

Minnesota Ground Water Association

Volume 7, Number 2: May, 1988

That tricky radon gas can be beat!

by Frank J. Donia of APPLIED RADON, INC. 52205 Warehime Rd. Cumberland, OH 43732-9804
reprinted from GAEA: April, 1988
Volume 12, No. 8

Radon Gas! The environment's way of getting back at us! virtually undetectable and mostly harmless, in and of itself. It's a noble gas with a half-life of only 3.82 days. If not for its lethal progeny, those solid mischievous daughters: polonium-218, lead-214, bismuth-214, polonium-214, lead-206, and their unstable sub-atomic alpha particles, obscurity would be its place in history. This mobile daughter of naturally occurring uranium-238 and, less frequently, thorium-232, is rising out of obscurity on a preponderance of evidence and may someday be proven to be the culprit responsible for untold cases of lung cancer among us.

"Home Sweet Home"! The greatest of engineers could not more effectively design a machine to collect radon gas from the depths of the underlying geology. Diffusion brings these heavy atoms of radon gas to the earth's surface to disperse into the atmosphere. They will pool in drain tile systems, hollow block foundations, the empty spaces among the aggregate beneath the slab, and the voids around the footers - the various substructures of a home in contact with the soil. Once the radon is collected in the voids, the house employs thermo-dynamics (the "Stack Effect") to pump it through each cold joint, crack and porous surface. It then collects in the basements and living areas of our premises, occasionally accumulating to hazardous proportions.

We humans are harmed when we breathe in the radioactive progeny of radon. They lodge in our lungs, decay, and emit alpha particles,

damaging the living cells with which we breathe. On occasion, DNA chains in the cells are broken, then mutate, and cancerous cells are then born. This process takes many years, often decades, depending on the levels of contamination. It can shorten a human life by 20 years.

Many areas of Ohio, and the U.S. for that matter, have geology which increases the probability that these unhealthy conditions exist. Recently, the National Academy of Sciences reported in the BREIR IV Report that 13,000 lives are sacrificed to this hazard annually in America. This study confirmed much of what the U.S. EPA has been reporting for the past several years on this health hazard.

Do you know if this hazard exists in your home? Have you screened to find out? Probably not. Most individuals view radon as another problem in their already complex lives and, oddly enough, seem willing to leave this to chance. I feel this to be twisted logic. If radon gas is present in your home, it has been there since it was built, with rare exception. Now that society is aware of this hazard there should be no excuse for lack of remedial action.

Economical screening and follow-up tests are available. If radon gas contamination is confirmed in your home, you need not allow it to shorten a life. A professional can diagnose the problem and show any homeowner how to control the influx of radon gas. The mitigation technology is often quite simple and can be installed by the homeowner. Sealing of entry routes is a simple way to lower slightly elevated levels. If a crawl space is the source, it can be sealed, isolated, and vented. Moderate to high levels of contamination can be controlled with active depressurization systems such as drain-tile, sub-slab or block wall suction systems.

These systems use a commercial duty inline fan mounted on a 4" or 6" PVC pipe stack to create a suction

field in existing drain tiles or, when these are not present, under the concrete slab or occasionally in the block walls. This collects the radon gas from the various sub-structural voids and vents it harmlessly into the atmosphere above the house. A system like this operates 24 hours a day, year-round and adds about \$150.00 to utility costs annually. It has been my experience that most Ohio homes with a first floor area of less than 1200 square feet can be mitigated for \$1,200.00 or less. Depressurization systems require some expertise and are probably best installed by a contractor. There are several other methods of controlling radon gas contamination. Each structure has a unique personality and a solution. Currently, there are no reliable guarantees. The technology used to fix a radon contaminated home is relatively new and some homes tend to be stubborn. Reductions of 90-99% are fairly common, with most reductions at or below the U.S. EPA's voluntary action level of 4 pCi/L.

A brief warning: avoid the use of air cleaners. The U.S. EPA finds that these units are not an adequate solution and that they may even aggravate a contamination problem. They

Table of Contents

<i>That tricky Radon Gas can be beat.....</i>	<i>1</i>
<i>Perspective</i>	<i>2</i>
<i>President's Page</i>	<i>3</i>
<i>North Dakota Maps</i>	<i>4</i>
<i>Freshwater Foundation</i>	<i>4</i>
<i>Humphrey calls for Federal accountability</i>	<i>5</i>
<i>Registration in Wisconsin .</i>	<i>6</i>
<i>Calendar</i>	<i>7</i>
<i>1988 Membership Roster... </i>	<i>8</i>

remove all the dust, leaving nothing for the radon daughters, which are highly charged ions, to attach to. These unattached progeny, therefore, may be drawn deeper into the lungs, where they then attach. This could result in even more damage than if nothing were done.

An ironic observation: currently, it seems individuals are motivated to test their home over concern for the property's value and not the obvious health risk. As if a valuable house is worth something to a ghost!

This is a long term health risk and the most important thing individuals can do to protect their family's health and their property's value is to first screen for the rare chance that the home has a moderate to high radon level (20 pCi/L or more), in need of immediate attention. Second, initiate a long-term follow-up test to measure average annual exposure in the most lived-in areas of the home. This is very important, for someday your property will be sold and this will guarantee a well-reasoned valuation. Radon gas levels can fluctuate several hundred percent from day to day, and season to season. There is no better way to head off panicked re-valuation than with long-term results kept in your files with the deed. Third, if you do find elevated levels, confirm with follow-up tests and use one of the many by-mail detection services to monitor the diagnostic and mitigative efforts independently of your hired contractor. This benefits you by heading off any misunderstandings and weeding out errors.

In closing, I would mention the fact that radon gas was here before us and will be here when we are gone. This does not mean that we should allow it to wreak havoc on our lives through pain and suffering in our later years. The only rational approach to dealing with the tricky gas is to face it head-on and dispose of it while we are still young. It may be a part of the Earth when I'm gone, but it won't be in my home.

Perspective

*By A. G. Harris; reprinted from
GAEA: April 1988 Volume 12, No. 8*

For the last 25 years, people from all over the world have been traveling to the Merry Widow, Earth Angel, Sunshine or Free Enterprise mines near Basin, Montana to pay from \$1.50 to \$4.00 an hour to sit and inhale the radon gas given off by uranium ores. They believe that it will cure cancer, diabetes, arthritis, ulcers, asthma, allergies, multiple sclerosis, emphysema, and other diseases.

On the other hand, most people are worried about the amount of radon that they are exposed to in their homes. The radon comes from the natural decay of radium in the soil or rock. The radon is derived from uranium-238 through radioactive decay. The actual daughter product that the radon is derived from is radium-226, producing radon-222 which has a half-life of 3.8 days. If the radon-222 becomes attached to a smoke or dust particle and is inhaled, it can become trapped in the respiratory tract and cause cellular damage as it continues to decay. The short half-life means that 90% of it decays in 13 days, therefore the radioactive atoms cannot travel far from the source.

People are worried about developing lung cancers, especially the smoker whose chances are increased. Inhaling radon is equal to smoking one-half pack of cigarettes, if the radon count is 4-20 pCi/L, which means that you have a 20% chance of developing cancer. If the count is 20-200, the risk of cancer rises to up to 50% and above 200 the chances are 44-77%. A picocurie is a trillionth of a curie or, in other words, equal to 2 atoms disintegrating per liter per minute. Radon levels are sometimes expressed in working levels (WL) which are 200 pCi/L of radon. At this level, steps should be taken immediately to correct the problem.

According to one set of statistics, 130,000 people die each year of lung cancer. Of these, 110,000 deaths are due to cigarette smoking and 5,000-20,000 deaths are due to inhaling radon in the air.

Prime areas for radon contamination are homes in the uranium belt in the west, phosphate areas in Florida and the "Reading Prong Formation" (granite) in a zone from Pennsylvania to northern New Jersey, certain fault zones of Mesozoic siltstones derived from granites, some metamorphic rocks such as gneiss derived from uranium-bearing sediments or soils derived from the weathering of any of these rocks. Permeability of these rocks seems to play an important part in the movement of the radon.

Some estimates say as many as 1 in 5 homes may have elevated levels of radon. The maximum allowed is 4 picocuries per liter of air. EPA tests showed the ratio of contaminated homes in the following states to be:

- Colorado 39%
- Wisconsin 27%
- Wyoming 26%
- Alabama 6%
- Michigan 9%

No figures were given for the remaining states which were studied, they were: Connecticut, Kansas, Kentucky, Rhode Island and Tennessee. The highest counts were found in Alabama (180) and Michigan (162). The main sources of radon were granites and black shales.

EPA is planning to test homes in Arizona, Indiana, Massachusetts, Minnesota, Missouri, North Dakota and Pennsylvania next.

It all started late in December of 1984 when a Pennsylvania man, Stanley Watras, who worked as an engineer in a nuclear power plant, kept tripping the radiation alarm (on his way in to the plant, no less). The source was traced to the soil beneath his home. It registered 2,500 picocuries (40 times that allowed a uranium worker per week). Steps have been taken to make his house safe.

Tightly sealed buildings can trap and concentrate the gas within the home, as can homes which were constructed on radon emitting soils and which have openings through which the gas can travel.

Prevention includes sealing of cracks in walls and floors, of entryways for pipes entering the house, or of porous cinder block. Adequate ventilation must be created for the house with air-to-air heat exchangers, sub-floor ventilation, and/or exhaust fans.

For your information:

The following circulars are available on request from your state office of radiation protection (at the Minnesota Department of Health: (612) 623-5350) or the Radon Project Office (1-800-23-RADON):

OPA-86-004 *A Citizen's Guide to Radon - What it is and what to do about it.*

OPA-86-005 *Radon Reduction Methods - A Homeowner's Guide.*

OPA-87-011 *Removal of Radon from Household Water.*

OPA-87-009 *Radon Reduction Techniques for Detached Houses - Technical Guidance.*

Water Resources Conference

Reprinted from Minnegrain, a publication of the Water Resources Research Center.

By all accounts, **Minnesota Water: 1988** was a major success. Conference attendance exceeded our expectations by a wide margin, and based on responses the Water Resources Research Center (WRRC) received to a questionnaire, conferees regarded the diverse, two-day program as worthwhile and enlightening. Highlights of the conference included luncheon addresses by U.S. Senator David Durenberger and Minnesota Representative Willard Munger, and the opening (plenary) session. The latter featured oral presentations by five well-known authorities, who discussed the status of water quality in the state and the nation and described legislative and research needs in areas of ground and surface water quality and river management.

In his luncheon address, Senator Durenberger described a major groundwater protection bill he has introduced in Congress. He also discussed findings from a series of public hearings on groundwater problems that he conducted around the state in the week preceding the

- see page 5

May, 1988

President's Page

by Linda Lehman

In this issue, I would like to discuss some of the many projects I have become involved in during the past year. Some of these activities are directly related to my role as President of the Minnesota Ground Water Association, while others relate to my personal consulting business. Overall, I think you will find I have been very active in promoting the goals of our organization.

On the Local Level

As they say, "charity begins at home," so does ground water protection. In accordance with this thought, I have begun to stress the importance of recycling as a means of reducing ground water contamination via landfills. In cooperation with Buckingham Disposal, a local trash hauler, I have started a monthly public education column in my community newsletter, *The Savage Review*. The goal of the column is to make the public aware of recycling opportunities and to provide education on ground water problems associated with landfills.

State Side

In the past several months, I have been appointed to two state committees to examine ground water related issues.

MPCA Joint Hydrology Task Force

This task force is a monthly gathering of hydrogeologists from MPCA, various other state agencies, and outside consultants. The purpose of the task force is to discuss various issues which are near and dear to the hearts of hydrogeologists, and to solicit differing viewpoints. We have had many productive meetings with topics such as pump test analyses, risk assessments, and standards development. In future meetings, the Task Force will be addressing the MDH well code and MPCA solid waste rules. I would appreciate any comments members might have on these or other issues.

EQB Advisory Committee on Ground Water Protection

This committee, chaired by Tom Anding, was established to review the current Draft Ground Water Protection Strategy for the state. I have been appointed the subcommittee chair to address the Ground Water Protection Strategy. Newell Searles has been appointed the subcommittee chair to review the Pest and Nutrient Management Strategy. Thus far, we have offered some alternatives and a general framework. Our work will not be completed until June. The final product should be an overall protection strategy which falls between a non-degradation and a limited-degradation policy, but one which emphasizes non-degradation as a goal. This policy should be in a form which can go to the Legislature next fall. We are also to come up with funding mechanisms for various programs which fall under this "strategy umbrella", such as an aquifer classification program, well abandonment, standards setting, regulatory reform, and public educational programs. Again, any comments or suggestions are welcomed.

International

INTRAVAL

The last week of April I will be attending an important hydrologic modeling workshop in Barcelona, Spain as part of the INTRAVAL project.

The INTRAVAL project addresses the important and difficult issue of validation of models used in the performance assessment of nuclear waste repositories. This will be done through a cooperative effort involving a group of participating organizations that will investigate various techniques for the validation of mathematical models for describing the transport of radionuclides in geologic media.

Participants are from France, Germany, Switzerland, Spain, Japan, Sweden, USA and Canada. I will be part of the USA contingent which includes representatives of the U.S. Department of Energy, U.S. Nuclear Regulatory Commission, and the U.S. Geological Survey. My participation is funded by Governor

Richard Bryan of Nevada. The State of Nevada and the U.S. in general are most interested in unsaturated flow and transport problems because of the selection of Yucca Mountain on the Nevada Test Site as our nation's first repository.

The INTRAVAL project is directed technically by a Coordinating Group consisting of one member from each of the participating organizations. The project is managed by the Swedish Nuclear Power Inspectorate (SKI) through a project secretary and includes a principal investigator (KEMAKTA Consultants Co.), and cooperative members from the United Kingdom's Department of Environment and the Organization of Economic Cooperation and Development/Nuclear Energy Agency (OECD/NEA).

The importance of validation of ground water models cannot be stressed enough. I hope to bring back to our organization a new perspective on methods.

Of General Interest

I have recently attended an informal meeting to discuss geologist/hydrologist registration or certification and have volunteered to help decide on how to proceed. Jane Willard and Pat Leonard-Mayer will soon be writing a paper on this subject. We hope to poll your opinion in the near future on whether a certification is desired by the geologic community.

Radium Seminar

Please remember our Radium Seminar; notice of this meeting has been sent to all on our mailing list and is reprinted in this newsletter. It is planned for Winona State University on May 12, 1988 from 1:30-5:00 p.m. Please plan on allowing enough time for travel so you can join us for conversation before the seminar and for refreshments after the seminar, so I can get to know more of you personally.

Students

Ask your professor about our Student Assistance Fund if your finances are a hindrance to attending this meeting. See you there!

New Geological Maps of North Dakota

North Dakota's Acting State Geologist announces the release of Miscellaneous Map 30 by the North Dakota Geological Survey. This map, entitled *Precambrian Map of North Dakota*, was compiled and drawn by Thomas J. Heck. The buried Precambrian surface is the deepest horizon recognized in North Dakota; it is the ancient surface of the igneous and metamorphic rocks upon which the sedimentary deposits of the Williston Basin were deposited, beginning about 600 million years ago.

The map shows the location of all the wells that have been drilled into the Precambrian rocks in North Dakota; all of these wells were used as data points in compiling the map. Structure contours are shown at a 200-foot interval. The Precambrian surface, which is not exposed anywhere in North Dakota, ranges from as high as 800 feet above sea level in the southeastern sediments, to as low as 14,200 feet below sea level, near the center of the Williston Basin in Williams and McKenzie Counties, where it is covered by over 16,000 feet of younger sedimentary rocks.

The map is at a scale of 1:1,000,000 (approximately 16 miles to an inch) and measures 20" x 26". It can be obtained for \$1.00 from the North Dakota Geological Survey, University Station, Grand Forks, North Dakota 58202-8156.

North Dakota has also released Miscellaneous Map 28 *Generalized Bedrock Geologic Map of North Dakota*, which was compiled and drawn by John P. Bluemle. The small (8.5" x 11") map is printed in color on a base that includes counties, major towns, and highways. The map shows the distribution pattern of the geologic formations that occur in North Dakota. No Minnesotan should have to drive through North Dakota without one, and besides, Miscellaneous Map 28 is free from the North Dakota Geological Survey, University Station, Grand Forks, North Dakota 58202-8156.

Jessen Named to Head Freshwater Foundation

H. Martin Jessen has been named president and CEO of the Freshwater Foundation. Jessen was selected by the Foundation's Board of Directors after an extensive, nationwide search. Board chairman, Daniel C. Chabot, who served as interim CEO, cites Jessen's extensive experience in public policy development and administration as the factors that have prepared Jessen to assume leadership of the Foundation.

The Freshwater Foundation was founded in 1968 by Richard G. Gray Sr., Hibbert Hill and Carroll Crawford for the purpose of assuring adequate supplies of freshwater for human consumption, industry and recreation. The Foundation raised private funds to build the Gray Freshwater Biological Institute on Lake Minnetonka in Navarre, Minnesota. In 1976 the Institute was given to the University of Minnesota.

The Freshwater Foundation is a non-profit, non-advocacy organization. In addition to supporting scientific research, the Foundation is a national center for water information. The Foundation produces the Journal of Freshwater and other informative publications, encourages dialogue on surface and groundwater issues and acts as a catalyst, seeking cooperation and commitment by bringing together people with differing points of view to promote the sound use and management of water resources.

Support for the Foundation is provided by grants and gifts from foundations, corporations and individuals, who share concern for water and, through the Freshwater Foundation, participate in keeping water resources useable.

The Freshwater Foundation expands awareness and understanding of water issues, promotes responsible stewardship of freshwater resources and provides specialized information for families and for professionals in the fields of government, research, public health, education, agriculture, business and industry. Membership in the Freshwater Foundation is open to any individual, organization or business who is interested in assuring adequate quantities of usable freshwater for this and future generations. The Foundation's offices are located at 2500 Shadywood Road, Navarre, MN 55392.

Humphrey presses for passage of Federal Hazardous Waste Enforcement bills

Attorney General Hubert Humphrey III has announced his support for two bills now being considered in the U.S. House of Representatives that would strengthen the ability of states to enforce hazardous waste laws at federal facilities.

"Federal facilities should be the models of compliance with hazardous waste laws," Humphrey said in a statement to the House Energy and Commerce Subcommittee on Transportation, Tourism, and Hazardous Materials. "Instead, federal facilities cases are often the most difficult hazardous waste enforcement cases a state encounters."

Many Department of Defense and Department of Energy facilities are among the most dangerous hazardous waste sites in the country, Humphrey said. At the same time, resolving problems at these facilities has been more difficult than resolving hazardous waste problems involving private parties.

Humphrey, one of four attorneys general to serve as a member of the National Environmental Enforcement Council, said that one of the reasons for this difficulty is that federal agencies do not face the same legal accountability as private parties.

Humphrey said the bills will address these issues by:

- clearly making federal facilities subject to state lawsuits for failure to properly manage hazardous waste;
- preventing the federal government from protecting its contractors from liability for the contractor's improper management of waste; and
- making a contractor who operates a federal facility a party to any hazardous waste permits issued to the U.S. government for the facility

"Strengthening the states' enforcement authority should encourage federal agencies to negotiate with the

states," Humphrey said. "And, it will likely lead to quicker agreements for cleanups of hazardous waste problems at federal facilities."

Several federal installations in Minnesota generate hazardous waste. Hazardous waste improperly stored, handled and disposed of at one of these facilities, the Twin Cities Army Ammunition Plant, resulted in the contamination of over 20 square miles of the principal aquifer underlying the northern suburbs of Minneapolis and St. Paul.

In July 1987, after months of pressing the U.S. Army to take responsibility for the contamination, Humphrey negotiated a landmark agreement with the U.S. Department of Defense for the cleanup.

Minnesota Water: 1988 cont.

conference. Representative Munger outlined the major features of his proposed Environmental Trust Fund, a major piece of legislation which will soon be considered by Minnesota's voters, and reviewed some of the important environmental bills that he helped to enact over the years as a State Representative from Duluth. Jack Ditmore, Chair of the EQB, presented a plaque of appreciation to Representative Munger for his years of dedicated service in protecting and improving Minnesota's water resources.

The oral technical sessions, computer workshops, and poster sessions all were very well attended, and in fact the large attendance strained the meeting room facilities. It is clear to the organizing committee that larger facilities will be needed for future conferences.

Over 340 people attended **Minnesota Water: 1988**, and the registrants represented a very broad distribution of water resources professionals from around the state, including many persons from state agencies; university faculty and graduate students (from both the University of Minnesota and out-state universities); planners and managers from local agencies, private consultants, and state legis-

lators. Nearly everyone who responded to the questionnaire agreed that conferences like **Minnesota Water: 1988** should be held on a regular basis, but sentiment was divided between an annual and biennial format. For a variety of reasons, the organizing committee believes that a biennial conference would be most feasible over the long term, and the WRRRC plans to organize and sponsor these conferences on even-numbered years. Planning for **Minnesota Water: 1990** will begin later this year.

Take Note

Foth & Van Dyke has moved to a larger office at 6474 City West Parkway, Eden Prairie, Minnesota 55344. The phone number is (612) 942-0396

ERT's expanded offices are located at 4500 Park Glen Road, Suite 210, St. Louis Park, MN 55416. The phone number is (612) 924-0117

1988 Board of Directors

Past-President

Rick Johnston
Braun Engineering
(612) 941-5600

President

Linda Lehman
L. Lehman & Associates
(612) 894-0357

President-Elect Vacant

Secretary
Gordy Hess
Sunde Engineering
(612) 881-3344

Treasurer/Membership
Pat Bloomgren
MN Department of Health
(612) 623-5297

Editor
Lee Trotta
U. S. Geological Survey
(612) 229-2600

Call for Nominees

The conference planning committee of the Minnesota Section, ASCE, is seeking individual nominees for its annual award for Outstanding Achievement in Water Resources. The award will be presented at the 21st Annual Water Resources Conference November 9-10, 1988. All public and private organizations are invited to submit nominees for review.

The following is the criteria for nomination and selection:

To be considered for the annual Award for Outstanding Achievement in Water Resources, an individual should have an extended history of contributing to the betterment of water resources in Minnesota. Nominees can be from any discipline and can represent such aspects as research, administration, engineering, etc.

Nominations should be received no later than July 1, 1988. Contact: Jan Becker, University of Minnesota, 315 Pillsbury Drive, SE, Minneapolis MN 55455 (612) 626-1358

Call for Abstracts

**21st Annual Water Resources Conference
November 9-10, 1988
University of Minnesota
St. Paul, Minnesota**

The conference planning committee of the Minnesota Section, ASCE, is seeking topics and exhibits. All public and private organizations are invited to submit abstracts for review.

Suggested topics include, but are not limited to:

- Computer Applications
- Erosion/Sedimentation
- Hydraulics
- Hydrology
- Watershed Planning
- Water Quality
- Non-Point Source Pollution
- Pollution Control

Presentation formats may involve case studies/practical design

methods, problem solving workshops, and lecture presentations.

The audience will consist of 100-125 water management professionals. Applicants should submit a brief abstract of their presentation or exhibit by May 15, 1988.

Contact: Jan Becker, University of Minnesota, 315 Pillsbury Drive, SE, Minneapolis MN 55455 (612) 626-1358

State of Wisconsin requires that hydrogeologists be trained in hydrogeology!

This letter was received from Paul Huebner, C.P.G.S., Hydrogeologist, Acting Chief, Residuals Management & Land Disposal Section, Bureau of Solid Waste Management.

Dear Interested Party:

As you may know, Wisconsin has revised its solid waste administrative codes. The new NR 500 series of codes became effective February 6, 1988. One provision of the new codes is that certain reports including groundwater monitoring plans, initial site reports, feasibility reports, plans of operation and in-field conditions reports must be signed by a hydrogeologist.

This letter is to let you know that effective February 6, 1988, the Department will not accept for review any report submitted for a proposed or existing landfill where interpretation of geology or hydrogeology is necessary unless the report is signed by a hydrogeologist in accordance with NR500.05(4), Wis. Adm. Code. NR500.03(64) and NR550.31(e)2 define a hydrogeologist as a person who is a graduate of an accredited institution of higher education who has successfully completed 30 semester or 45 quarter hours of course work in geology. At least 6 semester or 9 quarter hours must have been in hydrogeology, geohydrology or groundwater

geology. The person must also have acquired through education and actual field experience the ability to direct the drilling of borings and the installation and development of wells, and to evaluate and interpret geologic and hydrogeologic data in accordance with the requirements of chapters NR508, 510, and 512.

Therefore, hydrogeologists who sign reports which contain interpretation of geology or hydrogeology must certify that they meet the above definition. We suggest that the following wording be used: I, _____ hereby certify that I am a hydrogeologist and meet the requirements of NR 500.03(64), Wis. Adm. Code.

The purpose of this new requirement is to help ensure that the interpretation of the geologic and hydrogeologic data in the reports we receive for a landfill is being done by a qualified hydrogeologist. Also, we strongly believe a person has to have an advanced understanding of geology and hydrogeology along with actual field experience to correctly interpret the origin and stratigraphy of the subsurface environment and its physical and chemical characteristics.

If you should have any questions about this new requirement, please feel free to call me at (608) 267-7573.

Call For Papers!

The Association of Ground Waters Scientists and Engineers is currently soliciting papers for:

Environmental Problems in Karst Terranes and Their Solutions - November 16 - 18, 1988, Nashville, Tennessee. Deadline: June 24, 1988

Solving Ground Water Problems with Models - February 7 - 9, 1989, Indianapolis, Indiana. Deadline: August 19, 1988.

Ground water professionals interested in submitting abstracts for these conferences should do so by the appropriate deadlines. Abstract submission forms and suggested topics for papers can be obtained from the NWWA Education Department, 6375 Riverside Drive, Dublin OH 43017 (614) 761-1711

Calendar

May 23 - 26, 1988 *Second National Outdoor Action Conference on Aquifer Restoration, Ground Water Monitoring and Geophysical Methods.* To be held in Las Vegas, Nevada by NWWA.

June 6 - 10, 1988, and repeated **July 18-22** *Practical Approaches to Ground-Water Hydrology and Contamination.* Contact: Shari Dunn, School of Geology, Oklahoma State University, 151 Physical Sciences, Stillwater, OK 74078-0451.

June 7 - 9, 1988 *A Hands-On Workshop on Ground Water.* College Park, Maryland. Contact: Richard M. Miller, American Ecology Services, Inc. 127 East 59th St. New York, NY 10022 (212) 372-1620.

June 8 - 10, 1988 *9th Annual Indiana Water Resources Association Symposium: Water Resources: From Science to Regulation.* Contact: Greg A. Nethery, IWRA, 2605 North Shawnee Trail, LaPorte IN 46350.

June 12 - 14, 1988 *Third National Conference on Drinking Water.* St. John's Newfoundland, Canada. Contact: Chairman, Third National Conference on Drinking Water, P.O. Box 205, St. John's Newfoundland, Canada A1C 5J2.

June 12 - 18, 1988 *Karst Hydrology Field Studies at Mammoth Cave.* Graduate credit is available. Contact: Nicholas Crawford, Department of Geography and Geology, Western Kentucky University, Bowling Green, Kentucky 42101 (502) 843-4979.

June 13 - 16, 1988 *Ground Water Modeling Without Advanced Mathematics (Course I).* To be held in Baltimore by NWWA's AGWSE.

June 13 - 18, 1988 *International Conference on Constructed Wetlands for Wastewater Treatment.* Chattanooga, Tennessee. Contact: Donald A. Hammer, Senior

Wetlands Ecologist, TVA, Division of Land and Economic Resources, Forestry Bldg., Norris, TN 37828.

June 13 - 16, 1988 *Ground Water Modeling Without Advanced Mathematics (Course Mini II).* To be held in Baltimore, Maryland by NWWA's AGWSE.

June 13 - 17, 1988 *Safety at Hazardous Materials Sites: A Hands-On Workshop.* To be held in Valhalla, New York by NWWA's AGWSE.

June 14 - 16, 1988 *Ground Water Treatment Technology.* To be held in Baltimore by NWWA's AGWSE.

June 14 - 16, 1988 *Ground Water Monitoring and Sampling for the newly practicing Ground Water Professional.* To be held in Baltimore by NWWA's AGWSE.

June 20 - 24, 1988 *Parameter Estimation in Groundwater Simulation.* A short course to be held in Indianapolis by IGWMC.

June 21 - 24, 1988 *Canadian/American Conference on Hydrogeology: Fluid Flow, Heat Transfer and Mass Transport in Fractured Rocks.* To be held in Banff, Alberta, Canada, cosponsored by NWWA's AGWSE.

July 7 - 10, 1988, *1988 AWG Field Trip*, 4 day raft trip down Lodore Canyon on the Green River in NW Colorado and NE Utah! For information and reservation form contact Marcia Knadle, 20201 SE 216th St. Maple Valley, WA 98038 (206) 442-1641.

July 12 - 13, 1988, *Environmental Site Assessment Course.* A short course to be held in Boston by NWWA.

July 19 - 20, 1988, *Critical Issues in Underground Storage Tank Management.* A short course to be held in San Francisco by NWWA.

July 25 - 29, 1988, *Modeling of Fluid Flow and Contaminant Transport in Fractured or Granular Porous Media*, a short course to be held in Indianapolis by IGWMC.

August 22 - 26, 1988, *Stochastic and Geostatistical Analysis for Groundwater Modeling*, a short course to be held in Indianapolis by IGWMC.

August 28 - 31, 1988 *Symposium on Water-Use Data for Water Resources Management.* To be held in Tucson, Arizona by AWRA.

September 26 - 30, 1988 *GIS Symposium*, to be held at the Sheraton Tech Center in Denver, Colorado. Six 1/2-day short courses offered. Contact: Dr. T. Usselman, GIS Symposium, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418.

October 11 - 13, 1988 *Introduction to Contaminant Transport Modeling*, a short course to be held in Tampa by NWWA.

October 11 - 13, 1988 *33rd Annual Midwest Ground Water Conference.* Columbus, Ohio. Contact Steven M. Hindall USGS 975 W. Third Avenue, Columbus, OH 43212-3192.

November 7 - 9, 1988 *Water Modelling and Measurement*, to be held in Harrogate, England. Contact Rosemary Pickford, Symposium Organizer, Water Modelling and Measurement 2, BHRA, The Fluid Engineering Centre, Cranfield, Bedford, MK43 OJA, England (44) 234 750422.

November 9 - 10, 1988 *21st Annual Water Resources Conference*, to be held at the University of Minnesota by the Minnesota Section of ASCE. Contact Jan Becker, University of Minnesota, 315 Pillsbury Dr. SE, Minneapolis, Minnesota 55455.

For information about meetings and seminars to be held by the NWWA, contact NWWA at 6375 Riverside Drive, Dublin, Ohio 43017 (614) 761-1711, Telex 241302.

For information about Short Courses held by IGWMC, contact Margaret Butorac, International Ground Water Modeling Center, Holcomb Research Institute, Butler University, Indianapolis, IN 46208 (317) 283-9458.

**1988
Membership
Roster**

Byron Andrew Adams
MN Pollution Control
Site Response
520 Lafayette Road
St. Paul, MN 55155
(612) 297-1806

Don R. Albin
US Geological Survey
Post Office Building
Room 702
St. Paul, MN 55101
(612) 229-2600

Dr. E. Calvin Alexander
University of Minnesota
Geology Department
30A Pillsbury Hall
Minneapolis, MN 55455
(612) 624-3517

James Almendinger
University of Minnesota
Dept of Ecology
318 Church St. SE
Minneapolis, MN 55455
(612) 641-0974

Craig Anderson
Bay West Inc.
5 Empire Drive
St. Paul, MN 55103

(612) 291-0456

Henry W. Anderson
US Geological Survey
4105 Brigadoon Dr.
Shoreview, MN 55126

(612) 229-2600

Jack Anderson
Irrigators Assoc. of Minn.
Box 387
Brooten, MN 56316

(612) 346-2812

Lawrence Annen
Dames & Moore
1846 Hoffman St.
Suite 101
Madison, WI 53704
(608) 244-1788

Michael Applewick
Northeast Technical Services
31 Taconite
P.O. Box 1142
Virginia, MN 55792
(218) 741-4290

Dave Armstrong
MN-DNR-Waters
2372 Doswell Ave.
St. Paul, MN 55108

(612) 296-0438

Jim Bachhuber
WDNR
PO Box 7921
Madison, WI 53702

(608) 266-9269

Keith A. Bachmann
Bonestroo, Rosene, Anderlik
995 Glen Paul Ct.
Shoreview, MN 55126

(612) 636-4600

James W. Bakke
Twin City Testing Inc.
662 Cromwell Avenue
St. Paul, MN 55114

(612) 641-9307

Charles Barger
RCM Assoc. Inc.
10901 Red Circle Dr.
Minnetonka, MN 55343

(612) 935-6901

Douglas Barr
Barr Engineering Co.
7803 Glenroy Road
Minneapolis, MN 55435

(612) 830-0555

Kelton Barr
Biotrol
11 Peavey Road
Chaska, MN 55318

(612) 448-2515

Robert J. Beltrame
Nova Environmental Services
Suite 420
1107 Hazeltine Blvd.
Chaska, MN 55318
(612) 448-8888

Jim Berg
Bay West, Inc.
5 Empire Drive
St. Paul, MN 55103

(612) 291-0456

Larry A. Berndt
Bruce A. Liesch & Assoc.
3810 McKnight Road
White Bear Lake, MN 55110

(612) 429-9163

John Betcher
MN Waste Management Board
1350 Energy Lane
St. Paul, MN 55108

(612) 649-5791

Dr. Roger V. Blomquist
Braun Environmental Labs
6800 S. Co. Rd. 18
Box 35108
Minneapolis, MN 55435
(612) 941-5600

Peter Blomquist

P.O. Box 354
Morrison, CO 80465

(303) 431-6087

Patricia Bloomgren
MN Dept. of Health
717 Delaware Ave. S.E.
Minneapolis, MN 55414

(612) 623-5297

Justin Blum
MN Pollution Control
Site Response
520 Lafayette Road
St. Paul, MN 55155
(612) 296-7706

Carolyn Boben
Delta Environmental Consultants
1801 Hwy 8
Suite 123
St. Paul, MN 55112
(612) 636-2427

Paul Book
Braun Engineering
6800 S. Co. Rd. 18
Box 35108
Minneapolis, MN 55435
(612) 942-8228

Judy Boudreau
DNR-Waters - Metro
1200 Warner Road
St. Paul, MN 55106

(612) 296-7523

Linda Bruemmer
MN Pollution Control
Ground Water and Solid Waste
520 Lafayette Road
St. Paul, MN 55155
(612) 296-8612

Michael R. Burke
Leggette Brashears & Graham
1210 W. Co. Rd.E
Suite A1211
St. Paul, MN 55112
(612) 490-1405

Shelley Burman
MN Pollution Control
Solid Waste
520 Lafayette Road
St. Paul, MN 55155
(612) 296-8353

Bill Canty
GME
2083 East Center Circle
Plymouth, MN 55441

(612) 559-1859

Catherine A. Carlson

528 Johnson St.

Winona, MN 55987
(507) 454-8385

Larry Carlson
Environmental Spec.
Ramsey Co. Env. Health
1910 W. Co. Rd B2 #209
Roseville, MN 55113
(612) 633-0316

Robert Christen
Lakehead Testing Lab
226 Noth Central Ave
P.O. Box 7168
Duluth, MN 55807
(218) 628-2295

Thomas P. Clark
MN Pollution Control
Program Development
520 Lafayette Road
St. Paul, MN 55155
(612) 296-7335

Mark Collins
Illinois State Water Survey
2204 Griffith Drive
Champaign, IL 61820

(217) 333-8465

Daniel A. Comeau
PACE Laboratories, Inc.
1710 Douglas Drive N.
Minneapolis, MN 55422

(612) 544-5543

Doug Connell
Barr Engineering Co.
7803 Glenroy Road
Minneapolis, MN 55435

(612) 830-0555

Paula Connell
Federal Cartridge Corp.
2176 Camden Ct.
White Bear Lake, MN 55110

(612) 426-6589

Michael P. Convery
MN Pollution Control
Site Response Section
520 Lafayette Road
St. Paul, MN 55155
(612) 296-7710

R.J. Corbett
Corbett and Assoc.
7207 Kyle N.
Brooklyn Center, MN 55429

(612) 566-7065

Gary Costanzo
Bay West
5 Empire Drive
St. Paul, MN 55103

(612) 291-0456

Glen Craven
Culligan Water Systems
1137 Whitewater Ave.
St. Charles, MN 55972

(507) 932-4070

David Crisman
Delta Environmental
1801 Hwy 8
Suite 123
New Brighton, MN 55112
(612) 636-2427

Janet Dalglish
MN Pollution Control
Site Response
520 Lafayette Road
St. Paul, MN 55155
(612) 297-1790

James M. DeLambert
Bruce Leisch & Assoc.
3020 N. Harbor Lane
Plymouth, MN 55447

(612) 559-1423

Geoffrey N. Delin
US Geological Survey
702 Post Office Building
St. Paul, MN 55101

(612) 229-2600

David Diamond
Minnesota Valley Testing
Center at German St.
New Ulm, MN 56073

(507) 354-8517

Dr. Dianne Dorland
Materials Proc. Eng.
10 University Drive 176EB
UMD
Duluth, MN 55812
(218) 726-7126

John E. Drawz
LeFevere, Lefler, Kennedy et al
200 First Bank Place West
120 S. Sixth Street
Minneapolis, MN 55402
(612) 333-0543

Fletcher Driscoll
Fletcher Driscoll & Assoc.
28 Peninsula Dr.
Dellwood, MN 55110

(612) 429-8216

George H. Duckwitz, Jr.
George H. Duckwitz, Inc.
Route 1
Box 38
Holloway, MN 56249
(612) 394-2364

Jorja DuFresne
MN Pollution Control
WQ/MWTS
3140 Irving Ave. S.
Minneapolis, MN 55408
(612) 296-9292

Senator D. Durenberger
US Senate
1020 Plymouth Bldg.
12 S. 6th St.
Minneapolis, MN 55402
(612) 370-3382

Robert Elliott
Pace Laboratories, Inc.
1710 Douglas Drive North
Golden Valley, MN 55422

(612) 544-5543

Cathlin M. Endres

200 Winton Ave.
Rothschild, WI 54474

John B. Erdmann
Wenck Associates Inc.
15500 Wayzata Blvd. #832
Wayzata, MN 55391

(612) 475-0858

Don Erickson
Bay West Inc.
5 Empire Drive
St. Paul, MN 55103

(612) 291-0456

Craig O. Evans
USCOE
3107 4th St. SE #6
Minneapolis, MN 55414

(612) 378-2977

Glenn L. Evavold
RREM Inc.
408 Board of Trade Bldg.
301 W 1st Street
Duluth, MN 55802
(218) 722-3915

Jan D. Falteisek
MN Pollution Control - GW&SW
Site Response Section
520 Lafayette Road
St. Paul, MN 55155
(612) 297-1459

John Fax
DNR-Waters - Metro
2211 Matterhorn Lane
St. Paul, MN 55119

(612) 739-9205

John Findley
NOVA Environmental Services
Hazeltine Gates
Suite 420
Chaska, MN 55318
(612) 448-8888

Dale Folen
RCM Associates
P.O. Box 130
Minnetonka, MN 55343

(612) 935-6901

David R. Ford
DNR-Waters
Box 32
500 Lafayette Rd.
St. Paul, MN 55155
(612) 296-0437

G. Rudy Ford
MN Dept. of Transportation
130 Transportation Bldg
St. Paul, MN 55155

(612) 296-3263

Sandra J. Forrest
MN Pollution Control
Site Response
520 Lafayette Road
St. Paul, MN 55155
(612) 296-7390

Jay Ronald Frischman
DNR-Waters
Box 32
500 Lafayette Rd.
St. Paul, MN 55155
(612) 296-0517

Gilbert Gabanski
3407 Grand Ave.
Minneapolis, MN 55408

(612) 641-9359

Abraham Gafni
1232 Gibbs Avenue
St. Paul, MN 55108

(612) 645-9790

Chuck Geisler
Braun Environmental Labs
6800 S. Co. Rd. 18
P.O. Box 35108
Mpls., MN 55435
(612) 942-8228

Gary D. Gilbert
Delta Environmental Consultants
1801 Highway 8
Suite 123
New Brighton, MN 55112
(612) 636-2427

John Gilbertson
Bergerson-Caswell Inc.
5115 Industrial St.
Maple Plain, MN 55359

(612) 479-3121

Daniel C. Gillies
US Geological Survey
Nuclear Hydrology Program
Mail Stop 416, Federal Center
Lakewood, CO 80225
(303) 236-5044

John Gleason
Precision Environmental Services
8009 Ranchers Road NE
Minneapolis, MN 55432

(612) 780-9787

Diane Glinsman

545 Lake Cove Court
Shoreview, MN 55126

(612) 481-7141

Barb Gnabsik
MN Pollution Control
Solid Waste
520 Lafayette Road
St. Paul, MN 55155
(612) 296-7718

Scott Golberg
Steele County
Environmental Health Coord.
Box 890
Owatonna, MN 55060
(507) 451-4842

Paul Goudreault
Delta Environmental
1801 Highway 8
Suite 123
St. Paul, MN 55112
(612) 636-2427

John Grams
Delta Environmental
1801 Hwy 8
Suite 123
St. Paul, MN 55112
(612) 636-2427

John D. Gray
Minnesota Valley Testing Lab
326 Center Street
New Ulm, MN 56073

(800) 782-3557

William Gregg
ERT
4500 Park Glen Road
Suite 210
St. Louis Park, MN 55416
(612) 924-0117

Lynne Grigor
MN Pollution Control
14901 Hillside Lane
Burnsville, MN 55337

(612) 892-3632

Shiela Grow
MN Pollution Control
Water Quality
520 Lafayette Road
St. Paul, MN 55155
(612) 296-9593

Brian Gulbranson
Minnesota Geophysical Associates
14124 Ivywood St. NW
Andover, MN 55304

(612) 427-9509

Myrna Halbach
MN Pollution Control
Program Development
520 Lafayette Road
St. Paul, MN 55155
(612) 296-7830

LeeAnn Hammerbeck
Federal Cartridge Corp.
545 Lake Cove Court
Shoreview, MN 55126

(612) 481-7141

Michael J. Hansel
Koch Refining Company
8835 42nd St. N
Lake Elmo, MN 55042

(612) 437-0645

Eric J. Hansen
L. Lehman & Associates
1103 W. Burnsville Parkway
Suite 209
Burnsville, MN 55337
(612) 894-0357

Zachary J. Hanson

875 James St.

Lino Lakes, MN 55014

Henry He
Wenck Associates Inc.
Twelve Oaks Center
15500 Wayzata Blvd. #832
Wayzata, MN 55391
(612) 475-0858

Thomas L. Heenan
City of Crystal
Health Department
4141 Douglas Drive
Crystal, MN 55422
(612) 537-8421

Michael J. Heiling
IBM Corporation
708/658-B
Hwy. 52N and 37th St. NW
Rochester, MN 55901
(507) 253-8028

Dr. Gordon Hess
Sunde Engineering
9001 E. Bloomington Fwy
Bloomington, MN 55420

(612) 881-3344

Michael L. Hestick
NSP Co.
414 Nicollet Mall
Minneapolis, MN 55401

(612) 330-7634

Eugene Hickok
E. A. Hickok and Associates
545 Indian Mound
Wayzata, MN 55391

(612) 473-4224

Kenneth E. Hjelmstad
US Bureau of Mines
7426 Stevens Ave S
Minneapolis, MN 55423

(612) 725-4500

R. K. Hoagberg
Rudy Hoagberg and Associates
430 1st Ave N
Suite 790
Minneapolis, MN 55401
(612) 871-7765

Gene Hollenstein
Hydrologist Emeritus
8927 Hallmark Ave.
Cottage Grove, MN 55106

(612) 459-2162

Wayne Jacobson
Delta Environmental
1801 Hwy 8
Suite 123
St. Paul, MN 55112
(612) 636-2427

Jim Jacques
US Army
44 Robb Farm Rd
North Oaks, MN 55127

(612) 481-8114

David J. Jaeger
Staff Hydrogeologist
ERT
4500 Park Glen Rd. Suite 210
St. Louis Park, MN 55416
(612) 924-0117

Don Jakes
MN Pollution Control
Program Development
520 Lafayette Road
St. Paul, MN 55155
(612) 296-7736

Dr. Nancy O. Jannik
Geology Department
Winona State Univ.
Winona, MN 55987

(507) 457-5267

Stephen T. Jansen
GME Consultants
1772 Oakdale Ave., #216
West St. Paul, MN 55118

(612) 455-6316

James Japs
DNR-Waters
3453 Fremont Ave. S.
Minneapolis, MN 55408

(612) 824-7718

David A. Jerde
Bruce A. Liesch & Assoc.
3020 Harbor Lane
Plymouth, MN 55447

(612) 559-1423

Suzanne D. Jiwani
Barr Engineering Co.
7803 Glenroy Road
Minneapolis, MN 55435

(612) 830-0547

Charles A. Job

6300 W 98th St
Bloomington, MN 55438

(612) 893-9854

William P. Johnsen
TCAAP
19 Barton Ave. S.E.
Minneapolis, MN 55414

George E. Johnson
MN Pollution Control
Hazardous Waste
520 Lafayette Rd.
St. Paul, MN 55155
(612) 296-7787

Larry L. Johnson
Foth & VanDyke
6474 City West Parkway
Eden Prairie, MN 55344

(612) 942-0396

Scot B. Johnson
MN Pollution Control
Solid Waste
1402 Portland #2
St. Paul, MN 55104
(612) 296-9433

Rick Johnston
Braun Environmental Labs
6800 S. Co. Rd. 18
Box 35108
Minneapolis, MN 55435
(612) 942-8228

Perry M. Jones
301 5th St. SE
Apt. #12
Minneapolis, MN 55414

(612) 331-8814

Michael Jost
Bay West, Inc.
5 Empire Drive
St. Paul, MN 55103

(612) 291-0456

Eugene Jourdan
MDH-Duluth
Gov't Service Center
320 W. 2nd Ave.
Duluth, MN 55811

Joe Julik
MN Pollution Control
Rt 3 Box 681
St. Croix Falls, WI 54024

(612) 296-7753

John C. Jungwirth
Delta Environmental
1801 Highway 8
Suite 123
New Brighton, MN 55112
(612) 636-2427

Roman Kanivetsky
MN Geological Survey
2642 University Ave.
St. Paul, MN 55114

(612) 627-4780

Robert M. Karls
Delta Environmental
1801 Highway 8
Suite 123
New Brighton, MN 55112
(612) 636-2427

Loni Kemp
The Minnesota Project
P.O.Box 4
Preston, MN 55965

(800) 582-5179

Kristin M. Kennedy
Leggette Brashears and Graham
1210 W. Co. Rd. E
Suite A1211
St. Paul, MN 55112
(612) 490-1405

David L. Kill
Johnson Well Screens
P.O. Box 64118
St. Paul, MN 55164

(612) 636-3900

Kathryn Kramer
MN Pollution Control
Site Response
520 Lafayette Road
St. Paul, MN 55155
(612) 297-1802

Jon J. Kruger
Rice Co. Environmental Health
P.O. Box 40
Faribault, MN 55021

(507) 334-2281

Thomas Krzewinski
Lakehead Testing Lab
226 North Central Ave
P.O. Box 7168
Duluth, MN 55807
(218) 628-2295

Patricia E. Kuderer
Hoff and Allen P.A.
300 Prairie Center Drive
Eden Prairie, MN 55344

(612) 941-9220

Bill Kwasny P.E.
GME Consultants, Inc.
2083 East Center Circle
Minneapolis, MN 55441

(612) 559-1859

Jim de Lambert
Bruce A. Liesch & Assoc.
3020 Harbor Lane
Plymouth, MN 55447

(612) 559-1423

Patricia Lang
L. Lehman & Associates
1103 W. Burnsville Parkway
Suite 209
Burnsville, MN 55337
(612) 894-0357

Patrick M. Lannon
Braun Environmental Labs
6800 S. Co. Rd. 18
P.O.Box 35108
Mpls., MN 55435
(612) 942-8228

Mark B. Larson
L. Lehman & Associates
1103 West Burnsville Parkway
Suite 209
Burnsville, MN 55337
(612) 894-0357

Terrence Lee
Olmsted Co. Health Department
1650 4th St. SE
Rochester, MN 55904

(507) 285-8361

Dr. Jeanette H. Leete
DNR-Waters
Ground Water Unit
500 Lafayette Rd.
St. Paul, MN 55155
(612) 296-0433

Linda Lehman
L. Lehman & Associates
1103 W. Burnsville Parkway
Suite 209
Burnsville, MN 55337
(612) 894-0357

Patricia Leonard-Mayer
Harstad and Rainbow Atty's
1036 Norwest Midland Bldg.
Minneapolis, MN 55401

(612) 338-7811

Gary Lewis
Delta Environmental
1801 Hwy 8
Suite 123
New Brighton, MN 55112
(612) 636-2427

R. Lance Little
Sunde Engineering
9100 E. Bloomington Fwy.
Bloomington, MN 55420

(612) 881-3344

Mark Longson
Delta Environmental Eng.
1801 Highway 8
Suite 123
St. Paul, MN 55112
(612) 636-2427

David J. Lowell
6422 City West Pkwy
#2313
Eden Prairie, MN 55344

(612) 942-0895

Gail Lowry
MN Pollution Control
Site Response Section
520 Lafayette Road
St. Paul, MN 55155
(612) 296-7744

Tom Lucas
Northeast Technical Services
HCR S
Box 334
Hibbing, MN 55792
(218) 741-4290

Audrey J. Luebeck
Pope-Reid Assoc.
245 E 6th St
Suite 813
St. Paul, MN 55101
(612) 227-6500

Marilyn D. Lundberg
State Planning Agency
300 Sentennial Bldg
658 Cedar St.
St. Paul, MN 55155
(612) 296-0676

Michael Lustig P.E.
Patzig Testing Laboratories
3922 Delaware Avenue
Des Moines, IA 50313

(515) 266-5101

Patrick Lynch
DNR-Waters
173 Como Ave.
St. Paul, MN 55103

(612) 296-4800

William C. MacDonald
Delta Environmental Consultants
7417 59th Ave N
Crystal, MN 55428

(612) 636-2427

Kenneth R. Madison
SD Dept. of Water & Natural
Resources - Water Deveopment
1213 6th Ave NE
Watertown, SD 57201
(605) 773-3151

Eric Madsen
Control Data Corporation
1425 Arlington Ave. E.
St. Paul, MN 55106

(612) 853-5549

Suzanne Maeder
MN Land Mgmt Info Center
LL65
Metro Square Bldg.
St. Paul, MN 55101
(612) 296-1211

Eric Magee
Washington Co. Health Dept.
Wa. Co. Government Center
14900 N. 61st St. Po Box 6
Stillwater, MN 55082
(612) 779-5445

Joe Magner
MN Pollution Control
Water Quality
520 Lafayette Road
St. Paul, MN 55155
(612) 296-8689

Karl H. Martinson
Owen Ayres & Assoc.
15550 92nd Place N
Maple Grove, MN 55369

(612) 644-0604

Leslie Mateffy
Mateffy Eng. Inc.
663 Old Hwy. 8
New Brighton, MN 55112

(612) 636-6166

Tedd Mattke
Matteffy Eng. Inc.
663 Old Hwy. 8
New Brighton, MN 55112

(612) 636-6166

Brian W. McArdell
University of Minnesota
2165 Powers Ave.
St. Paul, MN 55119

(612) 738-0297

Steve McComas
Blue Water Science
1811 Eleanor Ave
St. Paul, MN 55116

(612) 699-0125

John McDermott
MN Pollution Control
P.O. Box 75571
St. Paul, MN 55175

(612) 296-7742

Chris McElligott
Twin City Testing Inc.
662 Cromwell Ave.
St. Paul, MN 55114

(612) 641-9354

Brian McHugh
Delta Envrionmental Consultants
1801 Highway 8
Suite 123
New Brighton, MN 55112
(612) 636-2427

Chris Mechenich
Central WS Ground Water Center
Room 10
UWSP
Stevens Point, WI 54481

Steven A. Meger
MN Pollution Control
Site Response
520 Lafayette Rd.
St. Paul, MN 55155
(612) 296-9543

Bob Merritt
DNR-Waters
Area Hydrologist
1223 Mn. Ave.
Detroit Lakes, MN 56501
(218) 847-7696

George Mickelson
I.T. Corporation
806 W.Co.Rd.D #134
New Brighton, MN 55112

(612) 481-8084

Donald K. Milless
Pace Laboratories, Inc.
1710 Douglas Drive N.
Golden Valley, MN 55422

(612) 544-5543

Leg. Comm. on Minnesota
Resources
Room 65
State Office Bldg
St. Paul, MN 55155

(612) 296-2406

Cathy Berg Moeger
MN Pollution Control
520 Lafayette Rd.
St. Paul, Mn 55155

(612) 296-8439

John Moeger
MN Pollution Control
Route 2
Box 195
River Falls, WI 54022
(612) 296-7974

Eric Mohring
DNR-Waters
35 Sidney Place SE
Minneapolis, MN 55414

(612) 331-1330

Gunilla Montgomery
MN Dept. of Health
Environmental Health
717 Delaware St. SE
Minneapolis, MN 55440
(612) 623-5326

Martin Moran
Delta Environmental
1801 Highway 8
Suite 123
St. Paul, MN 55112
(612) 636-2427

John Morley
Mn Waste Management Board
7323 58th Ave. N.
Crystal, MN 55428

(612) 536-0816

Christopher Mosentine
E.A.Hickok and Assoc.
545 Indian Mound
Wayzata, MN 55391

(612) 473-4224

Gene L. Mossing
Winona County
Solid Waste Mgmt
171 W. Third St.
Winona, MN 55987
(507) 457-6460

Leon F. Mucha
McGhie & Betts Inc.
1648 Third Avenue SE
Rochester, MN 55904

(507) 289-3919

Dean Myers
Precision Environmental Services
8009 Ranchers Road NE
Minneapolis, MN 55432

(612) 780-9787

Georgianna Myers
726 1st St NW
Rochester, MN 55901

(507) 285-9047

Laura Myers-Wittman
Braun Environmental Labs
2485 Orkla Drive North
Golden Valley, MN 55427

(612) 942-8228

Ron Nargang
Director DNR-DOW
5376 Osgood Ave. S.
Afton, MN 55001

(612) 296-4810

Michael Nash
LeFebvre Lefler Kennedy et al.
200 First Bank Place West
Minneapolis, MN 55402

(612) 333-0543

John Nedved
OH Materials
924 S. Smith Ave.
W. St. Paul, MN 55118

(612) 451-6899

Erick Neher
Delta Environmental
1801 Hwy 8
Suite 123
St. Paul, MN 55112
(612) 636-2427

David Nelson
MN Pollution Control
WQ/MWTS
520 Lafayette Road
St. Paul, MN 55155
(612) 296-9315

Dennis N. Nielsen
Winona State University
Dean, Science and Technology
Winona, MN 55987

(507) 457-5014

Robert C. Nielsen
Twin City Testing Inc.
19 Barton Ave. SE
Minneapolis, MN 55414

(612) 641-9363

Michael Nord
2825 32nd Ave S
Minneapolis, MN 55406

(612) 724-6626

Laura Noy
MN-DNR
Box 5
500 Lafayette Road
St. Paul, MN 55155
(612) 297-2214

Thomas K. Noyes
McCombs-Frank-Roos Assoc.
15050 23rd Ave N
Plymouth, MN 55447

(612) 476-6010

David F. O'Brien
Lakehead Testing Lab
Route 1
Box 93B
Wentworth, WI 54894
(715) 398-5616

Catherine H. O'Dell
Barr Engineering
168 Orlin Ave SE
Minneapolis, MN 55414

(612) 379-8508

Kenneth P. Olson
Bruce Leisch & Associates Inc.
3020 Harbor Lane
Minneapolis, MN 55447

(612) 559-1423

Terry Olson
Olson Well Drilling
Rural Route #1
Lake Park, MN 56554

(218) 238-5409

A. Bruce Paakh
MN Pollution Control
714 Lake Ave.
Suite 220
Detroit Lakes, MN 56501
(218) 847-1519

Gary Patton
DeWild Grant Reckert & Assoc
315 First Avenue
Rock Rapids, IA 51246

(712) 472-2531

Ronald Pearson
Delta Environmental
1801 Hwy 8
Suite 123
St. Paul, MN 55112
(612) 636-2427

John Pegors
MN Pollution Control/Duluth
320 W. 2nd St
Room 704
Duluth, MN 55802
(218) 723-4660

Robert E. Pendergast
Geotechnical Engineering Corp
1925 Oakcrest Ave.
Roseville, MN 55113

(612) 636-7744

Timothy J. Peschman

9630 104 Ave. N.
Maple Grove, MN 55369

(612) 424-2250

Dr. James Piegat
Hennepin Conservation District
12450 Wayzata Blvd
Suite 205
Minnetonka, MN 55343
(612) 544-8572

Randy Plante
Precision Environmental Services
8009 Ranchers Road NE
Minneapolis, MN 55432

(612) 780-9787

Robert J. Pofahl

1370 Boundary Rd
Middleton, WI 53562

(608) 831-0434

J. Kevin Powers
Leggette Brashears and Graham
1210 W. Co. Rd. E
Suite A1211
St. Paul, MN 55112
(612) 490-1405

James P. Prieur
Delta Environmental
1801 Highway 8
Suite 123
New Brighton, MN 55112
(612) 636-2427

Keith Rapp
Delta Environmental
1801 Hwy 8
Suite 123
St. Paul, MN 55112
(612) 636-2427

David Ratner

10201 Cedar Lake Rd.
Minnetonka, MN 55343

(612) 593-0979

Allen Rechnagel
Delta Environmental
19 Old Town Square
Suite 238
Fort Collins, CO 80524
(303) 493-0800

Laurel Reeves
DNR-Waters
Box 32
500 Lafayette Road
St. Paul, MN 55155
(612) 297-1786

Colin Reichhoff
RREM, Inc.
408 Board of Trade Bldg.
301 W 1st Street
Duluth, MN 55802
(218) 722-3915

Jerry R. Rick
Delta Environmental
1801 Highway 8
Suite 123
New Brighton, MN 55112
(612) 636-2427

Steve Robertson
Barr Engineering
7803 Glenroy Rd. #100
Minneapolis, MN 55435-3893

(612) 830-0555

Gregg A. Rocheford
Bruce A. Liesch & Assoc.
6723 Penn Ave. So.
Richfield, MN 55423

(612) 559-1423

Brian Rongitsch
DNR-Waters
Box 32
500 Lafayette Road
St. Paul, MN 55155
(612) 296-0434

David Ronnei
Delta Environmental
1801 Hwy 8
Suite 123
St. Paul, MN 55112
(612) 636-2427

Donald D. Rosenberry

1912 S. Estes St.
Lakewood, CO 80227

Tom Rosga
Rosga Well Drilling
Box 586
Hinckley, MN 55307

(612) 384-6103

Edwin H. Ross
MN Dept. of Health
Environmental Health
1642 3rd Street NW
New Brighton, MN 55112
(612) 623-5349

Thomas A. Roushar
Howard Needles Tammen et al.
6700 France Avenue South
Minneapolis, MN 55435

(612) 920-4666

Janet Rowe
E.A. Hickok and Assoc.
545 Indian Mound
Wayzata, MN 55391

(612) 473-4224

Patricia Ruble
Central MN Water Quality Project
P.O. 442
Princeton, MN 55371

(612) 389-4563

Rob Runkle
DNR-Waters
P.O. Box 1008
Detroit Lakes, MN 56501

(218) 847-1579

Gretchen Sabel
MN Pollution Control
Program Development
520 Lafayette Road
St. Paul, MN 55155
(612) 296-7358

Maynard T. Sand
Town Officers Association
Route 1
Box 270
Avon, MN 56310

Brian Sandberg

382 W. County Rd. D
St. Paul, MN 55112

(612) 639-0913

Daniel L. Sanville
Delta Environmental Consultants
1801 Highway 8
Suite 123
New Brighton, MN 55112
(612) 636-2427

Katherine M. Sanville

1893 Ross St
White Bear Lake, MN 55110

(612) 429-9607

Robert Sass
Pace Laboratories, Inc.
1710 Douglas Drive
Golden Valley, MN 55422

(612) 544-5543

Diana R. Lee Schaefer
Searles Well Drilling
Route 2
Box 202B
New Ulm, MN 56073
(507) 354-8633

Jon E. Scharf
Braun Environmental Labs
6800 So. Co. Rd. 18
P. O. Box 35108
Mpls., MN 55435
(612) 942-8228

T. W. Schaub
Bruce A. Liesch Assoc.
1125 W. 28th St.
#210
Mpls., MN 55408
(612) 870-1247

Ed Schneider
MN Department of Health
717 Delaware Ave. SE
Minneapolis, MN 55440

(612) 623-5557

Ralph J. Schnorr, PE
GME Consultants, Inc.
7330 Gallagher Dr.
#144
Edina, MN 55435
(612) 559-1859

Michael E. Schoenberg
US Geological Survey
702 Post Office Bldg.
St. Paul, MN 55101

(612) 229-2638

Martha A. Scholl
Dept. of Env. Sciences
Clark Hall
University of Virginia
Charlottesville, VA 22903
(804) 924-0532

John K. Seaberg
Barr Engineering
7803 Glenroy Ave.
Minneapolis, MN 55435

(612) 835-9933

Sheilah M. Seaberg
Science Museum of Minnesota
30 East Tenth Street
Box 2300
St. Paul, MN 55101
(612) 221-9439

Larry Seymour
New York Life
1080 Bwana Ct.
West St. Paul, MN 55118

(612) 452-1152

Mitchell Shields

1031 Victoria St.
St. Paul, MN 55103

(612) 488-9499

Mary Siedlecki
EWA, Inc.
#312
5740 East River Rd
Fridley, MN 55432
(612) 571-0126

Bradley R. Sielaff
MN Pollution Control
Program Development
6770 Plaza Curve
Fridley, MN 55432
(612) 296-8411

Mark Simonett
Hamline Law School
6949 Colorado Ave. N
Brooklyn Park, MN 55429

(612) 560-1318

Joseph A. Sislo

5055 Jackson
Minneapolis, MN 55421

(612) 571-2769

William R. Skallerud
LeFevere Lefler Kennedy O'Brien
2000 First Bank Place West
120 South 6th Street
Minneapolis, MN 55402
(612) 333-0543

Albert J. Smith
Johnson Well Screens
18551 Bates Street
Dayton, MN 55327

(612) 636-3900

Ron Spong
Dakota Public Health Dept.
1772 Ashland Ave.
St. Paul, MN 55104

(612) 450-2607

James R. Stark
US Geological Survey
Room 702
Post Office Bldg
St. Paul, MN 55101
(612) 229-2600

Matt Stevens
Winona State University
520 Harriet St.
Winona, MN 55987

(507) 452-3264

David R. Steward
University of Minnesota
3050 Old Hwy 8
#321
Roseville, MN 55113

Daniel R. Stoddard
MN Pollution Control
1209 Rhode Island Ave. N.
Golden Valley, MN 55427

(612) 546-6858

Jeffrey D. Stoner
US Geological Survey
Room 702
Post Office Bldg.
St. Paul, MN 55101
(612) 229-2621

Mark R. Storck

61 Mitawan Lake Rd.
Isabella, MN 55607

(218) 323-7791

Pete Storlie
CRA
382 West County Rd. D
St. Paul, MN 55112

(612) 639-0913

Dr. Otto D. L. Strack
University of Minnesota
Civil and Mineral Engineering
23 Black Oak Rd.
St. Paul, MN 55127
(612) 625-3009

Andrew Streit
DNR-Waters
Box 32
500 Lafayette Road
St. Paul, MN 55155
(612) 296-0442

Alan Strub

R.R. 3
Box 132
Caledonia, MN 55921

Jim D. Strudell
MN Pollution Control
Regulatory Compliance
520 Lafayette Road
St. Paul, MN 55155
(612) 296-7238

Mike Thein
Thein Well Co.
P.O. Box 429
Clara City, MN 56222

(612) 847-3207

Peter J. Thein
Thein Well Co.
Rt. 1
Box 153
Spicer, MN 56288
(612) 796-2111

Dale B. Thompson
MN Pollution Control
Site Response
520 Lafayette Road
St. Paul, MN 55155
(612) 296-7375

Ronald D. Thompson
MN Department of Health
Environmental Health
717 Delaware St. SE
Minneapolis, MN 55440
(612) 623-5264

Lee C. Trotta
US Geological Survey
702 Post Office Bldg.
St. Paul, MN 55101

(612) 229-2600

Sarah P. Tufford
DNR-Waters
Box 32
500 Lafayette Rd.
St. Paul, MN 55155
(612) 297-2431

Larry Van De Brake
Well Driller
Alton Well & Concrete
Box F
Alton, IA 51003
(712) 756-8818

Steve A. Vanderboom
Pace Laboratories, Inc.
1710 Douglas Drive North
Golden Valley, MN 55422

(612) 544-5543

Ingrid Verhagen
MN Pollution Control
Site Response
520 Lafayette Road
St. Paul, MN 55155
(612) 296-1799

David D. Vieau
NOVA Environmental Services
Hazeltime Gates
Suite 420
Chaska, MN 55318
(612) 448-8888

Andrew Vikman
Delta Environmental
1801 Hwy 8
Suite 123
St. Paul, MN 66112
(612) 636-2427

Cathleen A. Villas
MN Pollution Control
520 Lafayette Road
St. Paul, MN 55155

(612) 296-8595

Martin Wangensteen
Bay West
5 Empire Drive
St. Paul, MN 55103

(612) 291-0456

James L. Warner
MN Pollution Control
Solid Waste
520 Lafayette Road
St. Paul, MN 55155
(612) 296-7340

John Wells
MN State Planning Agency
550 Cedar Street
St. Paul, MN 55101

(612) 296-3985

Betty Wheeler
University of Minnesota
1830 Green Bay
LaCrosse, WI 54601

(608) 787-0499

Robin Whitaker
Twin City Testing
662 Cromwell
St. Paul, MN 55114

(612) 641-9371

Dan Whitman
STS Consultants
2405 Annapolis Lane
#280
Plymouth, MN 55441
(612) 559-1900

Cynthia Widlund

715 7th St. SE

Minneapolis, MN 55414

Douglas A. Wierman

1840 18th St. NW

New Brighton, MN 55112

Paul J. Wiese
Twin City Testing, Inc.
662 Cromwell Avenue
St. Paul, MN 55114

(612) 649-5582

Jane M. Willard

1950 Stanford Ave.
St. Paul, MN 55105

(612) 699-6101

David L. Williams

1839 61st Avenue N.
St. Cloud, MN 56301

(612) 255-0192

Earl Windahl
Bruce .A. Liesch & Assoc.
3020 N. Harbor Lane
Plymouth, MN 55447

(612) 559-1423

Brenda Winkler
Braun Environmental Labs
6800 S. Co. Rd. 18
Eden Prairie, MN 55435

(612) 942-8228

Jerry Wright
Univ. of Minnesota Extension
West Central Exper. Station
Morris, MN 56267

(612) 589-1711

John K. Yu
USAF-OEHL
Technical Operation
Brooks Air Force Base
San Antonio, TX 78235

Mark Zaban
Hennepin County
Dept. E & E
822 S. Third St, Suite 300
Minneapolis, MN 55415
(612) 348-2822

Joel A. Zeltinger
Twin City Testing and Eng.
L3100 E. Broadway
Box 1114
Bismarck, ND 58502
(701) 223-6149

Eugene Zempel

Box 112

Franklin, MN 55333

Terry Zien
Enviroscience Inc
1210 Cambridge St.
#15
Hopkins, MN 55343
(612) 932-9757

Dan Zwilling
DNR-Waters
Box 32
500 Lafayette Road
St. Paul, MN 55155
(612) 296-0427

Officers Needed

The MGWA is soliciting nominations for president-elect and treasurer-elect. It is important that each member participate in the search for good leaders. If you know someone with an interest in water issues and with sound ideas about what the goals of MGWA should be (perhaps yourself), then give us a call.

Midwest Ground Water Conference

The 33rd annual Midwest Ground Water Conference will be held in Columbus, Ohio, October 11-13, 1988. The conference provides an opportunity for ground water professionals and students throughout the Midwest to meet and discuss topics of mutual interest and concern. The conference will be held at the Parke Hotel, which is adjacent to the Ohio State University campus. The two-day program will consist of ground water-related papers, exhibits and a poster session. The conference will be hosted by the Ohio Environmental Protection Agency; the Ohio Department of Natural Resources, Division of Water; The Ohio State University, Department of Geology and Mineralogy; the U.S. Geological Survey; the Association of Ground Water Scientists and Engineers, a division of NWWA; and the Ohio chapter of the American Institute of Professional Geologists. For more information, contact Rebecca Petty, Ohio Division of Water, Fountain Square at Morse Road, Columbus, Ohio 43224.

**Groundwater Monitoring
Products
by
Johnson® screens**

P.O. Box 64118
St. Paul, Minnesota 55164
Telephone 612-636-3900

DAVID L. KILL, P.E.



GME CONSULTANTS, INC.
CONSULTING ENGINEERS

- Soil Borings, Angle Borings
- Monitoring Wells and Piezometers
- Soil Gas Wells
- Laboratory Testing of Soil

2083 East Center Circle
Minneapolis, Minnesota 55441
(612) 559-1859

Duluth Office
(218) 722-4323

Chicago Office
(312) 430-1071



Minnesota: Minneapolis • St. Cloud • Hibbing
Rochester • St. Paul
North Dakota: Bismarck • Williston **Montana:** Billings
(Minneapolis Phone (612) 941-5600)

Geotechnical, Materials, & Environmental Testing and Consultation:
Test Borings, Foundation Engineering, Non-Destructive Testing,
Physical & Chemical Tests of Soils, Water, Steel, Concrete,
Bituminous, Hazardous Wastes

THE IN WELL COMPANY

464-1177 or

(612) 796-2111

Join the Minnesota Ground Water Association!

If you are reading this newsletter second-hand, we'd like to take this opportunity to invite you to become a member of IMGWA. Annual dues are \$10 for professional members and \$5 for students.

Just complete the form below and mail to: Minnesota Ground Water Association, P.O. Box 65362, St. Paul, MN 55165

Name _____

Affiliation _____

Mailing Address _____

City, State, Zip _____

Telephone Number (____) _____

Bergerson-Caswell Inc.

- Ground water monitoring well drillers
- Air & mud rotary wells
- Cable tool wells
- Well abandonment
- Stabilization & zone pumping tests
- H.E.R.D. & high velocity well development
- Video well logging

Wells, Pumps, Service and Repairs 24 Hour Answering Service

John H. Gilbertson, P.E.
Registered
Monitoring Well Engineer

MEMBER
GROUND WATER INSTITUTE

5115 Industrial Street
Maple Plain, MN 55359
(612) 479-3121

L. LEHMAN & ASSOCIATES, INC.

Ground Water & Nuclear Waste Specialists

1103 W. Burnsville Parkway
Suite 209
Minneapolis, MN 55337
(612) 894-0357

Delta Environmental Consultants, Inc.

Hydrogeologists, Engineers
and Scientists

St. Paul
612 636-2427
Fort Collins
303 493-0800
Charlotte
704 523-1700

Tampa
813 874-8161
Phoenix
602 866-3469
Sacramento
916 923-1598



Foth & Van Dyke *50 years*

engineers • architects • planners • scientists • economists

Green Bay • Minneapolis

Madison • Milwaukee

6474 City West Parkway
Eden Prairie, MN 55344
612/942-0396

Minnesota Ground Water Association
P. O. Box 65362
St. Paul, MN 55165