,000	-
Wascana	75,000	-
Dakota	75,000	-
SPRI	2,062,720	-
Other	1,876	-
	3,753,782	-
Expenditures by task		
Task 1 – Collection of Field Data and Samples	761,175	1,426,000
Task 2 – Geoscience Framework	-	2,000
Task 3 – Geochemical Sampling, Monitoring & Predictioon	84,592	80,000
Task 4 – Crosswell Seismic	1,678,143	1,568,000
Task 5 – Laboratory Dynamic Fluid Testing	20,108	50,000
Task 6 – CO_2 Storage Econmics	-	-
Task 7 – Project Control	237,515	315,000
Task 8 – In Kind Contributions	-	-
	2,781,533	3,441,000
Unexpended funds	$ 972,249	$ (3,441,000)

PETROLEUM TECHNOLOGY RESEARCH CENTRE INC.
STATEMENT OF REVENUE GENERATED/EARNED/DEFERRED
FOR THE YEAR ENDED MARCH 31, 2001

Statement H

	Revenue Generated	Revenue Earned	Deferred Revenue
REVENUE			
GRANTS – ANNUAL FUNDING			
- Saskatchewan Energy & Mines	$ 250,000	$ 250,000	$ -
- Natural Resources Canada	980,000	980,000	-
GRANTS – PROJECT FUNDING			
- Saskatchewan Energy & Mines	140,000	55,000	85,000
- Natural Resources Canada	1,067,708	1,017,708	50,000
- SPRI	2,062,720	1,582,980	479,740
- Interest income	86,527	86,527	-
- Industry funding	846,062	51,253	794,809
	$ 5,433,017	$ 4,023,468	$ 1,409,549

NOTES TO THE FINANCIAL STATEMENTS
MARCH 31, 2001

1. SIGNIFICANT ACCOUNTING POLICIES

Purpose of organization

The Centre is an internationally recognized innovative leader in the petroleum research and development area that delivers world class basic and applied research for the benefits of the people of Saskatchewan, Canada and their customers around the globe.

Measurement uncertainty

The preparation of financial statements in accordance with generally accepted accounting principles requires management to make estimates and assumptions that affect the reported amount of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amount of revenues and expenses during the reported period. These estimates are reviewed periodically, and, as adjustments become necessary, they are reported in earnings in the period in which they become known.

Fund accounting

The accounts of the Centre are maintained in accordance with the principles of fund accounting. For financial reporting purposes, accounts with similar characteristics have been combined into the follow major funding groups:

i) Operating Fund

The operating fund reflects the primary operations of the Centre including revenues received from Sask. Energy & Mines, the federal government Dept of Natural Resources Canada and Industry to fund its operations and research projects. Expenses are for the daily operation of the Centre.

ii) Capital Fund

The capital fund reflects the commitment of the Provincial Government to assist in funding a Petroleum Research Building on the campus of the University of Regina. These funds are restricted to be used to construct a building ($ 400,000) and equipment ($ 2,600,000).

Revenue recognition

The Centre follows the deferral method of accounting for contributions. Restricted contributions related to general operations are recognized as revenue of the operating fund in the year in which the related expenses are incurred. All other restricted contributions are recognized as revenue of the appropriate restricted fund.

Unrestricted contributions are recognized as revenue of the operating fund in the year they are received or receivable if the amount to be received can be reasonably estimated and collection is reasonably assured.

1. SIGNIFICANT ACCOUNTING POLICIES (con't)

Temporary investments

Investments consist of money market mutual funds. They are stated at cost which approximates their fair market value.

Capital Assets

The capital assets are stated at cost and are amortized using the declining balance method at the rates indicated in Note 2. Half a year's amortization is taken in the year of acquisition.

2. CAPITAL ASSETS

	2001			2000
	Cost	Accumulated Amortization	Net Book Value	Net Book Value
Computers	$ 11,223	$ 4,420	$ 6,803	$ 9,121
Office furniture	12,175	1,217	10,958	-
	$ 23,398	$ 5,637	$ 17,761	$ 9,121

3. CONTINGENT LIABILITY

A reserve fund of $ 100,000 has been approved to cover termination costs for the General Manager. This fund will only be used if funding from the Federal and Provincial Governments end in 2003.

4. ECONOMIC DEPENDENCE

The Centre has received funding commitments from the Department of Natural Resources Canada and Saskatchewan Energy & Mines for the years 1999 through 2003 for its operating and research projects:

Funding	2000 - 2001 - $ 1,150,000
	2001 - 2002 - $ 1,150,000
	2002 - 2003 - $ 1,150,000

The Research Centre will be seeking additional funding for its research projects from the Petroleum Industry.

5. RESTATEMENT OF 2000 FIGURES

The prior year's financial statements included all revenues related to projects carried on by the Centre and similarly included all funds expended or committed to those projects. In order to be consistent with the current year's presentation the comparative figures have been reclassified to reflect only those revenues actually earned and expensed.

The effect of these adjustments to the comparative figures is that revenues have increased by $1,007,305 and expenses decreased by $110,562.

In a similar fashion, the Centre has reclassified its presentation of capital funds from equity to a liability. As funds are expended in this fund, an equivalent amount of revenue is recorded and any unexpended balance is shown as deferred revenue.

University of Regina Highlights

Research by University of Regina Faculty in support of PTRC related activities.

The year 2000 was one of expansion and consolidation as the University moved into its portion of the PTRC building in the Fall and the new NRCan professors established their research programs and, with their students, installed the new equipment bought with the grants awarded in 1999/2000. All of the new NRCan faculty received NSERC research grants, and while they are effective March 2001 the work for this notable achievement and recognition by their peers was done in 2000.
The total leveraged funding by University of Regina researchers in 2000 was $904,961.

Equipment Grants

Dr. L. Benedicenti, Dr. S. O'Leary, Dr. W. Abdul-Kader and Dr. R. Mayorga have received the total of $67,196 (NSERC Equipment grant -team) for a computer modelling system in 3D for oil reservoirs.

Dr. A. Chakma and Dr. P. Tontiwachwuthikul) have received a total of $99,322 (NSERC Equipment grant - team) for a Real Time Liquid Droplet Analyzer.

Dr. K. Johnson received $100,000 from Sask. E. C. & D. for a double glove box and reactor, to be located in SRC/PTRC for applied research on use of ionic liquids for oil upgrading, ethylene production and lignin processing.

Dr. P. Tontiwachwuthikul, Dr. R. Idem, Dr. K. Asghari and Dr. G. Huang have received a total of $85,525 (NSERC Equipment grant - team) for a GPC with Size Exclusion Analyzer system for studies on asphaltene and wax inhibition.

Dr. M. Ayub received a donation of computer software for drilling engineering, (WellView, value $120,000), from Pelaton Enterprises Inc. Calgary.

Research Grants

Dr. K. Asghari was awarded a $20,000 grant by PanCanadian Resources to study *"Application of gels for carbon dioxide conformance control in Weyburn oil field."*

Dr. G. Huang, Dr. A. Chakma and Dr. P. Tontiwachwithikul were awarded an NSERC Strategic Grant of $263,000 ($85,000 in 2000/20001) for *"An information system for assessing and managing environmental risks of air pollution from petroleum industries."*

Dr. K. Johnson was awarded a $12,000 research grant from Nautilus/Flatland Exploration for *"Unplugging oil wells using ionic liquids."*

The following grants become effective in 2001:

Dr. K. Asghari was awarded a four year research grant (2001/20005) of $86,000 by NSERC for his work on *"Gel placement and performance in fractures."*

Dr. R. Idem was awarded a four year research grant (2001/20005) of $86,000 by NSERC for his work on *"Separation of CO2 from flue gases: Alkanolamine degradation prevention studies."*

Dr. E. Shirif was awarded a four year research grant (2001/20005) of $76,000 by NSERC for his work on *"Drilling string vibration analysis."*

Dr. G. Zhao was awarded a four year research grant (2001/20005) of $86,000 by NSERC for his work on *"Fluid flow in naturally fractured reservoirs."*

On-going research grants and contracts

Work proceeded on multi-year contracts awarded in previous years, the value of these in 2000 was $315,918.

Publications by NRCan Research Professors and by professors with PTRC Grants, in 2000:

N. Lertpalangsunti and C.W. Chan, *"An Architectural Framework for Hybrid Intelligent Systems: Implementation Issues",* Journal of Intelligent Data Analysis, 4, p.375-393, 2000.

V. Uraikul, C.W. Chan and P. Tontiwachwuthikul, *"Development of an expert system for optimizing natural gas* operations*"*, Expert Systems with Applications, 18 (4), May 2000, p.271-282.

C.K. Sun, V. Uraikul, C.W. Chan and P. Tontiwachwuthikul, *"An integrated expert system/operations research approach for automation of natural gas pipeline operations"*, Engineering Applications of Artificial Intelligence,13, p.465-475, 2000.

C. W. Chan, L.L. Chen, and L. Q. Geng, *"Knowledge engineering for an intelligent case-based reasoning* system *for help desk automation"*, Expert Systems with Applications Journal (Elsevier Science*)*, 18 (2), Feb 2000, p.125-132.

C. W. Chan,, W. Kritpiphat and P. Tontiwachwuthikul, *"Knowledge engineering of a monitoring and control decision support system"*, Journal of Software Engineering and Knowledge Engineering (World Scientific Publishing Company*),* 10 (3), p.301-318, 2000.

University of Regina Highlights *Cont'd*

L. Chen and C.W. Chan, *"Ontology Construction from Knowledge Acquisition",* Proceedings of Pacific Knowledge Acquisition Workshop (PKAW 2000), Sydney, Australia, 11-13 December 2000.

L. Chen and C.W. Chan, "*Ontology design and its application to petroleum remediation domain",* Proceedings of Symposium on the Application of Artificial Intelligence in Industry, Melbourne Australia, Aug 28 - Sept 1, 2000.

S. Cheng, C.W. Chan and G.H. Huang, *"Multiple Criteria Decision Analysis for the Planning of Solid Waste* Management *Systems"*, CD of Proceedings of 4th International conference on engineering design and automation (*EDA 2000),* Orlando Florida, USA, July 30-Aug 2, 2000.

L. Q. Geng, C.W. Chan, Z.Y. Hu and G.H. Huang, *"Design of a knowledge-based system for* management *of petroleum contaminated sites"*, CD of Proceedings of 4th International conference on engineering design and automation (EDA 2000), Orlando Florida, USA, July 30-Aug 2, 2000.

L. Q. Geng, Z. Chen, C. W. Chan, and G. H. Huang, *"An intelligent decision support system for management of petroleum-contaminated sites",*Expert Systems with Applications, 20(3), in press (2001).

L. Liu, G. H. Huang, G.A. Fuller, A. Chakma and H.C. Guo, *"A dynamic optimization approach for non-renewable energy resources management in a regional system under uncertainty",* Journal of Petroleum Science and Engineering, 26(1), 301-310 (2000).

Z. Chen, G. H. Huang and A. Chakma, *"Risk assessment of a petroleum-contaminated site through a multi-phase and multi-component modeling approach",* Journal of Petroleum Science and Engineering, 26(1),273-282 (2000).

D.F. Wassell, K.E. Johnson and L.M. Mihichuk, *"Hydride ion behavior in acidic chloroaluminates at ambient temperatures"*, Proc. XIIth International Symposium on Molten Salts (Honolulu) Electrochem. Soc. 132 (2000).

M. Eltrub, K.E. Johnson, Y. Patell and R.D. Simank, "*Reactions of alkanes and cycloalkanes in ambient-temperature ionic liquids"*, Proc. XIIth International Symposium on Molten Salts (Honolulu) Electrochem. Soc. 143 (2000).

K. E. Johnson, "*Acids and bases in ionic liquids",* presented to NATO Advanced Research Workshop on Green Industrial Applications of Ionic Liquids, Crete, Greece, 2000. (Also in press).

Y. Patell, K.E. Johnson, L.M. Dulta, K.R. Seddon, L. Trowbridge and T. Welton, *"Dissolution of heavy oils and kerogen in ionic liquids"*, presented to NATO Advanced Research Workshop on Green Industrial Applications of Ionic Liquids, Crete, Greece, 2000. (Also in press).

K.E. Johnson, Y. Patell, D. Herrington, D. Soveran and C. Jackson "*Using ionic liquids to upgrade heavy oil",* S.R.C. Publication P-110-522-C-00.

P. Tontiwachwuthikul and A. Aroonwilas, *"Mechanistic Model for Prediction of Structured Packing Mass Transfer Performance in CO_2 Absorption with Chemical Reactions"*, Chemical Engineering Science,Vol. 55 *(2000) 3651-3663.*

A. Henni et al., *"Densities and Viscosities of Binary Mixtures of N-Methyldiethanolamine + Triethylene Glycol Monomethyl Ether from 25 °C - 75 °C and N-Methyldiethanolamine + Ethanol Mixtures at 40 °C",* Journal of Chemical and Engineering Data, 2000, Vol. 45, p. 247-253.

A. Chakma, W. Wilson and P. Tontiwachwuthikul, *"International Test Center for CO_2 Capture"*, 4th International Conference on Greenhouse gas Control Technologies", Cairns, Australia, August 2000.

A. Aboudheir, A, Chakma and P. Tontiwachwuthikul, *"CO_2-MEA Absorption in Packed Columns Comprehensive Experimental Data and Modeling Results"*, 4th International Conference on Greenhouse gas Control Technologies", Cairns, Australia, August 2000.

R. Idem et al. *"Economic and Cost Studies of Energy Efficient Solvent and Co-generation Process for CO_2 Separation from Flue Gas Streams"*, 4th International Conference on Greenhouse gas Control Technologies", Cairns, Australia, August 2000.

T. Supap et. al., *"A glance at the solvent stability problem in CO_2 Capture using Amine-treating Unit"*, 4th International Conference on Greenhouse gas Control Technologies Cairns, Australia, August 2000.

C.W. Chan, *"A Knowledge Modelling Technique and Industrial Applications",* (Chapter 34), in Knowledge-Based Systems Techniques and Applications, Volume 4, Academic Press USA, 2000.

G. H. Huang and L. Liu, *"Environmental management for energy industry"*,in Energy 2000: State of Art, Balaban Publishers, Charlottesville, VA, USA, 2000.

2000/2001 Annual Report

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