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WORKSHOP REPORT

CONSERVATION AND PROTECTION  
GROUNDWATER WORKSHOP

ENVIRONMENT CANADA

NOVEMBER 18-20, 1986

HULL, QUEBEC

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1986

KATHERINE E. ARKAY CONSULTING



TO  
A

Participants of the Groundwater Workshop

FROM  
DE

Assistant Deputy Minister  
Conservation and Protection

SECURITY - CLASSIFICATION - DE SÉCURITÉ
OUR FILE/NOTRE RÉFÉRENCE
YOUR FILE/VOTRE RÉFÉRENCE
DATE <b>SEP 11 1987</b>

SUBJECT  
OBJET

PROCEEDINGS OF GROUNDWATER WORKSHOP

I would like to take this opportunity to distribute to you the proceedings of the Groundwater Workshop and thank you for your participation and your very valuable contribution. It is a tribute to this Service that you have been able to respond to the groundwater issue in such an effective manner. I intend to ensure that effective management and direction of our future groundwater activities is provided by issuing an Action Plan in the very near future.

With this in mind, I will be looking to place the groundwater issue on the agenda of the Conservation and Protection National Management Conference to take place in October.

I thank you again and look for your support in our future endeavors related to groundwater conservation and protection.

  
Lorette Goulet

## ABSTRACT

Groundwater protection is an issue of increasing environmental concern in Canada. A Conservation and Protection (C&P) Groundwater Workshop was held November 18-20, 1986 in Hull, Quebec. The Workshop reviewed groundwater concerns, and the current C&P groundwater-related responsibilities, activities and resources. The Workshop identified directions for future groundwater work, and issues for consideration by C&P management.

Considerable C&P groundwater-related work is underway in the regions, research/technology development institutes and at headquarters. Work focuses on assessing, preventing and treating groundwater contamination. Workshop presentations covered: C&P management; research, technology development and demonstration; guides, standards, codes; assessments and agreements; and regional activities.

The Workshop Report includes summaries of individual Workshop presentations and Working Group reports, and an overall Summary of the Workshop proceedings and recommendations.

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**PART I**

**WORKSHOP SUMMARY**

**CONSERVATION AND PROTECTION  
GROUNDWATER WORKSHOP**

**NOVEMBER 18-20, 1986  
HULL, QUEBEC**

## WORKSHOP SUMMARY

### 1.1 INTRODUCTION

Workshop Format and Attendance

Workshop Report

Workshop Objectives

### 1.2 SUMMARY

Overview

Groundwater Issues

Organizations with Groundwater Interests

Federal Mandate and Role

Anticipated Results from Federal Involvement

Current C&P Groundwater Activities

Potential Areas for New C&P Initiatives

Current Co-ordination of Groundwater Work Within C&P

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Assessment of Workshop Results Versus Objectives

### 1.3 RECOMMENDATIONS

General Recommendations

Directions for Future Work

### 1.4 ACKNOWLEDGMENTS



## WORKSHOP SUMMARY

### 1.1 INTRODUCTION

Groundwater protection is an issue of increasing environmental concern in Canada. Conservation and Protection (C&P) personnel are involved in a broad spectrum of groundwater-related work in the regions, research institutes and at headquarters. At present, there is neither an approved C&P Groundwater Action Plan, nor a mechanism for assessing and co-ordinating C&P groundwater work.

#### Workshop Format and Attendance

To address C&P groundwater issues, a Conservation and Protection Groundwater Workshop was held at the Ramada Inn (Hull, Quebec) November 18-20, 1986. Fifty-nine (59) of the sixty-seven (67) Workshop participants were from within C&P. Inland Waters (IW), Environmental Protection (EP), headquarters, regions and research institutes were represented. A breakdown of participants by Organization and function, and a list of participants are provided in Part 4 of this Report.

During the first two days, presentations were made in five areas:

- C&P management;
- Research, technology development and demonstration;
- Guides, standards, codes and regulations;
- Overviews, assessment and agreements;
- Regional activities and issues.

On the third morning, Workshop participants were allocated to specific Working Groups. The Working Groups focused on identifying current groundwater issues and programs, and recommending future directions for groundwater-related work. In the afternoon, summaries and recommendations were presented for the individual Working Groups and the overall Workshop.

A Workshop Agenda is provided in Part 5.A of this Report.

### Workshop Report

The Workshop Report reflects the format and organization of the Workshop. Individual presentations are summarized. NOTE: The Report is a summary, not a transcript of the proceedings.

Some of the material in the Workshop Report was not included in the original presentations. Minor additions have been made to augment or clarify individual presentations.

### Workshop Objectives

The five Workshop objectives are listed below. Objectives 1, 2 and 3 are the original objectives. Objectives 4 and 5 were added in response to requests made by L. Goulet, R. Pentland and F. Hurtubise during their presentations.

1. **To Exchange Information.** Conservation and Protection participants should exchange information on groundwater issues, programs, and technology.

2. **To Develop Recommendations for Future C&P Groundwater Work.** Groundwater issues and current C&P groundwater work should be reviewed, to identify proposed directions for future work. The following questions should be answered:

- What are the C&P groundwater mandate and responsibilities?
- How can C&P best prevent groundwater-related problems?
- How can C&P best assess groundwater-related problems?
- How can C&P best remedy groundwater-related problems?

3. **To Develop a Proposed "Issues Management" Structure for Groundwater.** A management, and reporting system for C&P groundwater related work should be recommended.

4. To "Roll-Up" C&P Groundwater-Related Activities. Groundwater related activities are not focused in a specific Branch or Region, but are carried out in many responsibility centres within C&P.

To facilitate review and analysis, C&P groundwater activities should be "rolled-up" into a program. Emphasis should be given to the total resources, and to the inter-relationships of the different C&P responsibility centres through groundwater work.

5. To Provide Detailed Groundwater Work Plans for 1987-88. Detailed work plans showing proposed 1987-88 groundwater activities should be prepared. The information will assist in:

- Developing the draft C&P Groundwater Action Plan;
- Integrating groundwater activities into operations planning;
- Assessing whether current groundwater activities meet Departmental responsibilities;
- Identifying the best projects for allocation of available human and financial resources.

## 1.2 SUMMARY

### Overview

The Conservation and Protection Groundwater Workshop (November 18-20, 1986) provided the opportunity to: exchange groundwater-related information; assess existing C&P groundwater-related work; and develop recommendations for future work.

The Workshop participants identified groundwater contamination as an emerging environmental concern in Canada. Groundwater management is primarily a provincial responsibility. The federal government has specific

groundwater responsibilities relating to federal lands, federal activities/facilities, international and interprovincial waters. The federal government also has a publicly perceived, responsibility for ensuring protection of the Canadian environment, groundwater included. A variety of federal roles relating to groundwater were identified. There is a need for management review and decisions regarding the roles to be adopted.

A number of C&P Groundwater Action Plans have been drafted, but at present there is neither an approved Plan nor a co-ordinated Groundwater Program. An Action Plan and a co-ordinated Program are recommended to ensure that departmental responsibilities are met, and for most effective allocation of available resources.

Considerable C&P groundwater-related work is underway in the regions, research/technology development institutes and headquarters. Work focuses on assessing, preventing, and treating groundwater contamination.

Resources currently allocated to groundwater work are considered inadequate to satisfy the recommended C&P roles. There is a need for additional dollars, PY's and hydrogeological expertise.

The future C&P Groundwater Program should be partially "targetted" to specific issues. The program should also address the uniquely federal opportunities and responsibilities for national overviews, and co-ordination of a national program.

#### Groundwater Issues

Groundwater protection is a major health and environmental issue. Over 25% of Canadians are directly dependent on groundwater for drinking water. Because of the inter-relationship between ground and surface waters, many surface water users are also affected by groundwater quality.

Groundwater contamination can affect fish and wildlife habitat as well as human consumption and use. Contamination has resulted in known environmental problems, and clean-up costs in Canada.

Sources of groundwater contamination include:

- Leaking underground storage tanks;
- Decommissioning of industrial sites;
- Spills;
- Municipal/hazardous landfills;
- Acid rain;
- Pesticides.

Canadian groundwater resources (quantity and quality) are poorly known and documented. The extent of Canadian groundwater contamination is not known. It is probable that identified incidents of groundwater contamination are just the "tip of the iceberg".

#### Organizations with Groundwater Interests (Stakeholders)

There are numerous stakeholders with respect to groundwater. The provinces have the primary responsibility for groundwater management. The federal government, industry, public, consultants, universities and special interest groups all have interests and a role to play.

#### Federal Mandate and Role

To date there is no departmental policy regarding the federal mandate and role on groundwater issues. There is a need for management to clarify the federal role.

The federal mandate and role regarding groundwater have not been interpreted consistently within Conservation and Protection.

- Groundwater is considered within the federal mandate and related work is underway at Environmental Protection (Headquarters), and the C&P research and technology development centers.
- Groundwater management per se is generally not considered to be within the mandate of Inland Waters (Headquarters) although the Directorate has supported a major groundwater research program for several decades.
- In the Regions the work done regarding groundwater varies with perceived federal mandate, the regional importance of groundwater and other factors.

In her Workshop presentation, L. Goulet (ADM, Conservation and Protection) stated that the Department and the Minister have a responsibility for ensuring protection of the Canadian groundwater resource.

A number of appropriate federal roles relating to groundwater were identified during the Workshop. The roles focus on assessment, prevention and remediation of groundwater contamination. Specifically:

- Ensuring exemplary groundwater management in association with federal facilities and activities;
- Ensuring protection and quality of transboundary waters;
- Providing research and technology development/demonstration to improve prevention, assessment, and treatment of groundwater contamination;
- Working with provinces, industry and the public to build consensus on groundwater policy;
- Providing national leadership in developing guidelines, codes and standards which include groundwater protection;
- Participating in "targetted" groundwater projects addressing high profile issues (e.g. Niagara River);
- Integrating various aspects of water: surface, ground, quantity, quality, use, regional considerations;

- Developing models to predict movement and release of contaminants, groundwater use/supply, etc;
- Developing a uniform database management system;
- Participating in assessments to register and re-evaluate pesticides;
- Providing information, and training relating to groundwater protection.

### **Anticipated Results From Federal Involvement**

The federal role as listed above would:

- Help provinces, industry and the federal government respond effectively to groundwater issues;
- Provide a national overview of groundwater issues, and a more uniform response to the issues;
- Ensure that the Minister meets his publicly perceived responsibilities.

### **Current C&P Groundwater Activities**

#### **Research and Technology Development**

**National Hydrology Research Institute (NHRI)** is working primarily on toxic chemicals in Western Canada. Work involves assessing groundwater quality and contaminant problems, and understanding contamination processes. The objectives are to contribute to prevention of contamination problems. NHRI advises regional and provincial operations staff on specific issues. Work includes field, laboratory and modelling components.

**National Water Research Institute (NWRI)** is working to understand the movement and fate of contaminants in groundwater, and to develop tools for site-specific assessment and to support clean-up work. NWRI projects are primarily in Eastern Canada.

On specific projects NWRI works closely with C&P regions and headquarters, Wastewater Technology Centre, River Road Environmental Technology Centre (RRETC), and the provinces.

**Wastewater Technology Centre (WTC)** is working to develop: effective waste treatment technology; methods for predicting release of contaminants to groundwater; and technology to prevent and treat contaminated groundwater. WTC is also involved in technology demonstration projects for groundwater treatment.

WTC often works in collaboration with C&P headquarters, the regions, NWRI, RRETC, provinces and industry, by contributing to solution of specific problems, and to development of guidelines, codes and standards.

**River Road Environmental Technology Centre (RRETC)** is working on technology development and demonstration related to prevention, detection and response aspects of environmental emergencies (e.g. spills). RRETC generates technical information on the nature, behaviour and effects of spilled oil and chemicals. The Centre also provides advice and assistance, and promotes improved knowledge and better operating practices.

RRETC works closely with WTC, NWRI, C&P headquarters, provinces, and industry.

#### **Codes and Guidelines**

**Industrial Programs Branch (IPB).** Development of industrial codes of practice and guidelines, to assist in environmental protection, is an established Conservation and Protection function. The development of codes/guidelines involves participation from provinces, industry, and C&P (regions, headquarters and research institutes). Work involves: identifying problems; identifying and developing technology; developing codes/guidelines; implementing programs; and assessing effectiveness of the codes/guidelines.



C&P has frequently co-ordinated the provinces and industry in developing codes and guidelines in areas of primary provincial responsibility.

Codes/guidelines which include groundwater protection provisions have been, or are being, prepared to deal with:

- Underground storage tanks;
- Decommissioning of industrial sites;
- Steam electric power generation plants;
- Hazardous waste landfills;

Deepwell disposal of hazardous wastes is an activity with potentially serious groundwater effects, for which no guidelines or codes of practice exist in Canada. Guidelines or codes should be developed.

#### **Water Quality Guidelines**

**Water Quality Branch (WQB).** Water quality guides have been developed for five water uses:

- Drinking water supplies;
- Recreational waters;
- Freshwater aquatic life;
- Agriculture;
- Industrial.

The guidelines apply to both ground and surface waters.

#### **Regional/Operations Activities**

Groundwater-related work in the regions is focused on assessing, preventing and treating groundwater contamination. Some regions are more advanced in their groundwater programs. The Atlantic region is developing a Regional Groundwater Action Plan.

In all cases groundwater-related work undertaken in the regions is limited by available resources and expertise. Currently, only one region (Pacific) has a hydrogeologist in an operations position.

Groundwater work in the regions is closely linked to headquarters and research/technology development institutes on a project-specific basis.

### Potential Areas for New C&P Groundwater Initiatives

#### **Federal-Provincial Agreements**

At present groundwater is not included in federal-provincial agreements. The agreements would be a useful vehicle for promoting groundwater-related policy and programs. Consideration should be given to including groundwater in future agreements.

Note: Inclusion of groundwater in federal-provincial agreements would not involve federal cost-sharing of major groundwater monitoring. Such monitoring is considered a provincial responsibility.

#### **Groundwater Economics and Use**

At present no work is underway within C&P on groundwater economics, or supply and demand. Economics will ultimately influence all aspects of water use. The value of Canadian water resources should be quantified. In addition, the existing IWD water supply/demand model should be expanded to include groundwater.

### Current Co-ordination of Groundwater Work Within C&P

Considerable groundwater work is underway within C&P. To date groundwater work undertaken has been ad hoc, in response to perceived

needs. There is no formal C&P co-ordination process for groundwater activities. Groundwater-related work underway can be "rolled-up" into a groundwater "Program". However, the resulting "Program" is uneven, limited and may not meet departmental responsibilities.

#### Co-ordination With Other Branches of Environment Canada

Groundwater contamination can affect wildlife habitat, land use, and activities in national parks. Alternately, land use and parks activities can cause groundwater contamination. Wildlife and Parks personnel are involved in groundwater-related assessment/protection work, and deal with C&P on a project-specific basis.

#### Structure for Groundwater "Issues Management"

Owing to time limitations, the Working Groups did not develop a recommended structure for C&P groundwater "issues management" (co-ordination). It is apparent from the Workshop proceedings that there is a need for a formal co-ordinating mechanism, at least to initiate an effective groundwater program.

Options will be developed for inclusion in the C&P Groundwater Action Plan. One option is allocating 1 or 2 headquarters PY's to groundwater program co-ordination in 1987-88, and formation of a Task Force to work closely with the co-ordinator(s). The Task Force would include representatives from the regions, research and technology institutes, and headquarters.

#### Current Resources

The resources (\$ and PY's) allocated to C&P groundwater work are difficult to quantify because groundwater work is frequently part of more comprehensive projects.

Resource information was not provided in all Workshop presentations. A post-Workshop analysis by P.G. Finlay (IPB) estimates the 1986-87 resource allocation to C&P groundwater activities at 30 PY and over \$1.2M.

In addition to the C&P A-Base, resources have been obtained from: other federal sources including Program for Energy Research and Development (PERD) and Pestfund; industry; and provinces.

### Adequacy of the Current C&P Groundwater Program and Resources

Groundwater protection has not yet been integrated into Environment Canada planning and program development; groundwater was not mentioned in the Minister's most recent "State of the Environment Report".

In the absence of a stated departmental mandate/role or a co-ordinated groundwater program, it is difficult to determine whether departmental responsibilities are being met or to estimate required resources.

There is a definite need for a co-ordinated groundwater program to ensure that groundwater-related work meets departmental responsibilities, and to maximize program efficiency and cost-effectiveness.

Throughout C&P, groundwater-related work undertaken is limited by interpretation of the federal mandate and/or available resources and expertise.

Operations, research and technology development groups have insufficient resources to meet identified groundwater-related needs. It is estimated that for an effective C&P groundwater program an additional 20 PY's are required (10 PY's for assessment; 10 PY's for remediation). In addition to extra dollars and PY's there is a need for extra hydrogeological expertise.

### Assessment of Workshop Results Versus Objectives

The Workshop successfully met several but not all of the Workshop objectives.

- The Workshop did provide a good forum for exchanging information.
- The Workshop Report provides a "roll-up" of C&P groundwater-related work.
- Through presentations and Working Group activities, recommendations for future groundwater work were generated.
- An accurate summary of the 1986-87 groundwater-related resource allocation was not compiled. Not all presentations included resource information.
- Detailed work plans for 1987-88 were not generated. The information was not available.
- The Workshop confirmed the need for groundwater program co-ordination. A structure to provide groundwater "issues management" was not discussed (in detail) in Workshop presentations or by the Working Groups; no related recommendations were developed at the Workshop.

## 1.3 RECOMMENDATIONS

### General Recommendations

- Groundwater assessment and protection should be confirmed as departmental priorities.
  - The C&P mandate and roles regarding groundwater should be clarified, and confirmed by management.
  - A Conservation and Protection Groundwater Action Plan should be adopted.
  - A co-ordinated C&P Groundwater Program should be developed.
- Note: Recommended directions for future work are listed below.

- A Groundwater Program co-ordination structure should be established at least until the Program is well established.
- A National Groundwater Protection Strategy should be developed, in co-operation with the provinces and with input from industry and special interest groups.
- Resources (\$ and PY's) allocated to groundwater-related work should be increased. Available hydrogeological expertise should be increased, particularly to meet operational needs in the regions.

Note: To determine the resources required for groundwater activities, the departmental responsibilities and role require clarification, and an Action Plan is required. Additional resources are required based on the recommended departmental role and activities.

#### Directions for Future Work

Future groundwater work should focus on:

- Meeting clear federal responsibilities regarding transboundary waters and federal facilities;
- Working closely with the provinces and industry to develop a co-ordinated national strategy, guidelines, codes of practice, etc.;
- Developing an effective operations (regional) role;
- Research and technology development/demonstration related to assessment, prevention and treatment of groundwater contamination.

Note: The groundwater related research and technology development conducted by C&P are an important draw for negotiating a national strategy, etc. The provinces and industry, value the research and technology development/demonstration provided by C&P.

Through the Workshop presentations and the Working Groups a variety of recommended future work was identified:

- Prevention of groundwater contamination through development of industry-specific guidelines and codes of good practice. The guidelines should be developed in conjunction with the provinces and industry;
- Development of additional water quality guidelines;
- Ensuring groundwater protection for transboundary water;
- Ensuring groundwater protection in association with federal facilities and activities;
- "Targetted" (project or issue-specific) prevention, assessment and treatment of groundwater contamination;
- Effective input to registration and re-evaluation of specific pesticides;
- Participation in high profile groundwater management projects (e.g. Niagara);
- Assessment of regional environmental-emergency-response planning, and participation in response activities;
- Research on contaminant migration and processes in groundwater;
- Development of predictive models for contaminant-specific behaviour;
- Development and demonstration of technology for preventing and treating groundwater contamination resulting from industrial activities and spills;
- Inclusion of groundwater in federal-provincial agreements;
- Development of a groundwater supply/demand model;
- Better integration of all aspects of water: surface, ground, quantity, quality, use, demand;
- Consideration of aquifer classification systems based on water use;
- Consideration of the need and mechanisms for a Canadian equivalent to the U.S. Superfund, and for re-establishment of the former EC Toxfund;
- Development of an "audit" monitoring program;
- Development of a national groundwater database management system;
- Preparation of a "State of Canadian Groundwater Report";
- Provision of technical information and training to interested parties, and the public.

#### 1.4 ACKNOWLEDGMENTS

The Workshop was organized by a Steering Committee consisting of:

Patrick Finlay, IPB, Ottawa;

John Gilliland, NHRI, Saskatoon;

Rick Findlay, EP, Ontario Region, Toronto;

Terry Hennigar, IW, Atlantic Region, Dartmouth.

The Steering Committee members thank the Workshop participants for their interest and work.

Katherine Arkay (Katherine E. Arkay Consulting, Ottawa) co-ordinated Workshop organization and logistics and prepared the Workshop Report.



**PART II**

**WORKSHOP PRESENTATION SUMMARIES**

**CONSERVATION AND PROTECTION  
GROUNDWATER WORKSHOP**

**NOVEMBER 18-20, 1986  
HULL, QUEBEC**



**WORKSHOP PRESENTATION SUMMARIES**

**2.1 MANAGEMENT NOTES**



## INTRODUCTORY NOTES FROM L. GOULET

Assistant Deputy Minister, Conservation and Protection

The Minister recognizes the importance of groundwater as a Canadian resource, and the importance of groundwater assessment and protection to Environment Canada. It is also clear that the public expects Environment Canada to play a positive role in ensuring prudent use, and protection of groundwater.

Aspects of groundwater are being looked at by several groups within Conservation and Protection. Work of very good quality is done to protect groundwater. There is a major problem. To date, the groundwater work within C&P has not been "rolled up". It has not been possible to clearly review and assess:

- What we do;
- Whether we are working in the same direction;
- Whether we are meeting departmental objectives and responsibilities.

The groundwater issue is complex. It remains critical to review our work and ensure that we are meeting the Department's and the Minister's groundwater responsibilities.

Groundwater activities occur in several Branches and Divisions of C&P. The effective co-ordination of groundwater activities would be another example of the effective integration and functioning of C&P.

### Instruction to Workshop Participants

To assist management in reviewing the groundwater program, the Workshop should identify groundwater work underway within C&P and indicate how the various activities fit together.



## INTRODUCTORY NOTES FROM RALPH PENTLAND\*

Director, Water Planning and Management Branch, C&P

**\*Note:** R. Pentland present as designate for D. Davis,  
Director General, Inland Waters.

### Issues and Mandate

Groundwater contamination can be long-term and can affect groundwater quality, surface water quality, water use and regional economics.

Regional and market considerations will influence all aspects of groundwater, from determining desired water use to remediation decisions.

Groundwater management is a provincial responsibility. The federal mandate on groundwater issues is weaker than for surface waters, since constitutional responsibilities related to fisheries and navigation do not apply. There are some clear federal groundwater responsibilities related to:

- Transboundary waters;
- Federal facilities/activities/lands;
- Research.

There are several appropriate roles for federal involvement:

- Transboundary groundwater protection;
- Groundwater protection at federal facilities;
- "Targetted Management" in response to specific groundwater problems (e.g. Niagara Project Co-ordination);
- Development of guidelines and codes of practice to prevent groundwater contamination;

- Participation in economic agreements (e.g. P.E.I. Agreement);
- Integration of various aspects of water: quantity, quality, surface water, groundwater, water uses.

**Instruction to Workshop Participants**

Workshop participants should be thorough but pragmatic in developing the overall Program and Work Plan. Attempt to develop a Program that meets the identified needs and can be achieved ("is do-able").

Assume no new resources other than by reallocation within C&P, but remember that really worthwhile projects always seem to get the required resources.



**INTRODUCTORY NOTES FROM FERN HURTUBISE\***

Director, Technology Development and Technical Services, C&P.

**\*Note:** F. Hurtubise present as designate for P. Higgins,  
Director General, Environmental Protection.

**C&P Groundwater Strategy and Action Plan**

Over the past year, good progress has been made towards development of a C&P Groundwater Strategy and Action Plan. P. Higgins and D. Davis have reviewed the most recent (October 1986) draft. Prior to endorsing the Plan they have requested that Pat Finlay and John Gilliland submit a more detailed Action Plan by December 15, 1986. More detail is necessary, to understand the Program and resource implications.

Four items which should be included in the December 15 package are:

1. Recommendations on how to handle groundwater in terms of C&P "issue management".
2. A detailed strategy for implementing the Action Plan (Note: Consider federal, provincial, industry and public aspects).
3. Operational planning guidelines to ensure a well developed, integrated program.
4. Information on specific Projects and activities proposed for 1987-88, so that the overall Groundwater Program can be reviewed and assessed.

**Instruction to Workshop Participants**

The Workshop is a good forum for exchanging information, and developing recommendations for future groundwater related work. Try to ensure that the Workshop, and specifically the Working Groups, generate the information requested for the detailed Action Plan.

## C&P GROUNDWATER ACTION PLAN AND STRATEGY

P. G. Finlay (Industrial Programs Branch, Ottawa)

### History and Status

Groundwater work has been underway within C&P for many years, without a comprehensive Groundwater Strategy or Action Plan.

In 1984, Rick Findlay (EP - Ontario Region) identified groundwater protection as an emerging environmental concern, and noted that a Departmental strategy was required.

A draft Action Plan was prepared by EPS Ontario and submitted to the EPS Board in March, 1985. The Board instructed Vic Shantora (IPB - Ottawa) to further develop the Plan. Pat Finlay (IPB) and John Gilliland (NHRI) worked on subsequent drafts with input and review from numerous C&P responsibility centers. The current draft (October 1986) was submitted to C&P management. P. Higgins and D. Davis have reviewed the Plan and have requested more detailed information on groundwater work currently underway, and work recommended for 1987-88. The additional information is to be submitted by December 15, 1986.

### Content of the Action Plan (October 1986 Draft)

A copy of the Action Plan is included in Appendix 5.B of this Report. The Plan covers:

- . Problem definition
- . Opportunities
- . Stakeholders
- . Federal Role
- . Anticipated Results
- . Plans
- . Resources Required
- . Recommendations



**WORKSHOP PRESENTATION SUMMARIES**

**2.2 RESEARCH, TECHNOLOGY DEVELOPMENT AND DEMONSTRATION  
PRESENTATIONS**

**MODERATOR: R. FINDLAY**



## NATIONAL HYDROLOGY RESEARCH INSTITUTE (NHRI) PROGRAM

D. McNaughton (NHRI - Saskatoon)

### Mandate

NHRI conducts water related research in western Canada. The research is to assist Canadians in understanding and managing water resources. NHRI also provides information and advice on water resource issues.

### Program

Several groundwater projects are underway. The focus is on toxic chemicals. Projects include:

1. **Osoyoos, B.C.:** A sampling program to determine groundwater effects on Lake Osoyoos, an international water body.
2. **Abbotsford, B.C.:** A study to identify contaminants, degree of contamination, and provenance of contaminants in a major unconfined aquifer.
3. **Big Bend, Alberta:** A joint study with Alberta Environment. The study will look at pesticide contamination of a shallow, unconfined aquifer in an area of irrigation and well-documented, intensive pesticide use.
4. **Manitoba:** Negotiations are underway with Manitoba Department of Natural Resources for a general, water-shed survey of groundwater quality and pesticide use. The general survey would identify sites for detailed study.

5. **Nokomis, Saskatchewan:** Investigation of a shallow unconfined aquifer used as a village drinking water supply. The aquifer is in a farm area of long-term pesticide use.
6. **Maidstone, Saskatchewan:** Joint project with Agriculture Canada. An investigation of the effects of heavy-oil sludge land farming, on groundwater quality and soil moisture retention.
7. **LRTAP:** Several projects are underway on groundwater acidification and rock/water interaction.
8. **"Indoor Aquifer" Program:** Under this Program, simulation studies (e.g. flow, chemical reactions) are carried out using a large-scale laboratory aquifer.
9. **Miscellaneous Projects:** NHRI also provides input to regional operations and headquarters activities.

### Resources

The 1986-87 A-Base allocation for groundwater related work at NHRI was: 19 PY's and \$350K. The allocated PY's have not been completely staffed.



## NATIONAL WATER RESEARCH INSTITUTE (NWRI) PROGRAM

D. Jackson (NWRI - Burlington)

### Mandate

NWRI has the lead role in developing scientific expertise and knowledge, required to understand and resolve water issues of national interest. The Institute focuses on water quality issues and on eastern Canada.

### Program

The current objectives of the groundwater program are to:

- Understand movement and fate of contaminants in sedimentary rock aquifers;
- Develop operational tools for site specific groundwater assessment and remediation;
- Provide advice to federal agencies.

In 1986-87 five major projects are underway. Work includes field work, lab experiments and computer simulation.

1. **Hydrogeology on the Niagara Frontier:** There are numerous hazardous waste disposal sites along the American shore of the Niagara River. The underlying bedrock is very fractured. The study investigates groundwater contamination, and effects on the Niagara River.

2. **St. Clair Valley Hydrogeology:** The project investigates groundwater quality and flow patterns beneath Chemical Valley, Sarnia. The "St. Clair Blob" has provided impetus for the work. The Ontario Ministry of the Environment will be augmenting the project with an extensive assessment program (\$940.K over 4 years).

3. **Dense Non-Aqueous Phase Liquids (DNAPLS):** Dense non-aqueous phase liquid masses are a major groundwater contamination problem. This project investigates contaminant movement and chemical processes related to DNAPLS. The project is critical for the remediation of hazardous waste sites.

Note: A lab study is underway. A field study is proposed.

4. **Toxic Chemicals in Groundwater:** Development of site assessment and remediation techniques for use at hazardous waste sites.

5. **PEI Pesticide Study:** Assessment of the migration and fate of aldicarb beneath potato fields, and assessment of related well contamination.

6. **Miscellaneous Projects:** NWRI staff provide input to several other projects, often in conjunction with IPB, WTC, RRETC, C&P regional offices. Topics include the hazardous waste sites at Gloucester, Ville Mercier and Elmira.

### Resources

#### Budget 1986-87

	O&M (\$K)	CAPITAL (\$K)	PY'S
A Base	63.6	33.7	6
GLWQP	101.0	39.5	
PESTFUND	22.0	0	
<hr/>			
TOTAL	186.6	73.2	6
<hr/>			

**Seed Funding:** In addition to Environment Canada funds, other federal departments and provinces contribute significantly to NWRI projects.

The Gloucester Project has obtained \$2.6M from Transport Canada and \$350K from Environment Canada (Ratio 7:1).

The Sarnia Project has obtained \$940K from the Ontario Ministry of Environment, and \$160K from EC. (Ratio 6:1).

**Future Funding:** \$140K was obtained from the Great Lakes Water Quality Program in 1986-87. It is probable that no GLWQP money will be allocated to NWRI groundwater work in 1987-88. To maintain the current level of activity, total O&M \$ should remain at 1986 level.

A fund equivalent to the old EC Toxfund should be available for research relating to clean-up of contaminated sites in Canada.

Continued funding should be obtained from the Departmental Pestfund.

### Recommendations

The 1987-88 NWRI groundwater budget should be maintained at least at the 1986-87 level.

The Department should restore the Toxfund for research associated with remediation of hazardous waste sites.

## WASTEWATER TECHNOLOGY CENTER (WTC) PROGRAM

B. Jank (Director WTC, Burlington)

### Mandate

WTC is involved in development and demonstration of technology for wastewater processes. WTC contributes to groundwater protection by:

- Developing effective waste disposal technology;
- Predicting (modelling) release of contaminants to groundwater;
- Developing technology to treat contaminated groundwater;
- Demonstrating application of available technology.

### Program

To date WTC groundwater projects have dealt primarily with landfill leachate. Work is done in collaboration with several agencies including: RRETC, NWRI, C&P Regions, IPB, DOT.

Several projects are currently underway:

1. **Landfill Leachate Treatment Using Air Stripping and Vapour Phase Absorption.** The project objectives are design of a full scale air stripping process for removal and treatment of volatile organics from contaminated groundwater.
2. **Fate of Toxic Organic Constituents of Oil Industry Waste Applied to Soil.** The project objectives are: to monitor the fate of aromatic hydrocarbons applied to soil; and to develop management practices to prevent movement of the hydrocarbons into the groundwater.

3. **Degradation of Chlorinated Organics in Soil Systems.** The project investigates the fate of chlorinated organic chemicals in soil systems and will develop and demonstrate soil treatment methods which will also protect groundwater.

4. **Development of Test Methods for Solid Waste Characterization.** The objective of this project is to identify waste properties for input to a mathematical leaching model.

5. **Miscellaneous.** WTC provides input to a variety of headquarters and regional C&P activities as well as advice and input to industry and provincial agencies.

6. **Unsolicited Proposals.** Several major unsolicited proposals relating to solid waste disposal, leaching and clean-up are currently under review.

**Resources**

In 1986-87 WTC A-Base resources allocated for groundwater work were 4.3 PY and \$135.K.

Resources obtained from other sources are estimated at 9.2 PY and \$553.K.

The anticipated 1987-88 resources are:

	<u>PY</u>	<u>\$</u>
WTC	6.1	\$175K
OTHER	23.4	\$4.M

## RIVER ROAD ENVIRONMENTAL TECHNOLOGY CENTRE (RRETC) PROGRAM

D. Thornton (RRETC - Ottawa)

### Mandate

RRETC is involved in technology development and demonstration for detection, assessment and response to environmental emergencies. The primary link to groundwater is through the Emergencies Program.

RRETC contributes to groundwater protection by:

- Generating technical information and advising on nature, behaviour and effects of spilled oil and chemicals;
- Developing and demonstrating effective preventative and remedial technology relating to spills;
- Providing technical advice and assistance in resolution of specific spill incidents;
- Providing technical advice and assistance in resolution of similar problems (e.g. hazardous waste disposal);
- Promoting improved knowledge and better operating practices to reduce spill occurrences.

The Department has proven expertise and an accepted role in the spill technology, remediation area. The provinces and industry collaborate and welcome EC involvement.

### Program

RRETC projects deal with a wide variety of spill related issues including:

1. **Spill Prevention.** Prevention related activities include designing impermeable storage areas, testing underground storage tanks, and tank corrosion studies.

2. **Spill Detection and Assessment.** Work includes:

- Development and demonstration of person-portable and vehicle-mobile systems for air, water and soil measurements;
- Development of systems to detect leaking tanks;
- Detection activities focussed on the 150 chemicals identified as "spill priorities";
- Leak rate nomograms have been developed for some chemicals. Computer models for leakage, infiltration, etc. are being developed.

3. **Spill Treatment.** Reverse osmosis technology has been developed and used to remove a variety of substances from water contaminated by spills, leachate and runoff (e.g. Gloucester landfill leachate).

4. **Preparation of Envirotip Reports.** RRETC has prepared reports on the "Top 50 Chemicals" and is expanding the report series. Reports provide spill and response related information. The reports are to help prevent, assess and clean up spills.

5. **Provision of Information.** Information documents include:

- Envirotip reports;
- Catalogue of petroleum product properties including susceptibility to weathering and related effects;
- Spill countermeasures equipment Catalogue.

**Resources**

For 1986-87 A Base resources allocated to groundwater related projects are estimated at 2 PY and \$350.K.



**WORKSHOP PRESENTATION SUMMARIES**

**2.3 GUIDES, STANDARDS, CODES AND REGULATIONS  
PRESENTATIONS**

**MODERATOR: P.G. FINLAY**

**CONSERVATION AND PROTECTION  
GROUNDWATER WORKSHOP**

**NOVEMBER 18-20, 1986  
HULL, QUEBEC**



## MANAGEMENT OF UNDERGROUND STORAGE TANKS

K. Karr (Industrial Programs Branch - Ottawa)

### Mandate

The federal role on underground tanks includes:

- Management of tanks at federal facilities;
- Development and demonstration of effective pollution control and remedial technology;
- Providing leadership and consensus in joint federal-provincial-industry approaches including development of Codes of Practice;
- Providing information, education and training.

### Problem

There are over 200,000 underground storage tanks in Canada. Many tanks are approaching their life expectancy. It is estimated that 10,000 - 20,000 tanks are leaking; that number can be expected to increase. The Beak Report on groundwater contamination in Canada identifies leaking underground storage tanks (LUST) as a major groundwater contamination problem.

### Program History and Status

The program was initiated within C&P with a thorough review of the environmental and technical issues, existing federal and provincial legislation and programs.

A workshop was then held, with all provinces represented. The provinces, industry and C&P identified and endorsed:

- The LUST issues and priorities;
- A proposed program and schedule;
- The federal role.

With the program outlined and endorsed by the provinces and industry, the needs, benefits and predicted results could be readily explained to C&P Management. Program approval was obtained.

Activities in the Program include:

- Federal facilities inventory of underground tanks;
- Development of codes of practice for design, installation, operation and decommissioning;
- Legislative reviews;
- Workshops;
- Technology development and demonstration projects;
- LUST Newsletter;
- EPA Technology Exchange Program;
- Preparation of educational videos and booklets;
- Project Co-ordination.

### Resources

In 1986-87 the Underground Storage Tank Management Program was allocated 1.0 PY and \$14K from IPB A Base. An additional \$157K was obtained from other sources.

### Highlights

Leaking underground storage tanks are a major cause of groundwater contamination.

The LUST program is a good example of how the federal government can be active and influential in an area of provincial responsibility if:

- There are meaningful issues to deal with;
- The provinces and industry are supportive of federal involvement.

The absence of significant A-Base funding has not harmed the LUST Program. There are other organizations with strong interests, prepared to provide funding.

The LUST program is a comprehensive program. The program emphasizes prevention of groundwater contamination but ties in with environmental assessment and remediation activities. The program incorporates operations, technology development, training, and public/industry awareness.

## GUIDELINES FOR DECOMMISSIONING OF INDUSTRIAL SITES

### A. Stelzig (Industrial Programs Branch - Ottawa)

#### Mandate

The federal role on decommissioning includes:

- Environmental protection at federal facilities;
- Provision of a national overview and leadership.

#### Problem

At industrial facilities, routine and unintentional events (e.g. burial of wastes, leaks, spills) can cause soil and groundwater contamination.

Contaminated industrial sites can cause serious environmental problems, long after operations terminate. The problems can be avoided/resolved by good operating practices, and by appropriate review and action during decommissioning.

#### Program History and Status

IPB identified decommissioning as a problem requiring consideration. IPB staff then co-ordinated meetings with the provinces and industry to determine what should be done on decommissioning, to develop an action plan and define roles.

- A Federal-Provincial-Industry Task Force was formed.
- A consultant was hired to produce a report identifying basic approaches to decommissioning.
- Workshops were held.

On the basis of the Workshops the Task Force prepared an Action Plan. The Plan had provincial as well as federal input and was readily endorsed by CCREM. A major objective is development of national Decommissioning Guidelines (Scheduled for December 1988). The Guidelines will summarize recommended procedures for decommissioning and will include clean-up criteria and methodology. Specific "models" will be designed for different types of plants and for different wastes.

### Resources

In 1986-87 the Decommissioning Program was allocated .75 PY and \$20.K from the C&P A-Base. Industry and the Provinces provided an additional \$60.K.

The C&P contribution will remain at the same level in 1987-88, the contributions from industry, the provinces and other federal departments will increase.

### Highlights

- Decommissioning is an important environmental issue.
- Decommissioning is essentially a provincial responsibility but Environment Canada is co-ordinating the exercise.
- By working with the provinces and industry, Environment Canada can obtain consensus and develop a national program.
- Contamination prevention aspects are integrated with assessment, technology development/demonstration, and remediation in a comprehensive environmental protection approach.

## DEEPWELL INJECTION CONTROL PROGRAM FOR HAZARDOUS WASTES

R. Scroggins (Industrial Programs Branch - Ottawa)

### Mandate

Deepwell disposal is a provincial jurisdiction, with the exception of injection at federal lands/facilities, or disposal affecting transboundary waters.

### Problem

Disposal of hazardous wastes by deepwell injection is an existing waste disposal practice. There are several potential environmental problems associated with deepwell disposal. The injected waste can migrate along the wellbore if the casing/casing or casing/borehole annuli are not effectively sealed. The wastes can also migrate through faults, permeable rock and bedrock anomalies.

### Program Status

At present no provinces have legislation or control programs dealing specifically with hazardous waste injection. Alberta and Ontario are considering programs and legislation. Both provinces have experienced problems associated with injection of hazardous wastes.

Saskatchewan Environment has published a "Review of Injection Well Systems". The report includes a review of applicable Canadian legislation.

There are no regulations, guidelines or codes dealing with hazardous waste injection in Canada.



The U.S. Environmental Protection Agency (EPA) has a Hazardous Wastes Injection Restriction Program. EPA enforces the Program unless a State has an approved program; 70% of the States run their own programs.

The objective of the EPA program is to protect groundwater quality and specifically drinking waters. Waste injection proposals must be approved on a site-specific basis. Hazardous Wastes cannot be disposed of either into or above a drinking water aquifer. Disposal of wastes below drinking water aquifers is only acceptable if wastes are injected into a non-drinking water aquifer, and if there are proven confining layers between the aquifers.

In the US significant research is underway to improve deepwell disposal technology and detection of related environmental problems.

#### Recommendations for a Canadian Program

There is a clear need for a national review of deepwell injection as a disposal practice and for the establishment of guidelines or codes of practice. C&P should outline the issues and concerns and then meet with the provinces to develop a national program.

#### Resource Implications

Development of national guidelines/codes for deepwell disposal of wastes would be roughly a 4 year exercise costing \$100 K/year. The bulk of the funding would be provided by the provinces and industry. Environment Canada would provide "seed-funding" estimated at .3 PY and \$4K for 1987-88.

#### Highlights

There are potential environmental advantages and disadvantages to deepwell disposal of hazardous wastes. At present there are no related guidelines or codes in Canada. Development of national guidelines is recommended.

## STEAM ELECTRIC POWER GENERATION CODES

G. Ross (Industrial Programs Branch - Ottawa)

### Mandate

The federal mandate is:

- Environmental protection relating to federal facilities and activities;
- Development of national codes and standards.

### Environmental Concerns

The steam electric power generation (SEPG) industry includes fossil-fuelled (coal, oil or gas) and nuclear stations which utilize a steam cycle to generate electricity. Growth is predicted for the coal-fired sector in Alberta, Saskatchewan, New Brunswick and Nova Scotia, and for the nuclear sector in Ontario and New Brunswick.

Surface and groundwater contamination from the large volumes of fuel stored on the sites are major environmental concerns. Coal leachate can be very acidic and contains a wide spectrum of elements. Ash and sludges resulting from air pollution control processes are also potential sources of groundwater contamination.

### Program

A series of codes of practice covering the siting, design, construction, operation and decommissioning of SEPG facilities is being developed by a Federal-Provincial Industry Task Force. The codes are intended as a source of technical advice and guidance on environmental concerns and mitigating measures.

The Design Phase Code was published in March 1985, and the Siting Phase Code has been completed and will be published early in 1987. The following are examples of how groundwater concerns are addressed in these codes:

**Siting Phase Code:** General screening and avoidance criteria recommend that the following areas are to be avoided:

- highly fractured bedrock areas;
- permeable sands and gravel;
- important aquifer recharge areas.

**Design Phase Code:** Recommended seepage control criteria call for the material underlying coal piles, ash disposal sites and other facilities to be equivalent to a 1 m thickness of material with a permeability of  $1 \times 10^{-5}$  cm/s to  $1 \times 10^{-7}$  cm/s, depending on the characteristics of the facility. A permanent system of appropriately located piezometers and wells is also recommended to monitor the quality, quantity and flow direction of groundwater at these facilities.

Design Phase Code seepage control recommendations have been adopted in the design of at least one new power plant and are being used as the basis for Environment Canada intervention in the permitting of other new SEPG facilities.

### Resources

The 1986-87 IPB A-Base resources allocated to groundwater aspects of SEPGI Code development are estimated at: .2 PY and \$5K.

Additional PERD resources were used to fund work on flue-gas desulphurization and fluidized-bed combustion waste management. Groundwater related PERD resources are estimated at .5 PY and \$100K.

### Highlights

The SEPG Codes are comprehensive and consider groundwater aspects. The Codes have the support of the provinces and industry and are being used in the design and permitting at new SEPG facilities.

## HAZARDOUS WASTES PROGRAM

T. Foote (Industrial Programs Branch - Ottawa)

### History of IPB Program

In recognition of the potential environmental problems, and because of public concern, an Environment Canada Hazardous Wastes Program was established in 1981.

EC, in conjunction with provinces (except for Ontario and Quebec) identified and ranked 10,000 waste sites. Sites were ranked as 1st, 2nd or 3rd level of priority based on 20 parameters including hydrogeological factors.

- 58% of sites were active; 37% inactive.
- 9% Priority 1; 37% Priority 2; 40% Priority 3; 14% Unranked.

One hundred sites were subjected to more comprehensive assessment.

The Program was cut back in 1984 due to change in Departmental priorities and because of the lack of strong provincial support. EC continued to apply the Program to federal facilities and transboundary areas. The provinces continued to work independently.

By 1985 there was general concern over technical aspects of hazardous wastes management, and the cost implications of cleaning up problem sites. Several provinces approached EC and expressed interest in establishment of a National Environmental Trust Fund. The Canadian Council of Resource and Environment Ministers (CCREM) has set up a Task Force to review the need and mechanisms for such a fund.

The Fund would address remediation. Prevention of environmental problems is another issue. Under CCREM a Hazardous Wastes Action Plan with Standards and Guidelines is being developed.

EC has the lead role in developing Landfill Guidelines to consider:

- Siting;
- Permitted/prohibited substances;
- Facilities design;
- Drainage control;
- Groundwater monitoring;
- Operating/maintenance procedures.

### Resources

In 1986-87, IPB A-Base resources allocated to groundwater aspects of Landfill and Hazardous Wastes Guidelines Development are estimated at 0.5 PY and \$40K.

An additional \$10K is allocated for a national inventory of abandoned coal gasification sites.

The 1987-88 resource requirements have not been determined and will depend on the final approved program. Some new groundwater related activities may be included.

### Highlights

The history of the Program illustrates 3 points relevant to the Groundwater Action Plan:

- To develop and deliver a program, C&P must have clear objectives, a specific plan, and management support;
- The Hazardous Wastes Program relates largely to landfills of provincial jurisdiction. There is still a valuable role for EC;
- To develop and deliver the Program, the provinces (preferably all) must be convinced of the benefits and willing to participate.

## PESTICIDE CONTROL PROGRAM

H. Lerer (Pesticide Division,  
Commercial Chemicals Branch, C&P)

### Environment Canada Mandate and Objectives

Pesticides are unique in that they are chemical contaminants deliberately placed into the environment. There are over 5,000 pesticides currently registered for use in Canada.

The public and the provinces hold Environment Canada, and the Minister, responsible for pesticide related environmental problems. However, the major controlling legislation (The Pest Control Products Act) is administered by Agriculture Canada not Environment Canada.

Agriculture Canada administers pesticides by considering the risks and benefits. Environment Canada contributes information and advice regarding the risks.

The environmental objective regarding pesticides is not to eliminate pesticide use, but to minimize adverse effects of pesticide use and to prevent the use of unacceptable pesticides.

The Environment Canada pesticide related objectives are:

- To serve as an effective scientific advisor;
- To assure that pesticide products do not cause major environmental problems;
- To advocate alternative products or methods where alternatives are feasible.

### Environment Canada Program

The Program is co-ordinated through the Pesticides Division, Commercial Chemicals Branch, C&P. The Program provides input to the Agriculture Canada pesticide registration and re-evaluation process and addresses:

- The environmental chemistry and fate of pesticides;
- The effects on non-target organisms;
- The effects on wildlife and wildlife habitat.

Note: The movement of pesticides into and through groundwater, and the effects on water use are an EC concern.

### Requirements for Effective Environment Canada Input

Co-ordination and funding for pesticides related projects are provided by the Pesticides Division (C&P). The project work to meet EC objectives is conducted in the field (the Regions) and at NHRI and NWRI.

The following points are a guide to work that will constitute effective input to the pesticide registration and re-evaluation process.

1. Work done must be regional, product and use specific.
2. The environmental work must indicate the effects of the pesticide levels in the environment and not just define the levels.
3. The effects of the pesticides must be expressed as effects on populations not individuals.
4. Models to predict the movement of specific pesticides in the environment (e.g. soil to groundwater) are required.

5. Registered products and their environmental effects should be monitored. The Department needs a program to "audit" the monitoring information provided by the pesticide marketers.

6. Prevention of pesticide related environmental problems is the immediate goal. Clean up of pesticide contamination is another problem.

### Resources

The Departmental "Pestfund" consists of supplemental O&M resources, and is administered by the Pesticides Division. In 1986-87 the Pestfund supplementary allocation was \$500.K.

### Highlights

Environment Canada does not control pesticide legislation, but does provide input to the registration and re-evaluation of pesticides.

Funds for pesticide related work are allocated to the Department and administered by the Pesticides Division.

Pesticide related projects should be designed for effective input to the pesticide registration and re-evaluation process.



## CONTROL OF RADIONUCLIDES

C. Barraud (Management and Emergencies Branch, Ottawa)

### Problem

There are numerous radionuclide sources which could result in groundwater contamination. Potential sources of contamination include mining wastes, low-level and high-level radioactive waste disposal. Low-level "incidental wastes" can be generated by processes using naturally radioactive feedstock to produce non-radioactive products. Niobium slags and phosphogypsum fertilizer wastes are examples of "incidental wastes".

At present there are no existing or approved waste disposal sites in Canada. Even current low-level waste sites (e.g. tailings) are not considered as approved permanent disposal sites. The federal government has established three programs or initiatives to ensure proper management of radioactive wastes in Canada. All three waste management initiatives are under the responsibility of the Minister of Energy, Mines and Resources.

- The High-Level Radioactive Waste Disposal Research Program, managed by Atomic Energy of Canada Limited (AECL), to find a solution for the disposal of irradiated nuclear fuel from nuclear power reactors. This 10 year project started in 1978 spends \$33.M/year. The proposed disposal technique is excavation of a deep rock cavern, waste placement and backfilling. There is potential for groundwater contamination. The movement of radionuclides into and through groundwater is being carefully studied.
  
- The National Uranium Tailings Program (NUTP), managed by the Canada Centre for Mineral and Energy Technology (CANMET), to

conduct research into the long-term environmental evolution of uranium mine tailings.

- **The Low-Level Radioactive Waste Management Office**, managed by AECL to ensure that means are made available for the permanent disposal of low-level radioactive wastes in Canada, and that treatment and safe disposal services are available on a commercial basis.

### Environment Canada Mandate and Activities

Environment Canada (EC) has a general mandate under the Government Organization Act to ensure environmental protection and enhancement. In addition, under a 1981 Memorandum of Understanding with the Atomic Energy Control Board (AECB), Environment Canada provides technical advice to AECB in the licensing process, and also provides standards for groundwater quality.

To date EC has participated with AECB in the development of regulatory documents which will be used to assess specific waste disposal proposals. Documents include:

- R-71 "Deep Geological Disposal of Nuclear Fuel Waste"
- C-72 "Criteria for Concept Assessment"
- C-104 "Regulatory Objectives, Requirements and Guidelines for Disposal of Radioactive Wastes".

Environment Canada is also reviewing AECL's environmental assessment documents for Canadian nuclear fuel waste disposal.

### National Standards/Guidelines for Environmentally Sound Waste Disposal

The federal and provincial governments have recognized the need for standards and guidelines. Environment Canada is involved in ensuring that appropriate environmental information, on which to base guidelines, will be available. EC advises AECB in the development of guidelines for disposal of all nuclear wastes. EC has accepted the lead role in the development of National standards and guidelines for management of "incidental" nuclear wastes.

AECB and EC Protection Philosophies

The AECB philosophy is that if humans are protected, the environment is also protected. EC has reservations regarding the universality of this approach. For example, EC has established aquatic water quality standards (non-radioactive) that are more stringent than drinking water standards.

There is a need to determine whether standards for radionuclides in groundwater are required to ensure aquatic environmental protection.



**WORKSHOP PRESENTATION SUMMARIES**

**2.4 OVERVIEWS, ASSESSMENTS AND AGREEMENTS**

**MODERATOR: JOHN GILLILAND**



## PEARSE INQUIRY SUMMARY (GROUNDWATER SPECIFIC)

F. Quinn (Socio-Economic Division, Inland Waters - Ottawa)

The Pearse Commission received over 200 submissions. Safety of drinking water was a major concern, but groundwater was directly addressed in only 12 submissions. The groundwater submissions dealt primarily with quality aspects.

### Groundwater Related Submissions

- National and Provincial Waterwell Associations identified the need for more surveys, maps and information on water quality.
- Canadian Environmental Law Association suggested development of a National Water Strategy as per EPA.
- PACE dealt with underground storage tanks
- Canadian Coalition on Acid Rain addressed the connection between ground and surface waters.
- Professor John Gale (Memorial University) addressed the lack of groundwater information.
- All the federal and provincial submissions touched on groundwater but very cautiously. Only P.E.I. and N.B. made substantive submissions.

### Pearse Report Recommendations and Response

Only one of the Report recommendations (11.7) dealt directly with groundwater.

#### 11.7

"The federal government should seek the co-operation of the provincial governments to extend the water data collection systems to include Canadian groundwater resources".

No province has responded negatively to recommendation 11.7.

Other Federal Indications of the Status of Groundwater

- Groundwater was not mentioned in the Minister's most recent "State of the Environment Report".
- Groundwater is not mentioned in the Statistics Canada Report on "Human Activity and the Environment".
- The Science Council of Canada in reviewing water policy has noted the absence of groundwater in Canadian water policy.

Conclusion

"Targetting" and dealing with specific, priority issues is efficient and effective. However, the Federal government is the only government with a national mandate. We can accomplish on an overview/national scale what individual provinces cannot. We should not ignore these national responsibilities and opportunities.



INTERDEPARTMENTAL RESPONSE TO THE PEARSE INQUIRY  
REPORT ON FEDERAL WATER POLICY

J. Gilliland (NHRI - Saskatoon)

In Summary

The Federal mandate regarding groundwater is not clearly defined. However, Groundwater Program limitations reflect availability of human and financial resources not mandate.

Since resources are limited, it is essential that the important (priority) groundwater issues are identified. A "targetted" approach should be used in determining the groundwater Program.

What should we be doing?

What can we achieve?

The Federal Program should:

- Protect and enhance the environment;
- Meet our Minister's responsibilities;
- Address public concerns and perceptions;
- Educate the public.

Resources

To implement an effective, targetted groundwater program EC requires an additional 15 PY and \$1.5M.

## GROUNDWATER USE: SOCIO-ECONOMIC ASPECTS

H. Foerstel (Water Planning and Management Branch, IWD - Ottawa)

A. Kassem (Water Planning and Management Branch, IWD - Ottawa)

Demands on water in surface water systems will increase significantly in the future, especially in Western Canada. Additional withdrawals, and reservoir construction will alter existing groundwater flow regimes.

For effective management of water resources, and to predict problems, consideration must be given to both water demand and water supplies. The Socio-economic Division has generated regional and basin models for water supply and demand.

To date model development and application have been based on surface water information. Groundwater data is lacking. A comprehensive model should consider both surface and groundwater.

Departmental consideration of groundwater should not be limited to water quality. Water quantities are also important. The Department should foster development of groundwater quantity data required for effective water demand and supply modelling.

Note: This does not imply that the Department should undertake comprehensive data collection. The data could be obtained from or by the provinces. The availability of the data should be discussed with the provinces, and the use of the model encouraged.

## FEDERAL-PROVINCIAL AGREEMENTS

T. Davis (Water Quality Branch, IWD - Ottawa)

### Water Quality Branch Activities

The Branch provides scientific and technical information regarding water quality. Water quality is looked at from a regional and national perspective. Branch activities are operations oriented and include: laboratories, monitoring, data management, water quality reports, water quality guidelines, federal-provincial Agreements.

### Water Quality Agreements

Water quality Agreements are a method of responding to transboundary issues and concerns. The objectives of the Agreements are to:

- Assess boundary water quality;
- Determine long-term trends in quality;
- Identify emerging problems;
- Assess effectiveness of environmental protection tools (e.g. guidelines codes of practice);
- Determine whether water quality objectives are being met.

### Groundwater Inclusion in Agreements

The 1982 Cabinet directive did not specify whether or not groundwater should be included in the Agreements. It was stated that any groundwater monitoring work should be paid for by the provinces.

At present groundwater is not included in Agreements because:

- There is no management directive regarding federal groundwater mandate/responsibilities;
- Available resources (\$, PY's) are limited and committed to surface water work;
- We may not have the expertise to put in place and operate a groundwater monitoring program.

At least two provinces (Manitoba and Saskatchewan) wish to have groundwater included in the Agreements.

#### Canadian Water Quality Guidelines

The Guidelines apply to both groundwater and surface water. The Guidelines were developed by a Federal-Provincial Task Force under CCREM and will be published in January 1987.

The Guidelines can be used to develop water quality objectives, and to determine if, and what, remedial measures are required.

Water quality guides are outlined for 5 water uses:

- Drinking water supplies;
- Recreational water;
- Freshwater aquatic life;
- Agriculture;
- Industrial.

Relevant parameters and recommended levels are identified for each water-use. The Guidelines also provide information on sources, pathways and sinks for 120 chemicals.

### Highlights

- Water Quality Guidelines developed under CCREM apply to ground and surface waters. The descriptions of sources/pathways/sinks are less comprehensive for groundwater.
- The Federal-Provincial Water Quality Agreements do not include groundwater because of uncertainty over mandate and EC policy, and because of resource and technical limitations.
- Several provinces wish to include groundwater in Agreements.

### Resource Implications

Resources required will depend on groundwater activity undertaken.

Note: Monitoring will be fully funded by the provinces.

## GROUNDWATER CONTAMINATION OVERVIEW

F. Vena (Environmental Analysis Branch, Ottawa)

In 1985 a contract to document groundwater contamination in Canada was awarded to Beak Consulting. Project objectives were to:

- Document known cases of groundwater contamination;
- Identify pollution sources that could cause groundwater contamination;
- Review groundwater protection strategies that could be applied in Canada;

The Beak Report\* documents about 200 specific cases of groundwater contamination. The Report is a valuable step in identifying contamination problems in Canada. It is a start, not the final word. Groundwater quality is poorly monitored. With the exception of spills, most contamination is identified after complaints from groundwater users. The known incidents of contamination are probably just the tip of iceberg but support the mounting evidence that the major causes of contamination are:

- Landfills;
- Leaking tanks;
- Spills;
- Acid drainage from some mine wastes;
- Deep well disposal;
- Pesticides and fertilizers;
- Septic tank and household effluents;

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\* "Groundwater Contamination In Canada: Selected Cases, Potential Sources and Protection Strategy". Beak Consulting.

For each case of groundwater contamination consideration was given to:

- Location;
- Geology/hydrogeology;
- History;
- Impact;
- What should be done.

The Beak report has been distributed to the provinces. There have been many requests for copies, a good indication the groundwater contamination information is scarce. Feedback will be obtained from the provinces.

### Resources

The report cost C&P \$30K and 0.5 PY.

Note: Estimated cost for comprehensive review of groundwater contamination was \$250 K+

### Highlights

The Beak Report was a very good step in documenting known cases of groundwater contamination in Canada. However, the extent of groundwater contamination problems is not known.

## EMERGENCY RESPONSE PROGRAM

### B. Mansfield (Environmental Emergencies Division, Ottawa)

#### Problem

Spills can result in groundwater contamination. It is estimated that 5,000 to 10,000 spills occur in Canada each year. Spill reports are received by Environment Canada for up to 3,000 spills/year. The reports are detailed, so a good data base is being built. (Note: Petroleum products make up 60% of reported spills).

Spill prevention and rapid response/clean up are groundwater protection tools. The need for development and application of better prevention techniques and more effective clean up methods is paramount.

#### Federal Programs

The federal Environmental Emergency Response Program involves:

- Technology development;
- Contingency planning;
- Response training;
- Spill prevention through better operating practices (guidelines, codes);
- Better regional response to spills of federal concern, or at provincial/territorial request.

In the Regions, EC is involved in spill prevention and response programs for federal facilities. EC also works with the provinces and industry to:

- Reduce spill incidents;
- Ensure rapid detection and reporting of spills;
- Ensure rapid and effective emergency response;
- Ensure availability of effective clean-up technology;



Some aspects of a limited spill prevention program appear effective. Oil spill incidents (reported) peaked in 1981 and have decreased since, reflecting better operating practices. However, chemical spills reported have continued to increase, possibly due to better reporting mechanisms to provincial agencies.

The Environmental Emergency Technology Division of RRETC has developed a priority list of the "Top Priority 150 Substances". Available information includes behaviour, fate, effects and clean up aspects.

Emergency response teams exist in all regions. EC participates in the teams, and co-ordinates advice given to the on-scene commander for federal spills. Some regional teams are large with a wide range of expertise. The expertise called will depend on the specific emergency.

#### Are Groundwater Issues Given Adequate Consideration?

The degree of attention given to groundwater considerations varies with the Region. It would be worthwhile to review the different regional emergency response systems and make recommendations as appropriate.

#### Resources

In 1986-87 a total of 34 PY (19 in regions and 8.5 in R&D) were allocated to the Environmental Emergencies Program. The A-Base budget was \$1.6M (\$1.3M for research). These resources are not focused directly/uniquely on groundwater but relate to groundwater protection.

## INTERNATIONAL TRENDS IN GROUNDWATER MANAGEMENT

C. Pupp (Environmental Analysis Branch, Ottawa)

### Groundwater Use

Europe and the U.S. are ahead of Canada in developing groundwater protection programs. This is understandable. The U.S. and Europe are more dependent on groundwater.

- In Europe 90% of municipal drinking water is groundwater.
- In the U.S. 50% of water for domestic use is groundwater (versus 26% in Canada).
- In the U.S. 34 of the 100 largest cities depend on groundwater. In Canada only 2 cities with populations over 100,000 depend on groundwater.

Groundwater use in Canada is very regional. Prince Edward Island is completely dependent on groundwater. New Brunswick and Saskatchewan use a lot of groundwater. Other provinces use groundwater to varying degrees but could switch to surface water sources.

### Groundwater Management in the U.S.A.

In the U.S. there are a number of Statutes and responsible agencies involved in different aspects of groundwater protection.

(e.g. Superfund - Office of Emergency and Remedial Response;  
Safe Drinking Water Act - Office of Drinking Water;  
RCRA - Office of Solid Waste).

To overcome the diffusion of responsibility, a U.S. Groundwater Protection Strategy was developed. The objectives were to:

- Provide technical and program development assistance to individual states;
- Identify and resolve inconsistencies in federal groundwater programs;
- Classify groundwater into different categories with different protection needs;
- Assess groundwater problems from contamination sources not previously considered (e.g. septic tanks);
- Create an EPA Groundwater Protection Office to co-ordinate activities.

To date, the Office's accomplishments include:

- Raising general groundwater related consciousness;
- Promoting important documents;
- Developing a system for assessing groundwater pollution potential;
- Developing an evaluation system for septic tanks;
- Providing funds and advice for development of State management programs.

The Office has not yet succeeded in resolving the inconsistencies among federal programs: has not co-ordinated groundwater related activities of other federal programs; and has not co-ordinated EPA Regional activities related to groundwater. The Office has neither established a groundwater classification system, nor found an acceptable way to use such a system.

#### **State Versus Federal Responsibilities (U.S.)**

In the U.S. it appears agreed that the federal government should develop guidelines/legislation for environmental protection, support research programs, provide funds and technical advice.

Individual States will design and manage groundwater programs to meet their needs. States will undertake mapping, source control, monitoring, and program integration.

### Classification Systems (U.S.)

The U.S. is investigating the benefits of DRASTIC, a standardized system for evaluating groundwater pollution potential. The system is useful as a planning or screening tool but does not replace the ultimate need for on-site evaluations.

### Research and Technology Transfer Needs (U.S.)

Major research needs identified by the Science Advisory Board (EPA) include:

- Method development;
- Aquifer restoration;
- Specific source investigations;
- Transport and transformation studies;
- Subsurface environment descriptions;
- Technology development.

In addition to research there is a need for:

- Improved transfer of information on research results, available technology etc.;
- Sources of technical assistance/advice to individuals and organizations dealing with groundwater issues and problems.

### Current Research Trends (U.S.)

Major research trends in U.S. encompass everything that could reduce the high cost of monitoring and treatment and include:

- In-situ restoration;
- Geophysical methods to optimize observation wells;
- Risk/benefit analysis models;
- Easily applicable, inexpensive computer models to predict transport and fate of contaminants.

### European Approaches

Many European jurisdictions have adopted a graduated well-zone protection scheme:

- Different protection zones are delineated around well and recharge areas;
- The extent of the protection zones are determined by time of transport from the zone to the well;
- Protection related restrictions increase with proximity to the well/recharge areas;
- Implementation of the well-protection system has been very slow because of economic pressures and specifically resistance to land use restrictions.

## DEPARTMENTAL POLICY AND PROGRAM DEVELOPMENT

W. Richardson (Policy, Planning, Evaluation Directorate, Ottawa)

The Departmental mandate is to contribute to the management of resources held in common by all Canadians. Science and knowledge are the central focus of the Department.

Policy shapes, and is also shaped, by what the Department does. Policy is defined by Senior Management on the basis of pressure, input and knowledge from both inside and outside the Department. It is generally staff who develop policy.

To affect policy and generate a program it is important to know what you want, and what you are trying to achieve. With clear objectives it is possible to move towards objectives by adapting existing programs, seizing opportunities, co-operating, "levering".

To sell a program to management it is important to know and document:

- What the problem is;
- What we are doing now;
- What we should be doing;
- What others are doing;
- The consequences of not doing what we should be doing.

The plan submitted to management should include:

- Realistic short-term goals;
- Long-term goals
- Strengths and achievements;
- Short and long-term results anticipated;
- Available tools for achieving the plan. (e.g. Pestfund, federal-provincial agreements, CCREM).

**WORKSHOP PRESENTATION SUMMARIES**

**2.5 REGIONAL GROUNDWATER ACTIVITIES AND ISSUES**

**MODERATOR: JOHN GILLILAND**

**CONSERVATION AND PROTECTION  
GROUNDWATER WORKSHOP**

**NOVEMBER 18-20, 1986  
HULL, QUEBEC**





## ATLANTIC REGION GROUNDWATER PROGRAM AND ISSUES

J. Gibb\*, T. Hennigar, (Atlantic Region, IWD, Dartmouth)  
D. Kelly, (Atlantic Region, EP, Dartmouth)

### Groundwater Use and Management

Groundwater is an important water supply source in the Atlantic Region. The proportion of water supply from groundwater is:

100%      in P.E.I.;  
60%        in New Brunswick;  
50%        in Nova Scotia;  
10-15%    in Newfoundland.

An Atlantic Regional Groundwater Task Force has been established to develop a strategy for groundwater management, assessment and protection. A "matrix management" format (i.e., bring together all interested parties and speak) is proposed.

The Task force report due December 1986 will:

- Review and outline the federal role;
- Review federal and provincial activities;
- Define roles and objectives for C&P;
- Identify provincial expectations and wishes;
- Develop a regional groundwater strategy;
- Develop a detailed plan showing activities, resources and timing.

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\* J.Gibb gave the Workshop presentation.

### Groundwater Problems and Projects

Hazardous waste disposal is a politically delicate issue. The Atlantic provinces have a co-ordinating committee which has not met in years. The issue is not being addressed.

Nuclear wastes are an issue. The U.S. is considering nuclear wastes sites which could affect international waters in the region.

Abandoned mining wastes and LUST are other groundwater hazards.

Transboundary aquifer quality is being investigated through contacts with the provinces and the United States Geological Survey (USGS).

Toxics including pesticides and Perclor have been identified in groundwater. A preliminary review of pesticide use has identified products most likely to be a hazard. The review considered solubility, persistence, use patterns, and environmental factors including hydrogeology. The pesticide related work is a start.

Development of good public information projects is a priority.

Development of a good data base management system is a priority.

Identifying and meeting groundwater remediation needs is another objective. To date in excess of \$40M has been spent to clean up Sydney Tar Ponds. C&P is working on the groundwater related program:

- Identifying type and degree of contamination;
- Identifying movement of contaminants;
- Identifying recommended clean up procedures.

### Federal-Provincial Relations

Federal-Provincial relations on groundwater are cordial and co-operation is shown on both sides. In addition to joint handling of transboundary issues the provincial governments have expressed interest in:

- Development of a national well certification program;
- Assistance in reviewing pesticide related effects;
- Obtaining federal T.D. and demonstration input;
- Obtaining technical input (when it is requested).

### Resources

The 1986-87 A-Base allocation for groundwater related work is estimated at .4 PY and \$10.K.

## QUEBEC REGION GROUNDWATER PROGRAM AND ISSUES

A. Bernier (Quebec Region, EP, Montreal)

R. Bourdages: (Quebec Region, IWD Longueuil)

### C&P Groundwater Program in Quebec Region

There are C&P groundwater related activities underway but there is no integrated groundwater program or specific Action Plan.

Major groundwater work underway consists of:

1. **Ecotoxicology Evaluations.** The current emphasis is on effluents.
2. **Federal Waste Sites Evaluation and Remediation.** There is an independent provincial program for provincial waste sites.
3. **Pesticide Related Work.** There is good federal-provincial co-operation on pesticide work in Quebec. In 1982 and again in 1986 a joint pesticide use review was conducted. The sales and use of 150 commercial pesticides have been documented for 122 drainage basins.

INRS - Eau submitted an unsolicited proposal and was contracted to develop a system for evaluating vulnerability of groundwater to pesticide contamination. The system will help in effective resource allocation by identifying priorities for field work, monitoring, and surveillance.

### Provincial Activities

Since 1967 the province has required groundwater reporting associated with "development". To date drilling information for over 80,000 wells has been collected. Using geological and well data, the province has produced groundwater sensitivity maps.

The province maintains 230 monitoring sites and has a data bank ("Envirodoc").

The province has guidelines for drinking water, and bottled water quality.

Note: Water Quantity/Quality agreements with Quebec do not include groundwater.

### Resources

The 1986-87 A-Base allocation for groundwater related projects is estimated at 0.6 PY and \$40K. The .6PY is used for work on federal facilities and for emergencies and pesticides related work.

In addition to A-Base funds, DSS provided \$130K for the INRS-Eau pesticides study.

## ONTARIO REGION C&P GROUNDWATER PROGRAM

R. Findlay\* (Ontario Region, EP, Toronto)  
L. Kamp (Ontario Region, IWD, Guelph)  
F. Philbert (Ontario Region, IWD, Burlington)

### Groundwater Problems and Activities

1. **Great Lakes.** Great Lakes water quality is a groundwater related concern. 32% of Great Lakes water comes from groundwater.
2. **Niagara.** Groundwater quality in the Niagara area has implications on quality of international water bodies. Aquifer water movement in the Niagara area is to the Niagara River, Lake Ontario and ultimately the St. Lawrence River. There are 164 hazardous wastes dumps within 5 km. of the Niagara River. The underlying bedrock is fractured.

Canada, Ontario, U.S. and New York State are involved in groundwater related work. EPA was initially unenthusiastic but now wants a Lake Ontario Management Plan.

3. **Sarnia.** There are serious potential groundwater problems in the Sarnia area. A local aquifer is used for the Sarnia drinking water supply. Deep well disposal of chemical wastes was practiced for many years. Federal and provincial governments are working jointly on the problems.

\$160K of federal seed money has been augmented to \$1.1M by provincial contribution.

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\* Workshop presentation by R. Findlay.

4. **Nuclear Wastes.** There are 16 nuclear reactors in Ontario. The high-level reactive wastes (e.g. fuel bundles) are not disposed of permanently and are an AECB responsibility. There are also numerous low-level reactive waste sources (e.g. mines, refineries, hospitals). C&P is involved in siting reviews for disposal sites (e.g. Port Granby).
5. **Federal Facilities.** C&P is involved in preventing, assessing and cleaning up problems at federal facilities (e.g. C&P regional, NWRI, WTC and RRETC staff have been involved in Gloucester clean up).
6. **Coal Tar Sites.** Old coal tar sites have emerged as a problem at Ottawa and Kitchner-Waterloo. There are approximately 60 sites in Ontario. Several could cause problems.
7. **Monitoring.** The USGS has an extensive surface water quality and quantity monitoring network. There is no federal groundwater monitoring program in Ontario. IWD is investigating what should be done.

#### Provincial Priorities and Interests

Ontario's priority concern is abandoned waste sites, and prevention of future problems from new waste sites.

The province has inventoried 3,500 sites (2,000 active/1,500 abandoned) and categorized them on the basis of potential for affecting humans.

\$200. K was spent in 1986-87 to investigate 6 sites. \$500.K will be spent to review other sites in 1987-88.

In 1986-87 An additional \$300K was allocated by contract to investigate landfill technology (e.g. covers, liners, infiltration rates).

Pesticides, PCB's and acid rain are other priority groundwater issues.

Ontario considers that they are well ahead of the rest of Canada in their legislation, programs and strategies relating to groundwater. They are not particularly interested in development of national strategies. They would welcome more federal work in technology development and demonstration.

#### C&P Groundwater Strategy and Results

There are several important groundwater issues within the federal mandate. These are addressed in the 1985 Groundwater Protection Plan developed by Ontario Region.

More hydrogeological expertise is required within the Ontario Region. The groundwater specific operations support available from NHRI and NWRI is excellent in quality but insufficient to meet the operational needs.



## WESTERN AND NORTHERN REGION C&P GROUNDWATER PROGRAM

B. Armstrong (Western and Northern Region, EP, Edmonton)  
D. McNaughton (NHRI, Saskatoon)

### Groundwater Issues and Concerns

Generally, surface water is used more frequently than groundwater. Groundwater is often more abundantly locally, but may not be of sufficient quality for human, agricultural or industry use. The low groundwater quality is particularly significant in areas with low annual precipitation (e.g. southwestern Saskatchewan, southeastern Alberta).

Over-utilization or contamination of groundwater could have a negative effect on wetland habitat and ultimately on the wildlife (e.g. Pine Point Mine dewatering has a potential impact on the wetland habitat in Wood Buffalo National Park).

Potential causes of groundwater contamination include:

- LUST;
- Hazardous waste disposal (surface);
- Spills;
- Landfill leachates;
- Agricultural chemicals (insecticides, herbicides, fungicides and fertilizers);
- Industrial activities;
- Rural septic tanks, fields and lagoons;
- Deep well disposal;
- Abandonment;
- LRTAP.

### C&P Groundwater Program

At present the Region does not have a distinct groundwater program. Groundwater concerns are currently addressed within priority programs (e.g. agriculture, toxic substances, energy, northern development). Groundwater is also addressed through ongoing activities including environmental impact assessment, regulatory activities, research and development.

Groundwater specific projects underway include: PERD funded studies of deepwell injection and land-farming of oil sludges; development of IEE Guidelines for Northern Mining; the Environmental Impact Assessment of the Regina Rail Relocation; a post-registration pesticide evaluation study in the Primrose Range area.

### Groundwater Mandate and Program Needs

The management of groundwater resources is a provincial and an emerging territorial responsibility. The federal mandate and role require clarification. The federal role should build on federal/provincial/territorial liaison and include:

- Collecting information on national trends;
- Research, technology development and demonstration;
- Developing groundwater quality criteria;
- Developing monitoring technology;
- Developing analytic methods;
- Providing national co-ordination and leadership in groundwater strategy development;
- Transboundary issues;
- Exemplary management of groundwater issues relating to federal facilities.

Regional groundwater needs/priorities include:

- A policy and program for assessing deep well injection as a waste management option;

- Codes for evaluating new waste disposal proposals;
- A post-registration pesticide monitoring program.

### Federal-Provincial Interface

The groundwater interface varies with the province and territory. C&P maintains good working relationship with the appropriate provincial/territorial agencies and DIAND.

The federal government is the only government level that can address regional (multi-province) and national aspects of groundwater.

Any future national strategy development should be done in conjunction with the provinces. CRREM could be an appropriate vehicle for achieving consensus.

### Resources

**Current.** In 1986-87 groundwater considerations were integrated with existing C&P programs. It is not possible to determine the actual resources allocated to groundwater work.

Work done via PERD funding (\$58K) involved .2 PY.

**Resource Needs.** An estimated minimum 2.PY would be required to meet groundwater related needs in the Region.

### Highlights and Recommendations

- The C&P mandate and role regarding groundwater require clarification. Priority topics include: policies for groundwater assessment and protection; deepwell - injection as a waste - management option; post-registration monitoring of pesticides in groundwater.

- Provincial support is critical for successful implementation of any C&P mandate and role regarding groundwater.
- Provincial involvement and consensus should be obtained at an early stage.
- Depending upon the agreed on role for C&P, additional resources (PY and \$) may be required.

## PACIFIC AND YUKON REGION C&P GROUNDWATER PROGRAM

H. Liebscher\* (Pacific and Yukon Region, IW/L, Vancouver)

B. Kelso (Pacific and Yukon Region, EP, Vancouver)

Note: The following documentation was largely provided by H. Liebscher and B. Kelso.

Pacific and Yukon is the only C&P Region with a full time hydrologist in an "operations" position. There is still more groundwater related work required, than can be readily accommodated with existing resources in the Region.

Thirteen years ago over 95% of regional groundwater work was directed towards groundwater supply and groundwater development problems. Today over 95% of regional groundwater activities is focused on groundwater contamination or contaminant risk issues.

### Projects

A number of groundwater related projects are underway. Most projects are shared or are in support of work carried out by other federal agencies within, and occasionally outside, C&P.

1. **Flathead River.** A proposed open pit coal mine located near the Montana - B.C. boarder has resulted in an International Joint Commission (IJC) commitment to investigate potential downstream impacts. Major concerns relate to local trout spawning grounds located beside the proposed development. C&P involvement is ongoing.

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\* Workshop presentation by H. Liebscher

2. **Groundwater Pesticide Contamination.** This issue is gaining recognition as a serious problem in different parts of the country. Groundwater pesticide contamination appears to be a problem in the Lower Fraser Valley near Abbotsford, in the south Okanagan Valley near Osoyoos and likely elsewhere in the region. Some of the pesticides include carcinogens which indicates that some domestic and possibly municipal supplies should not be used for consumption.

C&P has been involved with groundwater pesticide contamination investigations in the Osoyoos area since 1981. The Osoyoos Lake fruit land area has been assessed at high risk to groundwater pesticide contamination. The surficial geological materials are highly permeable, the land is extensively irrigated and pesticide loadings are high. Analytical results, although scanty, show trace concentrations of four or more pesticides in each groundwater sample analyzed.

More research is required to determine how serious the pesticide problem is in high-risk agriculture communities, to better understand subsurface pesticide persistence, and to determine safe application practices. Results of such investigations would assist regional staff in identifying and dealing with problem areas, and in assisting headquarters with pesticide certification. C&P involvement is ongoing under the direction of NHRI.

4. **LUST.** there are at least four known leaky underground gasoline storage tanks, which have resulted in health and environmental concerns, in Greater Vancouver Regional District. Remedial measures are currently being carried out at all four sites.

5. **Landfill Leachates.** Most domestic and commercial refuse generated in P&Y region is placed in peat bog landfills in the Fraser River Estuary. There appears to be little concern over groundwater contamination at bog

landfills because of the low permeability of underlying flood plain clayey silts and compressed peats. Local problems exist where the low permeability units are discontinuous.

There are a large number of smaller landfills, located in abandoned sand and gravel pits, on fractured bedrock, etc., which have leachate discharge problems. Some cases of leachate discharge are well documented (e.g. Langley landfill where two aquifers and at least two domestic wells are locally contaminated).

6. **Chemical Spills.** For a number of years C&P has been involved with major chemical spill assessments, recommending and supervising remedial activities, and advising provincial regulatory staff. Large chemical spill related groundwater contamination projects which are currently being carried out include:

- A 250,000 to 400,000 litre ethylene dichloride spill at Ft. Langley has resulted in groundwater contamination of a major aquifer. Two subsurface contaminant plumes have been identified. The majority of contaminants appear to be in a non-aqueous phase liquid (NAPL) "blob" located at the bottom of the aquifer. Movement of this plume is unknown. A soluble aqueous phase plume, formed by the initial spill and by groundwater flowing over the plume, is moving towards the Fraser River at rates in excess of 1 metre/day. Remedial measures are aimed at purging contaminants from both plumes. Health concerns relate to contamination of domestic, municipal and Indian Reservation wells. Environmental concerns relate to contaminant discharge into the Fraser River. Subsurface attenuation rates and surface water assimilation rates remain unknown.
  
- In the Fraser River Estuary there are three major sloughs which provide protection and an abundant food supply for young salmonid and other fish and wildlife. A former Dow Chemical toluene plant located on

Tilbury Island has contaminated two aquifers with toluene, benzene, phenols, copper, cobalt and possibly other unknown compounds. Environmental concerns include contaminant discharge directly into Tilbury Slough and into the Fraser River. Contaminant plumes are migrating north towards the Fraser River and south towards the slough. Remedial measures are presently being used to minimize contaminant discharge into the slough. No remedial measures are being carried out on contaminants flowing directly towards the river.

- Industrial-chemical groundwater contamination exists at the former False Creek industrial lowland. Prior to developing this land into a commercial, hotel and residential area, an extensive drilling program and hydrogeological investigation are currently underway to determine the extent of contamination and to assess the fate of the contaminants. Chlorophenols, diesel fuel, oils, PCB's, heavy metals and a host of unidentified organics have been detected during preliminary subsurface investigations.
- Wood preservative compounds including chlorophenols, creosotes, and copper, chromium, arsenate solutions have caused minor and major groundwater contamination problems in the region. Large chlorophenol spills occurred at Penticton (1978) and Surrey (1985). Smaller spills and seepages are presently being investigated in the Fraser River Estuary and elsewhere.

7. **Groundwater Issues in the Yukon.** Groundwater supply and groundwater contamination problems are emerging as major groundwater issues in the Yukon. Because of costs and dependability, most Yukon communities are exclusively using (or hope to use) groundwater as a source of domestic and municipal supplies. Groundwater contamination problems in the North are common at existing and abandoned mine sites, landfills and industrialized areas.



Groundwater supply and contamination problems are believed to be significantly different in permafrost regions than in non-permafrost regions. A great deal of work and research is required in the North to better understand the mechanisms of groundwater flow, development and contaminant transport.

8. **Mine Leachates.** Acid mine drainage and gold cyanide leach operations have caused significant stress to waters under federal jurisdictions. Acid mine drainage at abandoned and existing sulfide-ore mines causes direct and indirect contaminant discharge into local surface and ground waters.

Gold cyanide heap leaching operations, on both sides of the international boundary in Similkameen Valley and elsewhere, are believed to have resulted in low but persistent cyanide concentrations in surface waters. Additional gold cyanide heap leach operations have been proposed in the Stewart and Hedley areas.

9. **Local Groundwater Contamination Problems.** There are a large number of "small" groundwater contamination problems affecting federal interests. Problems include:

- sewage effluent discharges;
- sewage effluent spray irrigation;
- nitrate contamination;
- leachates from "hog fuel" (sawdust and wood shavings) storage piles and landfills;
- minor chemical spills;
- transportation, handling and use of industrial chemicals.



**PART III**

**WORKING GROUP PRESENTATION SUMMARIES**

**CONSERVATION AND PROTECTION  
GROUNDWATER WORKSHOP**

**NOVEMBER 18-20, 1986  
HULL, QUEBEC**



## WORKING GROUP PRESENTATION SUMMARIES

### 3.1 WORKING GROUP OBJECTIVES

The objectives of the Working Group activity were to provide an opportunity for discussion, and to generate recommendations and detailed plans for future groundwater related work.

Forty-eight of the individuals who registered at the Workshop participated in the Working Group activity. Participants were allocated to one of four Working Groups.

- Research and Technology Group
- Regulations, Guides, Codes, Standards Group
- Operations Groups 1 and 2

Note: Two Operations Groups were formed to accommodate the number of participants, while limiting group size.

### 3.2 SUMMARY RESEARCH AND TECHNOLOGY DEVELOPMENT /DEMONSTRATION GROUP

Group Chairman: Rick Findlay

#### Issues

There are identified groundwater contamination concerns in Canada. The Beak Report provides a good summary of groundwater contamination issues and sources.

#### C&P Groundwater Research and T.D. to Date

To date C&P activities have been ad hoc and based on individual initiatives. Work has focused on:

- Spills;
- Nuclear waste disposal;
- Impact of pesticides;
- Deepwell disposal;
- LRTAP;
- Quasi - operational response to perceived needs.

### Groundwater Resources and Work by Organization

#### NHRI

Resources: \$400K; 9-19 PY

Work undertaken relates to:

- Fate and transport of contaminants;
- Groundwater supply and development;
- Pesticides;
- LRTAP;
- Regional operations support;
- Environmental assessment.

Achievements include:

- Protection of municipal aquifers from pesticide contamination;
- Defining the role of groundwater in protecting surface waters from acidification;
- Responding to emergencies in a sound technical manner;
- Evaluating the AECL concept for high level RAD waste repository.

#### NWRI

Resources: \$100.K; 6. PY.

Work undertaken relates to:

- Niagara;
- Sarnia;
- Pesticides;

- Landfills;
- Regional operations support;
- Technical advice (assessments).

**Achievements include:**

- Successfully addressing Aldicarb insecticide issue in PEI;
- Providing sound technical advice on Gloucester/Niagara contaminant issues;
- Obtaining resources (\$) and technical input from MOE on Sarnia work.

WTC

<b>Resources:</b>	<u>A-Base</u>	<u>Other</u>
	\$135K	+\$553K
	4.3 PY	+9.2 PY

**Work undertaken relates to:**

- Development/assessment of treatment technology for contaminated groundwater and soils;
- Support for regional operations;
- Technical advice and assessment.

**Achievements include:**

- Establishing a groundwater treatment process for Gloucester L.S.
- Developing management practices to prevent movement of aromatic hydrocarbons into groundwater at oil refineries;
- Developing procedures/protocols to evaluate hazardous waste solidification technology;
- Successfully obtaining funds and involvement from other organizations.

**RRETC**

**Resources: \$600K; 3PY.**

**Work underway relates to:**

- **Treatment technology for spills;**
- **Behaviour, fate, effects, properties of contaminants.**

**Achievements include:**

- **Application of reverse osmosis technology for groundwater cleanup;**
- **Developing over 100 publications including spill clean-up manuals;**
- **Developing models for spill movement into groundwater.**

**What Should C&P be Doing Regarding Groundwater?**

- **Operational needs should be addressed from within regions, with strong support from the research, technology development and demonstration institutes.**
- **A high profile demonstration program for prevention and remediation of groundwater and soil contamination should be undertaken.**
- **A groundwater protection strategy should be developed in co-operation with the provinces and private sector.**

**How Should We Do It?**

- **Regional positions for hydrogeologists should be created.**
- **Resources from within C&P (and from outside) should be assembled for specific demonstration projects dealing with the following priority sites/issues:**



Niagara	Gloucester
Sarnia	Uniroyal (Elmira)
Ville Mercier	Federal Pioneer, (Regina)
PEI Pesticides	Nanticoke
Sydney	BC Pesticides

- Future priority sites should be identified and addressed on the basis of a groundwater protection strategy, which should be developed in co-operation with the provinces and the private sector.
- A C&P office should be established to coordinate all C&P groundwater functions. The coordinators would report directly to the ADM of C&P.

### 3.3 SUMMARY REGULATIONS, GUIDES CODES AND STANDARDS GROUP

Group Chairman: Art Stelzig

#### C&P Mandate

Preservation and enhancement of Canadian groundwater resources.

#### Role

The federal role is not regulatory. Appropriate roles are:

- Leadership and co-ordination re guidelines, codes;
- Technology development and demonstration;
- Information exchange;
- Public information;
- Developing consensus among provinces, industries, public, federal government.

### **Current C&P Activities**

- **Developing codes, guidelines and standards:**
  - . **LUST guidelines;**
  - . **Decommissioning guidelines;**
  - . **SEPG guidelines;**
  - . **Water Quality guidelines;**
  - . **Hazardous wastes landfill guidelines;**
  
- **Evaluating pesticide fate and effects;**
- **Providing technology development and demonstration for spill prevention, cleanup and treatment.**

### **What Needs To Be Done**

- **C&P should collaborate with provinces, industry and the public to identify what should be done, and how.**
  
- **Potential initiatives relate to:**
  - . **Surface impoundments;**
  - . **Classification of aquifers;**
  - . **Expansion of water quality guidelines;**
  - . **Spills;**
  - . **Deepwell disposal;**
  - . **Mining wastes;**
  - . **Technology development and transfer;**
  - . **Information transfer;**
  - . **Funding mechanisms.**

### **Conclusion**

**C&P has a clear role to play regarding groundwater. Activity should focus on:**

- Developing national consensus;
- Developing guidelines and standards;
- Technology development and transfer.

Collaboration with the provinces and industry will be critical to an effective federal program. Many groundwater initiatives could work through federal-provincial agreements.

### 3.4 OPERATIONS GROUP #1

Group Chairman: John Gilliland

#### Pesticide Related Requirements

- Pesticide contamination should be identified;
- More work is required on the fate and movement of pesticides in groundwater;
- Pesticide use patterns should be correlated to groundwater characteristics, quality;
- Effective modelling is required to assess pesticides pre-registration;
- Environmental effects information is required to review pesticides prior to relicencing.

#### Contamination Prevention

Hydrogeological input is required in both contamination prevention and environmental impact assessment activities for many issues including:

- Underground storage tanks;
- Landfills;
- Mine development and decommissioning;
- Nuclear issues;
- Federal facilities;
- Subsurface waste injection;
- Pesticide use.

### Aquifer Remediation

Needs include:

- "After the fact" means of correcting groundwater contamination, resulting from spills, leaks, non-point source pollutants, etc.;
- Research into clean-up methods e.g., containment, removal;
- Development of a C&P emergency response plan to assist in handling emergency cases of groundwater contamination;
- Adequate C&P resources for knowledge acquisition and technology transfer in this rapidly-developing area;
- Ensuring that the federal house is in order. Federal facilities should be a priority .

### Monitoring

There is a need for some site/issue specific "audit" monitoring. At present there are no funds allocated for groundwater monitoring.

### Conclusion

There is a clear federal role relating to groundwater. Some direction is required from management to indicate how far groundwater work should proceed in C&P and to provide focus. At present C&P regional groundwater programs just scratch the surface of the issue; there are no comprehensive programs.

Available resources (PY and \$) are inadequate for an effective groundwater program. An additional 20 PY's (10 for prevention and 10 for remediation) are required to mount an effective program. There is a particular need for more hydrogeological expertise within C&P.

### 3.5 OPERATIONS GROUP #2

Chairman: Alain Bernier

Rapporteur: John Gibb

#### Mandate

There is a clear federal mandate for groundwater work relating to federal lands/federal activities and transboundary waters.

The federal mandate should be used as a lever to:

- Open discussion with provinces;
- Provide a national overview;
- Provide leadership in awareness and communications;
- Market our expertise and ideas to the public.

#### Issues

Issues of national and regional concern include:

- Pesticides;
- Groundwater resource evaluation;
- Deepwell injection of hazardous wastes;
- Waste disposal;
- Radioactive wastes;
- Mine tailings;
- Acid mine drainage;
- Transboundary groundwater issues;
- LUST.

**Groundwater Related Needs**

NEEDS	A/P/R	S/L
Groundwater Criteria	P	L
Code and Standard Development for Federal Facilities/Activities	P	L
R&D for In-Situ Clean Up Technology	R	ON GOING
R&D Contaminant Monitoring Technology	A	ON GOING
Socio-Economic Evaluation of Groundwater A. As a Resource B. For Clean Up	A	L
Development of Economic Incentives	P	L
Preparation of State of Environment Report on Groundwater	A	S

**Legend**

A - Assessment  
P - Prevention  
R - Remediation

S - Short Term  
L - Long Term

**Mechanisms for Implementation**

- Identify and take advantage of pooled resources e.g. ERDA, PERD;
- Use of CCREM;
- Treasury Board Submissions;
- Ad hoc cost sharing agreements with provinces, other government departments, etc.

**PART IV**

**LIST OF WORKSHOP PARTICIPANTS**

**CONSERVATION AND PROTECTION  
GROUNDWATER WORKSHOP**

**NOVEMBER 18-20, 1986  
HULL, QUEBEC**





## **WORKSHOP ATTENDANCE**

A summary of the 67 workshop participants is provided below, on the basis of organization and function.

### **Participants by Organization**

IWD Headquarters	9
EP Headquarters	25
C&P Regions	12
C&P Research/TD Institutes	11
Lands	2
Parks	2
Corporate and Miscellaneous	6
<hr/>	
TOTAL	67

### **Participants by Function**

Conservation/Planning/Management (HQT.)	11
Assessment (HQT.)	26
Research/Technology Development	14
Regional Operations	12
General (Policy/Communications)	4
<hr/>	
TOTAL	67

### **List of Participants**

To facilitate communication between Workshop participants, addresses and telephone numbers have been included. To avoid repetition the Place Vincent Massey location and mailing address (Ottawa, Ontario, K1A 0E7) are indicated by an asterisk (\*).

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**PART V**

**APPENDICES**

**CONSERVATION AND PROTECTION  
GROUNDWATER WORKSHOP**

**NOVEMBER 18-20, 1986  
HULL, QUEBEC**





**APPENDIX 5.A**

**WORKSHOP AGENDA**



A G E N D A

TOPIC: Groundwater Workshop -- Conservation & Protection (C&P)  
Environment Canada

DATE: November 18-20, 1986.

PLACE: Hôtel Ramada, 35 rue Laurier, Hull, Québec J8X 4E9  
Tel: (819)778-2322; (819)778-6111; (800)567-9607

- OBJECTIVES:
- 1) To exchange information on current C&P groundwater projects, activities and concerns.
  - 2) To recommend direction for future C&P groundwater projects, activities and issues.
  - 3) To begin a detailed C&P Groundwater Assessment and Protection Action Plan.

- QUESTIONS:
- 1) How do we (C&P) most effectively assess groundwater quality and quantity?
  - 2) How do we (C&P) most effectively prevent groundwater contamination?
  - 3) How do we (C&P) help remedy groundwater contamination?
  - 4) Where do we go from here?

PARTICIPANTS: Tentative participants list appended.

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C&P GROUNDWATER WORKSHOP

Rev.: 86/11/14

TUESDAY, 18 NOVEMBER, 1986

Introduction

9:00	Welcome	L. Goulet and designates of D.A. Davis and P.M. Higgins
9:15	Workshop Objectives and Outline	P.G. Finlay/K. Arkay

Planning, Co-ordination

9:30	Groundwater Assessment and Protection Plans	P.G. Finlay
10:00	Canadian Trends and Pearse Inquiry Response	J. Gilliland
10:30	Coffee	

Research, Development of Demonstration (Moderator: R.Finlay)

10:45	NHRI Program	J. Gilliland
11:15	Pearse Inquiry	F. Quinn*
11:45	WTC Program	B. Jank
12:15	RRETC Program	D. Thornton
12:45	Lunch	

Guides, Standards, Codes, Regulations (Moderator: P.G. Finlay)

1:45	Management of Underground Storage Tank - Code	K. Karr
2:15	Decommissioning of Industrial Sites - Standards	A. Stelzig
2:30	U.S. Deepwell Injection Control Program	R. Scroggins
3:00	Steam Electric Power Generation - Codes	G. Ross
3:30	Coffee	
3:45	Hazardous Wastes Landfill - Guidelines & Program	T. Foote
4:15	Pesticides Control Program	H. Lerer
4:45	Discussion and Summary	P.G. Finlay

\* Rescheduled

C&P GROUNDWATER WORKSHOP  
WEDNESDAY, 19 NOVEMBER, 1986

Rev.: 86/11/14

Overviews, Assessments, Agreements (Moderator: J.Gilliland)

9:00	Workshop Objectives and Outline	J. Gilliland
9:10	NWRI Program	R. Jackson*
9:30	Groundwater Use - Socio-Economic Aspects	H. Foerstel
10:00	Federal-Provincial Agreements	T. Davis
10:30	Coffee	
10:45	Groundwater Contamination Overview	F. Vena/G. Grove
11:00	Emergency Response Program	B. Mansfield
11:15	International Trends in Groundwater	C. Pupp
11:45	Lunch	

Regional Activities and Issues (Moderator: J. Gilliland)

12:45	Atlantic	T. Hennigar (D. Kelly)
1:15	Quebec	A. Bernier (R. Bourdages)
1:45	Ontario	R. Findlay (L. Kamp)
2:15	Western & Northern	D. McNaughton (B. Armstrong)
2:45	Pacific & Yukon	H. Liebscher (B. Kelso)
3:15	Coffee	
3:30	Discussion and Summary	T. Gilliland
4:00	Work Group Introduction	K. Arkay/P.G. Finlay

THURSDAY, 20 NOVEMBER, 1986  
(Agenda to be finalized)

9:00	Workshop Objectives and Outline	
9:15	Strategy Planning Work Groups	
	How do we best <u>assess</u> , <u>prevent</u> and <u>remedy</u> ?	
	Group 1 and 2 - Regional and Operational Issues	
	Group 3 and 4 - Research, Development and Demonstration Issues	
	Group 5 and 6 - Guides, Standards, Codes, Agreements	
12:00	Lunch	
2:00	Group Reports and Panel Discussion	
3:30	Coffee	
3:45	Summary, Recommendations and Closing	

\* Rescheduled

Agenda Amendments

The Atlantic Regional presentation was given by John Gibb (IWD - Dartmouth).

Two presentations were added to the agenda:

- "Policy and Program Development" - W. Richardson
- "Control of Radionuclides" - C. Barraud

**APPENDIX 5.B**

**C&P GROUNDWATER ACTION PLAN (October 1986 Draft**







MEMORANDUM

NOTE DE SERVICE

TO  
A

DISTRIBUTION  
(Management)

FROM  
DE

P.G. Finlay  
Industrial Programs Branch  
Environmental Protection  
Conservation & Protection

SECURITY - CLASSIFICATION - DE SECURITE
OUR FILE/NOTRE REFERENCE 4693-9
YOUR FILE/VOTRE REFERENCE
DATE October 3, 1986

SUBJECT  
OBJET

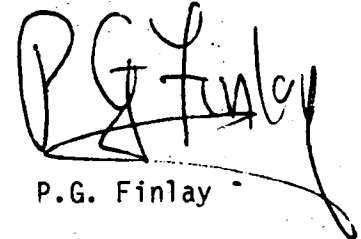
Groundwater Assessment and Protection Plans

Attached is the 86/10/01 version for the Groundwater program proposal as requested.

The last draft was reviewed by Headquarters and Regional Branches of Inland Waters, and was also commented on by most Regional Directors of Environmental Protection. Comments were also provided by Headquarters Directors of Environmental Protection after a July 1986 presentation of the earlier draft. As previously indicated, the document has been developed with John Gilliland of NHRI, with extensive contributions by other C&P staff.

This revision attempts to incorporate comments received, and also reflects current thinking for the C&P management of environmental issues. A copy of the Ministers "groundwater speech" is annexed and a suggested letter of transmittal to the Assistant Deputy Minister from both Directors General is also included with a one page "executive notes".

I trust this is satisfactory and thank participants for their involvement with the initiative.

  
P.G. Finlay

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EXECUTIVE NOTES -- GROUNDWATER ASSESSMENT & PROTECTION PROGRAM (GAPP)

1. PROBLEM: "Groundwater" is emerging as a major environmental and health issue directly affecting 25% of Canadians. Groundwater also affects surface water quality and supplies, and fish and wildlife habitat.
2. OPPORTUNITY: To provide leadership and co-ordination federally, and appropriate assistance provincially.
3. STAKEHOLDERS: Conservation & Protection; many federal, provincial, municipal agencies; US Environmental Protection Agency and states; industries; universities; media; public interest groups; and general public.
4. ROLE: In collaboration with stakeholders: (i) focus for federal groundwater responsibilities; (ii) research, development, demonstration (RD&D); (iii) information on scientific, technological and general aspects of groundwater; (iv) consensus building on preventive and remedial practices.
5. RESULTS: (oriented to specific issues - e.g., leaking underground storage tanks, etc.) - (i) federal responses to groundwater threats are consistent; (ii) regional responses to site-specific issues are effective; (iii) preventive and remedial technologies are available and implemented; (iv) publics are informed; (v) Minister and Department respond, and are seen to respond, effectively.
6. PLANS -
  - 6.1 Senior Management (SM): Establish an accountable Director General, a Project Leader and Task Force.
  - 6.2 Project Leader and Task Force: Produce, for example,
    - a) Briefings for SM, Minister
    - b) Pearse Inquiry follow-up
    - c) Communications products
    - d) Discussion Papers
    - e) Management Reports
    - f) C&P Workshop 18-19 Nov. 1986
    - g) National Workshops FY 87/88
    - h) C&P Action Plan
  - 6.3 C&P Action Plan: To be developed for FY 87/88 by Project Leader, Task Force and appropriate individual C&P resource centres. human and financial resource requirements to be included.
7. RESOURCES: Project Leader and Task Force: 1PY full time, plus others part-time. Task Force support, contracts, travel, misc: 86/87 Budget \$120K

(\*NOTE: In Pearse Inquiry response, an additional 15PY and \$1,500K was suggested for C&P groundwater activities. Task Force would refine this estimate.)

8. RECOMMENDATIONS

- (i) Establish the assessment and protection of groundwater as a priority;
- (ii) ensure that competent expertise is readily available for operational support to address groundwater contamination problems;
- (iii) establish a co-ordinated and effective Groundwater Assessment and Protection Program (GAPP);
- (iv) establish an accountable Director General, Project Leader and Task Force to further develop, co-ordinate and report on a Groundwater Program and Action Plan.

86/10/01

## GROUNDWATER ASSESSMENT AND PROTECTION

### Background

Public and government concern with the quality of groundwater has been growing. Environment Canada is involved with an increasing number of groundwater problems (for example, Niagara, St. Clair, leaking underground storage tanks, pesticides, etc., etc.). Excellent scientific and technical work and a number of initiatives to protect groundwater have been and are being conducted. However, Environment Canada has dealt with this complex issue in an "ad hoc" manner with no overall guiding strategy, consistency, co-ordination or focus. Consequently, responses to some specific groundwater problems have been less than ideal.

In August 1985, the Ontario Region of the Environmental Protection Service (EPS) proposed a Groundwater Plan of Action to deal with this emerging issue. A Results Definition Model was included. Ontario Region first raised the concern in September 1984 and, with the help from Headquarters' Program Management Branch, produced a draft in March, 1985.

In October 1985, Industrial Programs Branch (IPB) of Environmental Protection (EP) was tasked with further developing this initiative. Informal networks were established with representatives from EP, National Hydrology Research Institute (NHRI), Wastewater Technology Centre (WTC), River Road Environmental Technology Centre (RRETC), and also with all Regions. In some Regions, representatives of Inland Waters Directorate, as well as Environmental Protection were involved in the process. The US Environmental Protection Agency Office of Ground Water Protection in Washington, D.C. was also visited by team members.

The proposal for a Groundwater Assessment and Protection Program (GAPP) represents a good consensus of the many interests and perspectives consulted in its development. Drafts of the document were made available for review to Headquarters and Regional directorates of both Inland Waters and Environmental Protection (see Annex 1). An Environment Canada groundwater program will of course evolve and improve with time as contributions to this emerging issue are increased.

The Minister, in a speech given 12 September 1986 in Saint John, N.B., declared that groundwater and its assessment and protection would be a departmental priority, which, would be reflected in budgetary and personnel planning. He suggested a focus in Atlantic Canada, offered help to provinces and announced national Workshops on Groundwater Assessment and Protection. He also called for the development of a "national ... strategy" with stakeholders.

Included in this proposal are outlines of the problem, opportunity, stakeholders, Environment Canada's role and the results expected. Plans are presented for the overall management, the co-ordination and the development of a detailed Action Plan, together with associated resource implications. Four recommendations are made to initiate a co-ordinated program.

- There is a need for a co-ordinated focus for scientific, technological, economic, policy and public awareness aspects of groundwater, in collaboration and in harmony with the provinces and other stakeholders.

### 3. STAKEHOLDERS

#### 3.1 Environment Canada

The Department has stakes in groundwater aspects of federal responsibilities which include:

- i) International waters (e.g., Rivers - Niagara, St. Clair, Poplar, etc.; Nuclear waste disposal - Minnesota, Maine, etc.).
- ii) Interprovincial/territorial waters (e.g. Manitoba/Saskatchewan potash; Saskatchewan/Alberta heavy oil activities).
- iii) Federal lands, facilities and funded projects (e.g. Banff Park, fish hatcheries - B.C.; airports - Charlottetown, P.E.I., Gloucester, Ont. and Sept-Iles, Qué., National Defence bases - Gagetown, N.B., etc.).
- iv) Federal regulations and policies (e.g. Environmental Contaminants Act, Pest Control Products Act, Fisheries Act, Transportation of Dangerous Goods Act (TDGA), Canada Water Act, Policy on Land Use, etc.).
- v) National information bases and public reports on state of the environment (e.g. groundwater use [published 1986] and contamination reports [in preparation]).
- vi) Research, development and demonstration in support of water and environmental management (e.g. modelling, toxics migration, land drainage, nuclear waste, leachate treatment, aquifer clean-up, specific site assessments, etc.).
- vii) Services to other stakeholders as required (e.g. advice to B.C. on landfills, to P.E.I. on Charlottetown water supply, to Sask. on Poplar River ash disposal, etc., etc.).

Within Environment Canada, Conservation and Protection,

- National Hydrology and National Water Institute (NHRI Saskatoon, NWRI Burlington) of Inland Waters Directorate (IWD) provide a primary source of scientific and technical expertise and advice (e.g. hydrogeological site surveys, contaminant migration modelling, etc.),
- Industrial Programs Branch (IPB) develops generic technical guides and codes on preventive measures and conducts project-specific reviews (e.g. coal ash disposal, waste landfill design, mine developments, plant decommissioning, leaking underground storage tanks. etc.),

- Wastewater Technology Centre (WTC) and River Road Environmental Technology Centre (RRETC) develop remedial and preventive technologies (e.g. waste fixation, leachate treatment, site clean-ups, etc.),
- Water Resources Branch (WRB) is involved with groundwater level monitoring with provinces,
- Water Quality Branch (WQB) analyses groundwater samples through federal-provincial Water Quality Monitoring Agreements,
- Water Planning and Management Branch (WPMB) is involved with federal-provincial cost-shared studies,
- Commercial Chemicals Branch (CCB) may consider groundwater contamination in registration of chemicals,
- Canadian Wildlife Service (CWS) concerns includes groundwater quality in wetlands (e.g. North American Waterfowl Management Plan),
- Regions of both Environmental Protection (EP) and Inland Waters and Lands (IWL) provide technical advice on remedial and preventive measures for specific sites and incidences, and provide important liaison with provinces.

### 3.2 International, Federal/Provincial and Other Federal Interests

- The U.S. Environmental Protection Agency (EPA) and neighbouring states (e.g. Michigan, New York, North Dakota) have stakes in groundwater quality on both sides of the border.
- External Affairs and International Joint Commission (IJC) are involved with these issues.
- Prairie Provinces Water Board (PPWB) concerns itself with groundwater (Committee on Groundwater).
- Canadian Council of Resource and Environment Ministers is the organization which includes the most important stakeholders - the provinces.
- Other federal departments and agencies include:
  - Health & Welfare (drinking water quality)
  - Transport Canada (TDGA, airports, railways)
  - Agriculture Canada (pesticides, fertilizers)
  - Fisheries and Oceans (fish hatcheries and habitat)
  - National Defence (army, airforce, navy bases)
  - Indian & Northern Affairs (North, Indian reserves)
  - Federal Env't'l Assessment Review Office (EA Review Panels)
  - National Research Council (soil barrier investigations)
  - Atomic Energy Control Board (nuclear industry regulation)
  - Atomic Energy of Canada Ltd. (nuclear power development, wastes)
  - Eldorado Nuclear (nuclear wastes)
  - Energy, Mines and Resources (Geological Survey, uranium tailings)
  - Public Works (dredging wastes, federal buildings)
  - Harbour Commissions (dredging wastes)

### 3.3 Provinces and Municipalities

The most important groundwater stakeholder, in terms of public accountability and regulatory influence, are the provinces.

- Provinces have ultimate responsibility for the management of their groundwater resources. Any federal involvement in provincial groundwater issues must be in harmony and collaboration with provincial authorities.
- Provincial agencies with regulatory and management responsibilities in groundwater include departments of environment, health, agriculture, resource management, fire marshal, commerce, transportation, etc.
- Municipalities also enact relevant by-laws (e.g. zoning, well permits, etc.) and they may also contribute to groundwater contamination (e.g. road salt, landfill, etc.).

### 3.4 Industries and Consultants

- Industries are realizing the economic significance of groundwater contamination because of product loss, clean-up costs (associated with spills, leaks, accidents, plant decommissioning, etc.), insurance liabilities and adverse publicity.
- Industrial associations representing these interests include:
  - Petroleum Association for Conservation of Canadian Environment (PACE)
  - Canadian Petroleum Association (CPA)
  - Canadian Chemical Producers Association (CCPA)
  - Canadian Electrical Association (CEA)
  - Mining Association of Canada (MAC)
  - Canadian Nuclear Association & Society (CNA, CNS)
  - Canadian Pulp & Paper Association (CPPA)
- Consulting companies are generally increasing staff to respond to groundwater needs. These include, but are not limited to:

<u>Beak</u>	<u>Jacques Whitford</u>
<u>Gartner Lee</u>	<u>Foratek</u>
<u>Monenco</u>	<u>Hardy</u>
<u>Interra</u>	<u>Klohn Leonoff</u>

### 3.5 Universities

- Universities with specialist interest in groundwater include:
  - University of Waterloo (hydrogeological degrees & research)
  - McMaster University (nuclear waste program review)
  - Laval University (pesticides)
  - University of New Brunswick (proposed Eastern studies group)
  - Memorial University of Newfoundland
  - Technical University of Nova Scotia
  - University of British Columbia
  - University of Saskatchewan

### 3.6 Media

- Following trends in U.S. media, Canadian media coverage of groundwater contamination and concerns is increasing, as more incidents emerge.
- Typically topics include:
  - Well contamination by gasoline from leaking tanks, dry cleaning solvents, landfill sites, agricultural chemicals, herbicide and insecticide spraying, etc..
  - Groundwater concerns with nuclear waste disposal, toxics deep well disposal.
  - Toxics in surface drinking water from contaminated groundwater.
  - Sewer contamination and explosions from leaking petroleum tanks, etc., etc.

### 3.7 Publics

- Media and environmental groups are leading governments in publicizing the problem. Groups include:
    - Conservation Council of N.B.
    - Pollution Probe
    - Friends of the Earth
- More importantly, individual members of the public are being affected by contaminated wells, and are increasingly vocal with their concerns.

### 4.0 ENVIRONMENT CANADA ROLE

- Environment Canada's mission includes the preservation and enhancement of the groundwater resource for the beneficial uses of this and future generations.

The Department's current roles are indicated in Section 3.1 and discussed extensively in the Pearse Report, (3).
- Groundwater assessment and protection is directly linked to the Departmental priority issues of Toxics and Federal Water Policy.
- Groundwater is associated with a number of existing initiatives and Action Plans (e.g. Pesticides, Hazardous Wastes, PCBs, Acid Rain, Industrial Plant Decommissioning, Leaking Underground Storage Tanks, Steam Electric Power Generation Codes of Practice, etc.).
- In consultation with provinces and other stakeholders, Environment Canada should:
  - i) provide the federal focus for groundwater aspects of federal programs;
  - ii) provide scientific information, data, assessment, expertise and advice on groundwater to stakeholders;



- iii) conduct research, development, demonstration of required groundwater protection technologies;
- iv) seek consensus on preventive and remedial practices for management of groundwater resources, in collaboration with provincial, federal and other stakeholders.

#### 5.0 RESULTS EXPECTED

The long-term results expected from a co-ordinated, planned and issue-oriented Groundwater Assessment and Protection Program are:

- i) immediate federal groundwater issues (e.g. involving transboundary water or federal lands) will be addressed efficiently and effectively by Regions;
- ii) groundwater aspects of federal programs will be dealt with in a co-ordinated, consistent manner, with a focus on preventive measures;
- iii) water resources specialists, environmental managers and the public will be better informed on Canada's groundwater resources, and the contamination of groundwater and associated surface water;
- iv) efficient and cost-effective preventive and remedial technologies will be available to water resource and environmental managers, in government and industry;
- v) effective preventive and remedial strategies will be developed and implemented by various stakeholders;
- vi) various publics will be informed on groundwater issues and on the public's role in protecting the resource;
- vii) the Minister and the Department will respond, and will be seen to respond effectively, to a major environmental and health issue of public concern.

These results would be issue-oriented and many would be associated with other departmental initiatives under the Toxics and Acid Rain priorities. Some examples, with particular regional interest shown, may be:

Leaking Underground Storage Tanks .....	(All Regions)
Pesticides .....	(Atlantic, Western)
Irrigation/salination .....	(Sask., Alta.)
Nitrates/nitrites .....	(All)
Water Supply .....	(P.E.I., Prairies)
Sub-Surface Disposal .....	(Alta., Sask., Ont.)
Nuclear Wastes .....	(Ont., Man., N.B., Que.)
Mine Tailings .....	(North, West, Ont.)
Plant Site Decommissioning .....	(Alta., Ont., Que.)
Accidents, Spills, Emergency Responses .....	(All)
Municipal Landfills .....	(B.C., All)
Hazardous Waste Landfills .....	(All)
Transboundary Contamination .....	(USA, Ont, Sask, B.C., etc.)

These examples are not comprehensive and can only be further developed in consultation with Regions, Provinces and other stakeholders.

## 6. PLANS

The intended scope of a Groundwater Assessment and Protection Program includes activities such as research; resource evaluation, development and management plans; prevention and remediation of the contamination of the resource; policy and strategy development; environmental assessment; public information and education, etc. The relative importance of various activities would be determined depending on the priorities and capabilities of various responsibility centres in headquarters, regions and research centres. The management and implementation of activities rests with these centres. Also, more groundwater activities will be gradually integrated into current programs such as toxics, pesticides, LRTAP, etc., etc.

In addition to encouraging excellence in groundwater activities, overall co-ordination and broad representation is required to provide more focus and effectiveness to the Department's activities. Further consultations and co-operation between various Conservation and Protection resource centres should be used to develop a detailed Groundwater Action Plan. To achieve this, the following plans are proposed for overall management and co-ordination.

### 6.1 SENIOR MANAGEMENT PLAN

Groundwater has been identified as an emerging issue for C&P and the Minister has declared interest and commitment to the subject. The following overall management plan proposed follows the current C&P thinking for the management of environmental issues.

- i) Assistant Deputy Minister (ADM) appoints accountable Director General (DG) and Project Leader (PL).
- ii) Project Leader assembles Task Force.
- iii) Task Force prepares Action Plan in consultation with Headquarters (HQ) and Regions.
- iv) ADM and C&P Executive Committee approve Action Plan.
- v) HQ and Regional Managers prepare their plans in consultation with PL.
- vi) ADM and Exec. Committee approve plans.
- vii) HQ and Regional Managers implement plans.
- viii) Project Leader updates ADM, Exec. Comm. on status of Plan, based on reports from HQ and Regional Managers.
- ix) Project Leader liaises with various other C&P managers, Central Policy Group (CPG), provinces, etc., as appropriate.

## 6.2 PROJECT LEADER AND TASK FORCE PLAN

Various tasks have been initiated, and some completed, by the informal teams formed in the development of this Groundwater Proposal. The following can serve as preliminary terms of reference for the PL with appropriate support staff, and the Task Force.

- i) Prepare briefing notes, etc., for Senior Management, Minister (e.g. CCREM notes completed Sept. 86).
- ii) Prepare responses for Ministerial/other correspondence (ongoing).
- iii) Prepare responses and follow-up to Pearse Inquiry (groundwater response completed July 86).
- iv) Identify hydrogeologists for participation in emergency response teams.
- v) Plan Communications Strategy and Products and prepare some (e.g. Canadian Groundwater Directory in preparation, Groundwater Primer by Conservation Council of N.B. will be funded).
- vi) Plan and prepare some discussion papers on groundwater policies, strategies, issues, etc.
- vii) Plan, organize and report on C&P Groundwater Assessment and Protection Workshop (planned 19-20 Nov., 1986, Ottawa).
- viii) Compile current C&P groundwater activities (extracted from C&P Workshop report Jan. 87).
- ix) Provide advice to guide C&P research, development, demonstration, overview studies, technical guides, site investigations, etc.
- x) Plan, organize and report on National Groundwater Assessment and Protection Workshops (currently proposed for N.B., July 1987; Alta., Sept. 1987; Ottawa, Feb. 1988).
- xi) Prepare C&P Groundwater Action Plan (March 1987).

## 6.3 POSSIBLE ELEMENTS IN C&P ACTION PLAN

As shown in Annex 2, elements are suggested by way of example, as possible outputs of a C&P Groundwater Action Plan. These can be more appropriately identified and better defined by the Task Force after the C&P Workshop and during the 87/88 Work Planning activities. Any items on the Minister's or Senior Management's agendas, will be given special attention. Eventually a National Groundwater Action Plan might be developed through CCREM.

7. RESOURCES

The human resources required are a full-time Project Leader (1PY) and support staff (1PY equivalent which could be under contract). Task Force membership would entail time for meeting preparation, travel, consultation (estimated 0.1PY each member).

The financial resources required are estimated at \$120K for FY86/87.

Contract professional support (Workshop preparation report, etc.) ..	30K
Groundwater Primer (Conservation Council N.B.) .....	25K
Groundwater Clean-Up Technology Review Report .....	20K
Groundwater Protection Technical Options Report .....	10K
Workshops, Meetings, etc. ....	10K
Travel .....	10K
Misc. (printing, etc.) .....	15K
	<u>120K</u>

8. RECOMMENDATIONS

The major recommendations are that Environment Canada should: -

- i) establish the assessment and protection of groundwater as a priority;
- ii) ensure that competent expertise is readily available for regional operational support to address groundwater contamination problems;
- iii) establish a co-ordinated and effective Groundwater Assessment and Protection Program;
- iv) establish an accountable Director General, Project Leader and Task Force to further develop, co-ordinate and report on a Groundwater Program and Action Plan, in collaboration with stakeholders.

Environment Canada will be forced to react to an increasing number of groundwater problems in international, national, provincial and personal contexts. The Department should be focused, co-ordinated, consistent, knowledgeable and pro-active in their responses and in preventing degradation of the groundwater resource.

REFERENCES

- 1) National Hydrology Research Institute, "Ground-Water Use in Canada, 1981", by Hess, P.J., Inland Waters Directorate Tech. Bulletin No. 140, Environment Canada, 1986.
- 2) Beak Consultants Ltd., "Ground Water Contamination in Canada: Selected Cases, Potential Sources and Protection Strategy", prepared for Environment Canada, July 1986.
- 3) Pearse, P.H., Bertrand, F., MacLaren, J.W., "Currents of Change, Final Report on Federal Water Policy", for Environment Canada, September 1985.