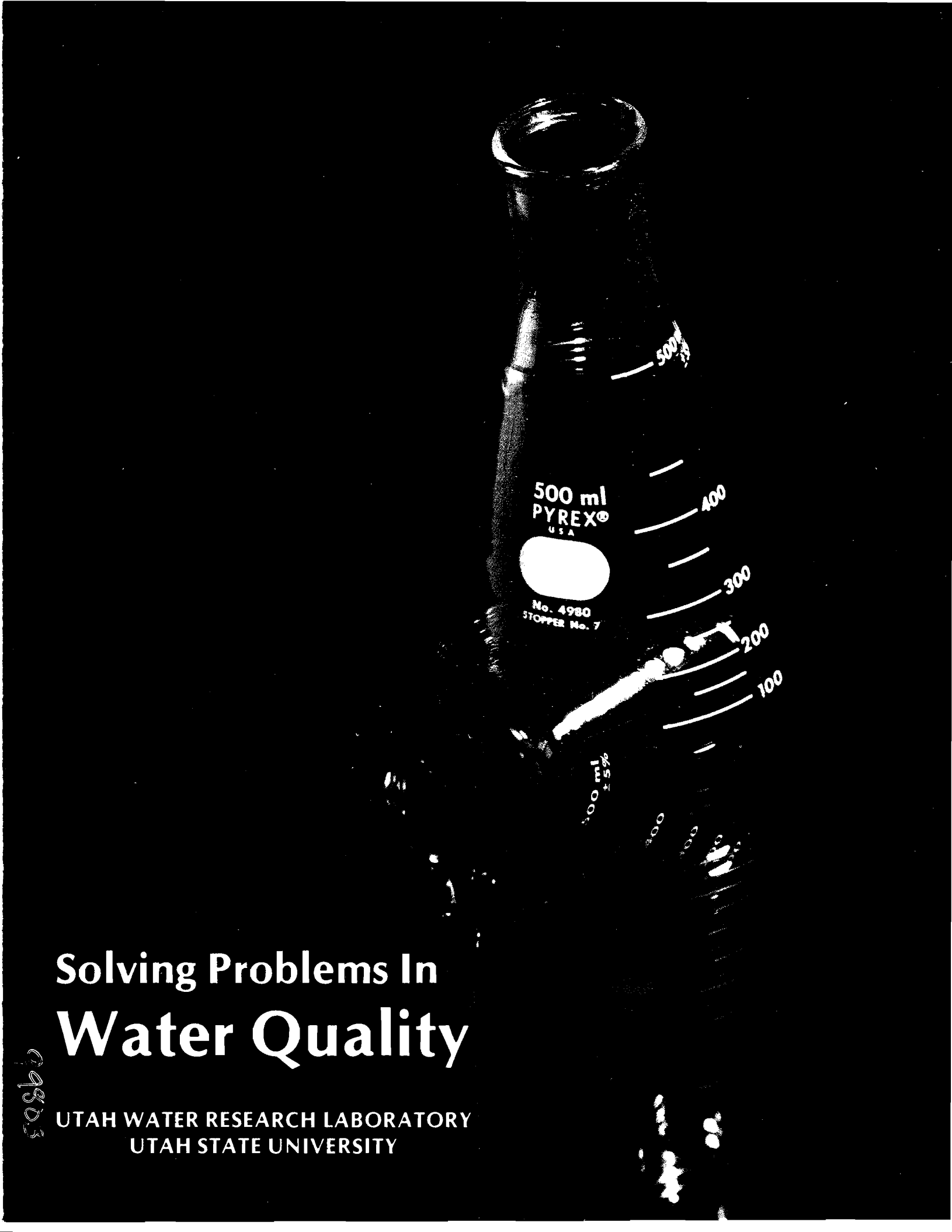
January 2012

Solving Problems in Water Quality

Utah Water Research Laboratory

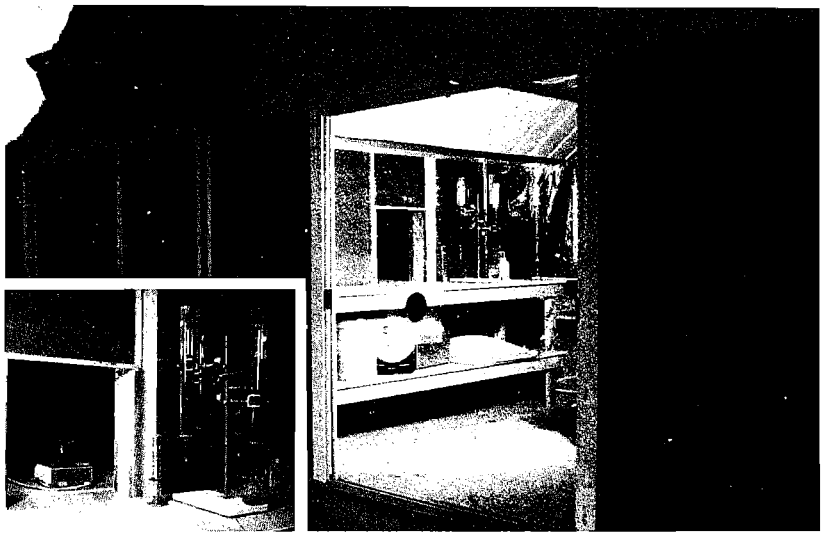


Solving Problems In
Water Quality

UTAH WATER RESEARCH LABORATORY
UTAH STATE UNIVERSITY

Hazardous Waste Management

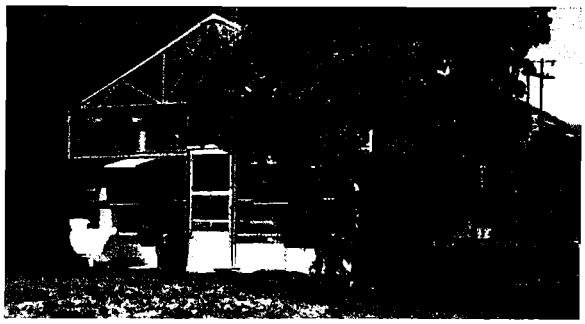
Water quality management research at UW applies multi- media (water, atmosphere, and restrial systems) analysis to providing or maint ing high quality water for man and nat . Research areas include quality of natural waters, environmental impacts of development, potable water protection, agricultural, industrial, and municipal wastewater management, and toxic and hazardous waste management. Specific research activities include detection and identification of pollutants, evaluation of sources and fate of pollutants, and development of treatment technologies for control of pollutants.



RIFFLE

The Research Installation for Fate and Effects in Lotic Environments (RIFFLE) is a facility for ecosystem-level studies of chemicals in mountain streams. The facility contains eight pool-and-riffle stream microcosms housed in a 20 x 60 foot greenhouse. The streams can be configured to provide a variety of conditions found in cold hardwater mountain streams.

Facilities are available for conducting static fish, algal and terrestrial bioassays.



Equipment Capabilities

Table 1. UWRL Instrumentation for Characterization, Fractionation, and Identification of Environmental Samples.

Analytical and Bioassay Instrumentation	Application to Environmental Samples Analysis
Atomic Absorption Spectrophotometer	Inorganic
Inductively Coupled Plasma Emission Spectrophotometer	Inorganic — Simultaneous analysis of multiple components
Gas Chromatographs	Organic
Gas Chromatograph/Mass Spectrometer	Organic — Identification/ quantification
High Performance Liquid Chromatograph	Organic Inorganic — Individual ion species
	Complex Mixture Fractionation — Preparation of fractions for bioassay testing
Beckman Microtox™ Toxicity Analyzer	toxicity — Complex mixtures

General Laboratory

A 12,000-square foot facility provides space and equipment to conduct laboratory bench-scale and pilot plant studies, and to perform analytical and bioassay tests for water quality and environmental management research. The facility includes a 4800-square foot wet chemistry laboratory which serves as the center for analytical instrumentation; a microbiology complex for bacterial, algae, and viral research; four constant temperature bioassay and research laboratories; and a soil/waste treatability laboratory. UWRL maintains state and EPA certification for its water quality laboratory and conducts quarterly QA/QC audits for routine analyses.

Major instrumentation for chemical characterization, fractionation, and identification of environmental samples is summarized in Table 1.

Mutagenicity testing is done through the Ames **Salmonella**/mammalian microsome assay. The Ames assay is a bacterial test used to detect carcinogens as mutagens. The assay is versatile; it can be applied to liquid, solid, and gaseous samples. Assays are conducted with six *Salmonella* strains, a minimum of five doses per test, triplicate plates, with and without metabolic activation, and includes toxicity and mutagenicity tests. Positive and negative controls are used.

Staff

V. Dean Adams, Professor (PhD, Utah State University)

Presently coordinating the activities of the UWRL Water Quality Laboratory with respect to State of Utah and U.S. Environmental Protection Agency certification requirements. Over 10 years experience and multiple publications in organic and inorganic analysis methods development, and evaluation of natural systems, toxic and hazardous wastes, heavy metals, and impacts of energy development on water quality.

Bill B. Barnett, Research Associate Professor (PhD, Utah State University)

Research expertise in microbiology and environmental virology, experienced in evaluating slow rate sand filters in drinking water, granular media filters in secondary wastewater treatment plants, and viruses in reclaimed wastewater.

R. Ryan Dupont, Research Assistant Professor (PhD, University of Kansas)

Presently investigating applications of microcomputers in environmental engineering and in toxic and hazardous waste management. Expertise is in biological treatment processes, industrial waste pretreatment, wastewater treatment plant operations and evaluations, and air pollution.

William J. Grenney, Professor and Department Head, Civil and Environmental Engineering (PhD, Oregon State University

Over 10 years experience in mathematical modeling of natural systems and physical/chemical processes for water treatment, and extensively involved in developing application of microcomputer systems for water resources management.

Norman B. Jones, Professor (MS, University of California at Berkeley)

Thirty years of research and teaching in solid and hazardous waste management, resource recovery, and water and wastewater treatment plant operator training and safety.

Joan McLean, Research Scientist/Chemist (MS, University of California at Davis)

Supervisor for the Water Quality Laboratory and responsible for its day-to- day operation. Experienced in soil, water and wastewater chemical analyses, and in the evaluation of the behavior of heavy metals in soil systems.

Jay J. Messer, Research Associate Professor (PhD, University of Florida)

Expertise in development of mathematical models of natural systems including nutrient and heavy metal biogeochemistry. Extensively involved with projects in nitrogen and phosphorus dynamics in lake sediments, eutrophication assessment and management, and impacts of fossil fuel development on aquatic systems.

Alberta J. Seierstad, Research Scientist/Chemist (BS, University of Wisconsin)

Quality control coordinator for the Water Quality management group and responsible for U.S. EPA certification program for the Water Quality Laboratory, with expertise in water quality chemical analysis methods development, chemical and toxicology aspects of fossil fuels process, and aquatic bioassay applications.

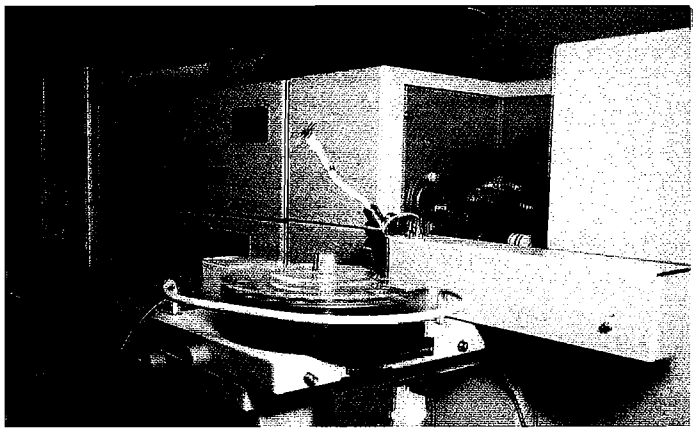
Ronald C. Sims, Research Associate Professor and Head, Division of Environmental Engineering (PhD, North Carolina State University at Raleigh)

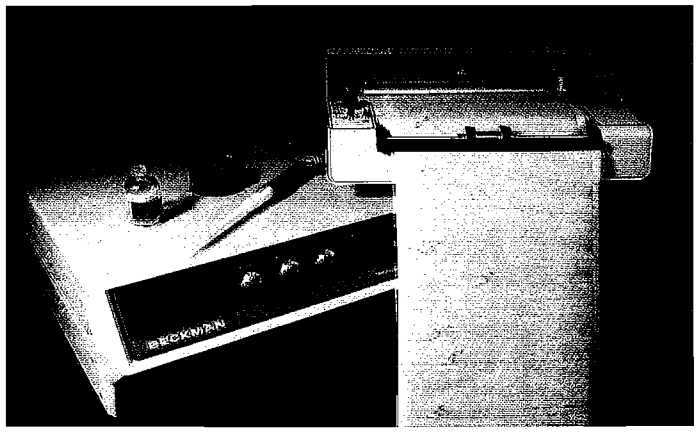
Expertise is in design and management of hazardous waste land treatment systems, industrial wastewater treatment process design and evaluation, and low technology water treatment systems.

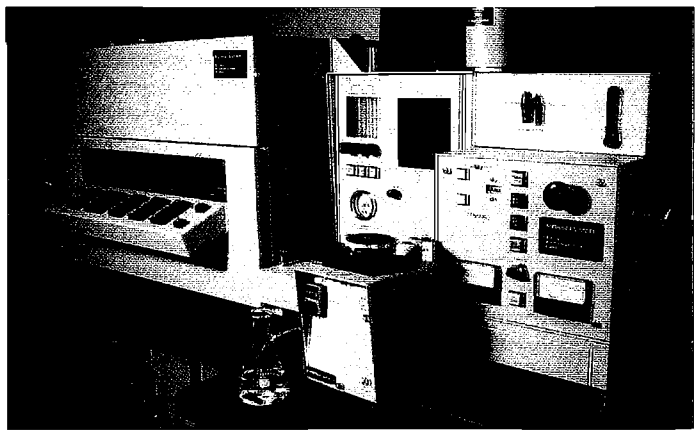
Darwin L. Sorensen, Research Assistant Professor (PhD, Colorado State University)

Extensive research experience in the microbiology of soils, mine land reclamation, and nitrogen cycling processes in arid areas, and in evaluating the behavior and fate of toxic and hazardous waste constituents in soil systems and impacts of hazardous waste on soil microbial processes.

Modern Equipment







Current Research

Adams — *Wastewater Disinfection by Ultraviolet Radiation*

Laboratory comparisons are examining the cost effectiveness of ultraviolet radiation as an alternative to chlorination for wastewater disinfection that destroys virus but does not create carcinogens.

Adams — *Design of Sampling and Analytical Scheme for Priority Pollutant Evaluation of Groundwater Resources*

Laboratory techniques and convective-dispersive transport models are being organized for use in monitoring areas around potential pollution sources for threats to groundwater quality and for evaluating the effectiveness of proposed remedies for dealing with aquifers already polluted.

Dupont — *Projected Water Quality for the Upper Gila Water Supply Study*

A number of alternative sites under consideration for reservoir storage in the Gila River Basin are being examined for their effects on water quality and for development of an effective water quality control program should they be constructed.

Dupont — *Treatment of Oil Shale Wastewater*

Sensitized photooxidation is being evaluated as a pretreatment to precede land intensive biological treatment for wastewater from the oil shale industry as a method of making the wastewater reusable within the industry or suitable for discharge into streams.

Messer — *Internal Phosphorus Loading in Deer Creek Reservoir*

Sediment cores are being sampled from the bed of Deer Creek Reservoir in order to calibrate a quantitative phosphorus model that will be used to evaluate alternative operating scenarios for minimizing algal blooms.

Messer — *Effects of Complexation with Oil Shale Leachate on Heavy Metal Bioaccumulation*

Stream microcosms, using Logan River water and natural substrates, perfusion columns, and crop studies were employed to examine cadmium complexing in the presence of raw oil shale leachate, transport through aquatic ecosystems, and the effects on ecosystem health and crop productivity.

J. L. Sims — *Evaluation of the Mound Systems of On-Site Waste Disposal for Use in Utah*

Laboratory tests are being used to develop guidelines for sand selection and sizing for mound systems that can be used to reduce the cost of domestic waste disposal in rural communities without sewers and impermeable, shallow, or waterlogged soils.

R. C. Sims — *Evaluating the Effectiveness of Slow Rate Sand Filters for Treating Drinking Water*

A survey of the long-term performance of operating slow sand filters used by small communities as a low cost method for treating drinking water and supplemental laboratory testing are being used to assess the cost effectiveness of this treatment in removing trace organics, viruses, and other contaminants threatening drinking water safety.

R. C. Sims — *In Situ Treatment Techniques Applicable to Large Quantities of Hazardous Waste Contaminated Soils*

A manual is being compiled to guide characterization of land areas contaminated by hazardous wastes, assessment of resulting impacts, selection of an effective in situ treatment (possibly using additives or flushing), and monitoring the results.

Sorensen — *Evaluation of the Potential Transport of Chlorinated Hydrocarbons through Land Application Systems*

Chlorinated and spiked municipal wastewater treatment plant effluent is being applied by spray irrigation to various soil types, and soil water samples are being analyzed for chlorinated organics so that guidelines for design and operation can be established to prevent new municipal systems from contaminating groundwater.

Sorensen — *Nitrogen Mineralization Potential and Nitrification Potential of Coal Mine Spoils*

Samples of replaced natural soil and mine spoil material from New Mexico mines are being tested to determine nitrification rates and process characteristics for use in guiding revegetation practices.