

PROJECT FACT SHEET

CONTRACT TITLE: Waterloo Cement-Casing Rock Interaction, A Special Project of the Porous Media Research Institute

ID NUMBER: 75-01SW51634

CONTRACTOR: University of Waterloo

B&R CODE: AB0555000

ADDR: Porous Media Research Institute
Department of Earth Sciences
Waterloo, Ontario, CAN N2L 3G1

DOE PROJECT MANAGER:

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CONTRACT PROJECT MANAGER:

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PROJECT SITE

CITY: Waterloo, Ontario **STATE:** CAN
CITY: **STATE:**
CITY: **STATE:**

CONTRACT PERFORMANCE PERIOD:

4/15/2001 to 4/14/2002
PROGRAM: Environmental-Gas
RESEARCH AREA: Environmental
PRODUCT LINE: DCS

CO-PARTICIPANTS:

| | | | |
|-------------------|--------------|---------------|------------|
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| FUNDING (1000'S) | DOE | CONTRACTOR | TOTAL |
|------------------------------------|-----|------------|-------|
| PRIOR FISCAL YRS | 7 | 0 | 7 |
| FY 2002 CURRENT OBLIGATIONS | 0 | 0 | 0 |
| FUTURE FUNDS | 0 | 0 | 0 |
| TOTAL EST'D FUNDS | 7 | 0 | 7 |

OBJECTIVE: Conduct research on the behavior of cement when used to secure casing and prevent formation communication.

PROJECT DESCRIPTION:

Background: The oilfield cement part of the cement consortium is being led by Dr. Maurice Dusseault, who has organized and directed a number of successful joint industry research project in the disciplines of petroleum geomechanics and new production technologies. The oilfield cement aspects are being undertaken from a new viewpoint based on geomechanics, rather than cement chemistry alone. The approach is based on stress/strain relationship in casing, cement and rock that develop during set and cure, exposure to thermal shocking, etc. The approach should provide a new basis on which to design cements. The Porous Media Research Institute has an international reputation in the discipline of petroleum rock mechanics.

Work to be Performed: Goals for the Final Year of the Project are as follows:

- Test the strength and shrinkage characteristics of the new cement formulation with light-weight aggregate to reduce its density. Three different densities have been tested, with different water contents
- Field install the cement for surface casings (200 m depth) and for deeper casings in shallow applications in Alberta. (These wells will be un-instrumented).
- Field install the cement in a well with deeper casing sometime in 2002.
- Test the cement formulation in the laboratory with ground rubber as an additive (ground rubber is a waste material that is lightweight, ductile, and can serve to replace part of the mineral aggregate in the cements).
- Execute a series of workability and consistency tests in a commercial cement company laboratory (NOWSCO (BJ Services), Calgary, Alberta) to demonstrate that it meets specifications.
- Strength tests and shrinkage tests with Type-50 cement (Sulphate resistant and less susceptible to salt and acid effects)
- Laboratory sonic transit time tests for dense formulations

PROJECT STATUS:

- Current Work:** Thermal conductivity tests are complete for the high-density formulation
- Thermal expansivity tests are complete on the high-density formulation
- Strength tests on the high-density formulation are complete (high density designed for squeeze cement applications)
- Several unconfined compression strengths at high temperatures (250 C and 350 C) on high density cement complete
- Shrinkage assessments are ongoing, but a great deal of data has been collected, showing that the high-density formulations are all non-shrinking
- Acid resistance tests are complete
- Cyclic and stage triaxial testing of the dense formulation are complete.
 - Testing done at room temperature, 35 C and 55 C
 - Load-unload cycles used to test ductility and stiffness
 - Peak strength determined
 - Fracture type noted (photographic data)

The Waterloo Cement Project presented a Joint Industry Proposal for a full-scale field testing of the cement in wells that are properly instrumented. This was not supported at this time by the industry, despite the fact that support for the project was provided in the past. Therefore, it has been decided to terminate the project in the 2002 Year.

Scheduled Milestones:

- Continue work on mechanisms of leakage cmplt
- Continue work on characteristics of conventional oilfield cements cmplt
- Continue development of new cement formulation ongoing
- Provide reports on developments of laboratory work ongoing
- Attend the Porous Media Research Institute Annual Review
- Opportunity to participate in field trials canceled

Accomplishments: Society of Petroleum Engineers Paper 64733, ?Why Oilwells Leak: Cement Behavior and Long-Team Consequences?, Maurice B. Dusseault, SPE, Porous Media Research Institute, University of Waterloo, Waterloo, Ontario; Malcolm N. Gray, Atomic Energy of Canada Limited, Mississauga, Ontario; and Pawel A. Nawrocki, CANMET, Sudbury, Ontario.

TECHNOLOGY TRANSFER:**Technology/Information Transfer:**

Public Relations: Dr. Maurice B. Dusseault, 519-888-4590

The new cement formulation and variations of it are now available commercially to any buyer through:

PRISM Production Technologies Inc Phone: 1 780 486 2222, ask for Hal Soderberg (extension 223)
 #207 – 11434 168 St Fax 1 780 484 7177
 Edmonton AB T5M 3T9 Visit www.prismpt.com