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# Water Current

## New Method For Detecting Trace Amounts of MTBE and Ethanol at Heart of UNL Contamination Research

by Steve Ress

Gasoline additives that help keep our air clean can contaminate the water we drink. But they can be difficult to find when they get into our water supplies.

University of Nebraska-Lincoln researchers have developed a method for detecting minute traces of these additives, called oxygenates, in groundwater and surface water. The method could pave the way to determine the extent of their environmental impacts.

"There is a great deal of concern over MTBE (methyl tertiary butyl ether) in our water supplies, but there has been very little in the way of funding to study the extent of the problem and how to clean it up, and measuring for trace levels of ethanol in groundwater and surface water have been virtually nonexistent," said Roy Spalding, Research Hydrochemist and head of UNL's Water Sciences Laboratory.

Ethanol and MTBE are the primary oxygenates petroleum refiners add to gasoline to produce higher octane and cleaner burning fuel. Many of the nation's largest cities now mandate their use to help curb growing problems with air pollution. MTBE is the most widely used.

Gasoline containing MTBE can reduce vehicle carbon monoxide emissions by as much as 20 percent, but if it gets in your drinking water, even trace amounts can make it taste and smell like creosote or turpentine. It is also a suspected carcinogen.

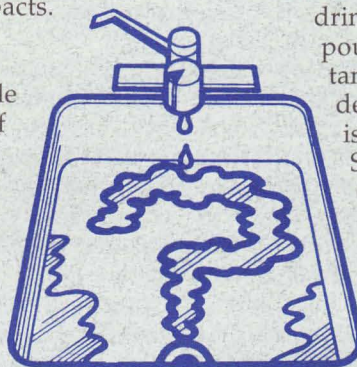
Maine and California already have banned MTBE's use and the U.S. Environmental Protection Agency is studying plans to phase down or phase out use nationally in the near future. Potential health risks associated

with ethanol, which also reduces harmful vehicle emissions, are considered small.

"Although ethanol is the same alcohol consumed in alcoholic beverages, the effect of alcohol spills on beneficial groundwater bacteria is unknown. There is concern that ethanol could negatively impact the ability of these unseen microbes to degrade toxic contaminants that are present in gasoline spills.

"Most of the information available on oxygenates in drinking water is limited to ether-based compounds, primarily MTBE. This made it important to develop a reliable analytical method for detecting trace levels of ethanol even though it is much more accepted in potable water," Spalding said. How ethanol travels through the environment is largely unknown, due to the lack of reliable and accurate analytical methods to detect it in trace amounts.

The UNL laboratory has been researching ways to reliably detect both ethanol and MTBE in quantities of parts per billion (ppb) or less, which would allow for assessing background groundwater levels and higher levels of the oxygenates in groundwater and surface water



Even trace amounts of the clean-air gasoline additive MTBE can make your drinking water taste and smell bad.

at spill sites.

"No one has ever cleaned up a groundwater aquifer contaminated with MTBE. If we find more sensitive methods to detect it in trace quantities, there is a higher likelihood of stopping a spill or leak and developing techniques to clean up the contamination before it becomes widespread," Spalding said.

Solid phase micro-extraction (SPME), an innovative method that concentrates the compounds from water on resin coated fibers, is the vehicle for detecting these

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# New Director, New Directions, New Challenges

## from the DIRECTOR



Kyle D. Hoagland

Being the new Director of the Water Center, many of you would probably like to know a bit about my background. I came to UNL in 1990 as a limnologist (one who studies lakes and streams) in the former Department of Forestry, Fisheries and Wildlife. This was after seven years as a faculty member at Texas Christian University (TCU) in Fort Worth. My charge, or appointment, since then has largely been research and teaching in the area of surface water quality, including the ecology of attached algae in lakes and streams; ecotoxicology of agricultural pesticides; reservoir aging; lake restoration; and the effects of global warming on aquatic ecosystems.

I was involved in planning and forming the relatively new NU School of Natural Resource Sciences (SNRS) and have retained portions of

my research and teaching responsibilities there as my academic home.

In my new responsibilities as Director of the Water Center, I want to say that the transition and settling-in process are going well. We owe a huge debt of gratitude to Ed Vitzthum for serving as the Water Center's Interim Director over the past year and a half. Ed provided a much needed steadying influence during a difficult period of transition and continues to be a first class mentor.

You should also know that Bob Kuzelka has stepped-down from his 11-year post as the Water Center's Assistant to the Director. This is at Bob's own request in order to give him more time for his primary loves of teaching and working with The Groundwater Foundation. He also becomes Director of the UNL Environmental Studies Program in January, 2001. His energy, zeal and knowledge have been legendary.

Ed and Bob's dedication to the Water Center and it's missions have made a real difference and are sincerely appreciated.

I feel extremely fortunate to have the opportunity to serve as Director. Many positive changes have occurred at UNL in the natural resources arena over the past few years, including formation of the SNRS. As an integral part of these changes I can say that these are both exciting and challenging times at the Water Center. Exciting because of the outstanding faculty and staff working in water sciences across the entire University of Nebraska system, and challenging because of shrinking financial resources that help maintain and develop the programs that support water research, teaching and outreach.

As I attempt to meet these challenges, it is my earnest goal to help identify both emerging needs in the water sciences and the funds to address those needs from both national and international sources. Times have changed and we must change with them to continue to flourish and serve the needs of Nebraskans and beyond.

But we can't meet these goals alone. In the coming months I plan to form both internal and external advisory committees, comprised of experts in various aspects of water, to identify new directions, goals and implementation strategies. This will require an unprecedented level of collaboration and cooperation among NU faculty in all areas of the water sciences, commensurate with the myriad needs for water, its multiple uses and the problems that confront us.

We also will introduce innovations in information transfer to help meet these goals, including changes in the appearance and content of our web site and this newsletter. Beginning in the next issue of the *Water Current*, you will see changes in design and content that will include regular introductions to water-related faculty members and their research and outreach programs. We welcome your suggestions and comments on these changes.

A total team effort will be needed to solve the water quality and quantity problems we face in this state and region. It will require the combined input of biologists, economists, geologists, sociologists, hydrologists, chemists, engineers, agricultural producers, consumers and others to address the complex issues before us.

Let's get on with it.

## *Water Current*

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Roy F. Spalding — Associate Director,  
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# Lawn and Garden Drought and Climate Tolerance Are Focus of Festival of Color

by Steve Ress

Help nursing parched lawns and gardens through the drought and preparing for next year's growing season can be found at next month's eighth annual Festival of Color.

The turfgrass and landscape display and open house is Saturday, Sept. 16 at the University of Nebraska's John Seaton Anderson Turfgrass and Ornamental Research Area, which is part of NU's Agricultural Research and Development Center near Mead.

Demonstrations, displays and how-to sessions will be from 9 a.m. to 3 p.m., a shift from the 10 a.m. to 4 p.m. hours in past years.

The festival's focus is on turfgrass management; trees, flowers and shrubs; landscape management and maintenance; and residential landscape design and maintenance.

Within each of these primary areas are a variety of half-hour talks, many of which will be given once in the morning and then repeated in the afternoon.

A sampling of this year's topics includes:

- Mowing, fertilizing and other turfgrass management practices to reduce water and pesticide applications.
- Choosing the right turfgrass for your site.
- Choosing and caring for trees, shrubs, wild-flowers and native grass mixes.
- Mulch selection and how they can influence plant health and weed control.
- Soil amendments and how to incorporate them.
- Pond design, maintenance and plant selection.
- Designing and renovating windbreaks.
- Attracting wildlife to your landscape.
- Identifying and controlling weeds and diseases in your lawn.

"Tent Talks" feature a question and answer session with NU extension horticulturist Don Steinegger, turfgrass specialist Roch Gaussoin, entomologist Fred Baxendale and plant pathologist John Watkins, who are the panel of Nebraska Educational Television's Backyard Farmer.

Other demonstrations include a sustainable landscape mound featuring water-conserving plants that was renovated in part with funds from last year's donor contributions; a model train area and how to incorporate one into your landscape and a master gardener tent that will be staffed through the day to answer your questions.



Faculty and staff from the UNL Department of Agronomy and Horticulture will present the Fischer USA Flower Trials 2000, featuring 78 varieties of geraniums, 29 varieties of impatiens and five varieties of vinca (periwinkle). Retailers will also offer a large selection of plant material, equipment and other landscaping materials for sale throughout the day. Food and beverages, including water, will be available all day.

An expanded family fun center will have demonstrations on "All the Water In the World," "When It Rains on the Plains" and "Groundwater Resources" in the morning and "Pumpkin Circles," "Soil Matters," and "Pollinators" in the afternoon.

Children's flower and vegetable gardens will have Asian and Latin American kitchen gardens, vertical gardens and "Mr. and Mrs. McGregors Maze" to help entertain.

Representatives of the Nebraska Beekeepers Association will also be willing to show you how Honeybees are among the most beneficial insects to man through their pollination of fruit and vegetable crops and production of wax and honey.

Festival of Color has grown to become the single largest annual public event within NU's Institute of Agriculture and Natural Resources (IANR).

You can access the Festival on the Internet at <http://hort.unl.edu/fallfest/>. Volunteer donations of \$5 per family or \$2 per person are encouraged to help defray costs.

Festival of Color is supported by the U.S. Environmental Protection Agency, Region VII through the Nebraska Department of Environmental Quality; Nebraska Nursery and Landscape Association; Nebraska Turfgrass Foundation; Earl May Seed and Nursery, Limited Partnership; the Lower Platte North Natural Resources District; Campbell's Nursery and Garden Center; Nebraska Statewide Arboretum; NU's IANR, Agricultural Research and Development Center, School of Natural Resource Sciences, Water Center, and Departments of Agronomy and Horticulture, Plant Pathology and Entomology.

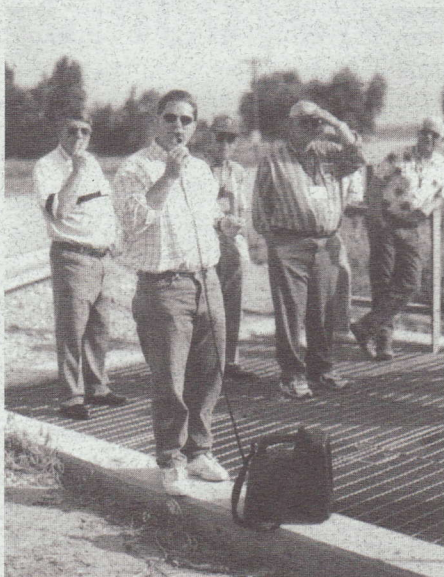




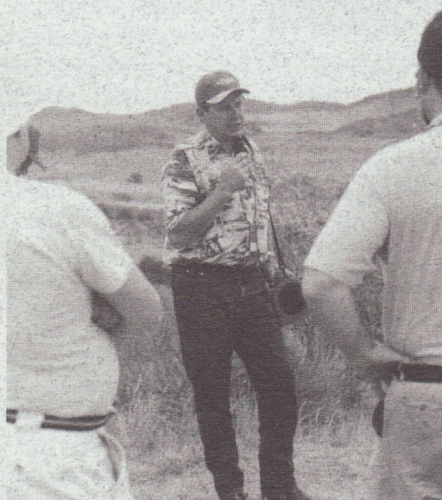
# Summer 2000

## Water and Natural Resources Tour

### *“Water Transfers and Marketing in Nebraska and Colorado”*



Hydrologist Forrest Leaf talks about water augmentation plans in the Central Colorado Water Conservancy District near Greeley.



Alan Berryman, head of the engineering services branch of the Northern Colorado Water Conservancy District, discusses the district's Flatiron Reservoir and Carter Lake projects near Loveland.



Water rushes through the Western Canal near the Nebraska-Colorado border as tour participants listen to a rundown of current water projects in the South Platte Natural Resources District.



Kearney Daily Hub reporter Lori Potter (left) gets a steak at a chuckwagon barbecue at Viestenz-Smith Park on the Big Thompson River.



Lining-up for steaks on the Big Thompson River, near Loveland.





Getting a look at commercial sand-and-gravel operations near Greeley.



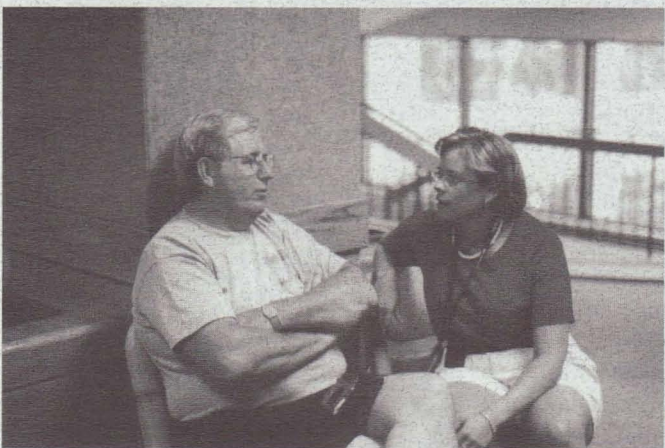
General Manager Virgil Norton discusses groundwater transfers in the Upper Republican NRD near Grant.



Jon Altenhofen of the Northern Colorado Water Conservancy District explains Colorado's water recharge and augmentation project at Tamarack Ranch near Julesburg.



Blowout....thankfully the A/C kept working!!



Central Nebraska Public Power and Irrigation District's Tim Anderson and Angela Wood of Governor Mike Johann's office catch-up on politics at Coors Brewing Co. in Golden.



Engineer Mike Glade gets into the details of Coors' water operations and water rights at the brewery in Golden.

(photos by Steve Ress and Mary Harding)





# Water News Briefs

## Re-Cap of Water Management Issues Available Free

Those attending this spring's 29th Annual Nebraska Water Conference confirmed what many of us already suspected.....that Nebraskans are concerned about preventing and controlling pollution in the state's public and private water sources. Balloting to develop a prioritized list of water management issues at the conference also confirmed that they are equally concerned about unifying systems to govern surface water and groundwater, state funding for water research, developing a state water management plan and protecting environmentally sensitive water resources.

These were the highest ranked of 33 priority water management issues facing Nebraskans, according to those attending the March 6-8 conference at Lincoln's Cornhusker Hotel. Complete polling results, which were electronically prepared by the Nebraska Public Power District, with voting breakdowns and percentages, are available free from the UNL Water Center. Send your request for copies to Water Management Issues, Water Center, P.O. Box 830844, University of Nebraska, Lincoln, NE 68583-0844, e-mail [sress1@unl.edu](mailto:sress1@unl.edu) or phone (402)472-3305.

## See You At Husker Harvest Days

Stop in and see the Water Center staff at next month's Husker Harvest Days in Grand Island. We'll be there with displays and materials on water quality and how to access agencies and organizations dealing with water issues in Nebraska.

We'll answer your questions and have free gifts for everyone. There will be daily drawings for free NU sweatshirts, presentation pens and free subscriptions to the Water Current newsletter.

We'll be in the NU Institute of Agriculture and Natural Resources (IANR) building. Just look for the distinctive Husker Red steel building with the white roof.

Husker Harvest Days is one of the nation's premier agricultural shows. It was first held in 1978 and IANR faculty and staff have been involved since year one! About 20 IANR units exhibit during the three-day show. This year's event is Tuesday through Thursday, Sept. 12-14. See you there!

## NDEQ Water Quality Monitoring

Recent passage of LB 1234 requires the Nebraska Department of Environmental Quality (NDEQ) conduct a comprehensive study of water quality monitoring in Nebraska. NDEQ is working with an advisory committee to develop this study.

The committee consists of representatives of American Consulting Engineers, Nebraska Department of Health and Human Services Regula-

tion and Licensure, Nebraska Association of Resource Districts, Nebraska Game and Parks Commission, UNL Water Center, Nebraska Department of Agriculture, League of Nebraska Municipalities, Nebraska Department of Natural Resources and the U.S. Geological Survey.

Phase I of the study will assess Nebraska's current water quality monitoring efforts and results are to be presented to the Legislature by Dec. 1.

Phase II will use the information gathered in Phase I and will include a detailed description of changes required in the current monitoring system. This will be used to develop a comprehensive, integrated statewide water quality monitoring system. Phase II is to be completed by June 30, 2001.

Surface water and groundwater questionnaires are part of the process and have been sent to both individuals and appropriate entities. These questionnaires must be completed and returned by Sept. 30. If you have not seen the questionnaires, or have questions about them, contact Steve Walker at the NDEQ at (402)471-4227 or e-mail [deq013@mail.deq.state.ne.us](mailto:deq013@mail.deq.state.ne.us).

## Center-Pivot Map Available

by Charlie Flowerday,  
Editor, UNL Conservation and Survey Division

Center-pivot irrigation systems in Nebraska increased 59 percent from 1988 to 1997, according to a new University of Nebraska-Lincoln report.

Totals increased from 26,741 in 1988 to 42,444 in 1997, the last year for which data is available from UNL's Center for Advanced Land Management Information Technologies (CALMIT). This is the first CALMIT inventory and map of center-pivot irrigation systems since 1990.

"We got partial funding for the map through a cooperative project called the Platte River and Basin Cooperative Hydrology Study, but it's only for one year," said Marcus Tooze, research coordinator with CALMIT and principal investigator of the part of the study analyzing land use that contributed to the inventory.

Counties with more than 500 pivots that had the highest percentage increases were: **Cuming:** 313 percent, from 128 to 529; **Merrick:** 159

percent, from 348 to 903; **Hall:** 145 percent, from 240 to 588; **Platte:** 118 percent, from 519 to 1,132; and **York:** 100 percent, from 609 to 1,220. Lindsay Manufacturing of Lindsay contributed partial funding for the 1997 data, but future inventories will depend on more outside funding, explained Mark Kuzila, director of UNL's Conservation and Survey Division, with which CALMIT is affiliated.

In addition to CALMIT, the study was sponsored by two public power districts and five natural resources districts, as well as the state Department of Water Resources and its Natural Resources and Game and Parks commissions.

The map is available from UNL's Conservation and Survey Division for \$5 plus \$3 shipping and handling for a folded map, or \$4 for an unfolded map in a tube. For more information, phone (402)472-7523 or e-mail [csdsales@unl.edu](mailto:csdsales@unl.edu).



## AUGUST

**28-31:** American Water Resources Association Annual Specialty Conference, "Riparian Ecology and Management in Multi-Land Use Watershed," Doubletree Hotel, Lloyd Center, Portland, OR. For information, phone (540)687-8390 or e-mail [info@awra.org](mailto:info@awra.org).

**29-31:** "Carbon: Exploring the Benefits to Farmers and Society," Des Moines, IA. Registrations due Aug. 8. For information, contact Alice Vinsand at (515)225-1051 or e-mail [avinsand@aol.com](mailto:avinsand@aol.com)

## SEPTEMBER

**2-8:** Fourth International Conference on Integrating Geographic Information Systems (GIS) and Environmental Modeling, Banff Centre for Conferences, Banff, Alberta, Canada. For information, phone (303)497-6330 or e-mail [bparks@colorado.edu](mailto:bparks@colorado.edu).

**8-20:** Fragmentation 2000 - A Conference on Sustaining Private Forests in the 21st Century, Annapolis, MD. Contact Terri Bates at (703)538-1134 or e-mail [Bates-Stasny@erois.com](mailto:Bates-Stasny@erois.com).

**10-13:** Water in the New Millennium: "The Possible, the Probable and the Preferable," 2000 RMSAWWA/RMWEA Joint annual conference, Vail, CO. For information, go to <http://www.rmsawwa.org> or e-mail [catch@ci.grandjct.co.us](mailto:catch@ci.grandjct.co.us).

**12-14:** Husker Harvest Days, Grand Island. 8 a.m. to 5 p.m. each day. See *Nebraska Farmer* magazine for details.

**17-22:** International Conference on Coastal Zone Management, Saint John, New Brunswick, Canada. For information, phone (506)462-5961 or e-mail [czc2000@gov.nb.ca](mailto:czc2000@gov.nb.ca).

**22-24:** Environmental Problem Solving with GIS, Cincinnati, OH. Contact Lisa Enderle at (412)741-5462 or e-mail [lisa.e.enderle@cpmx.saic.com](mailto:lisa.e.enderle@cpmx.saic.com).

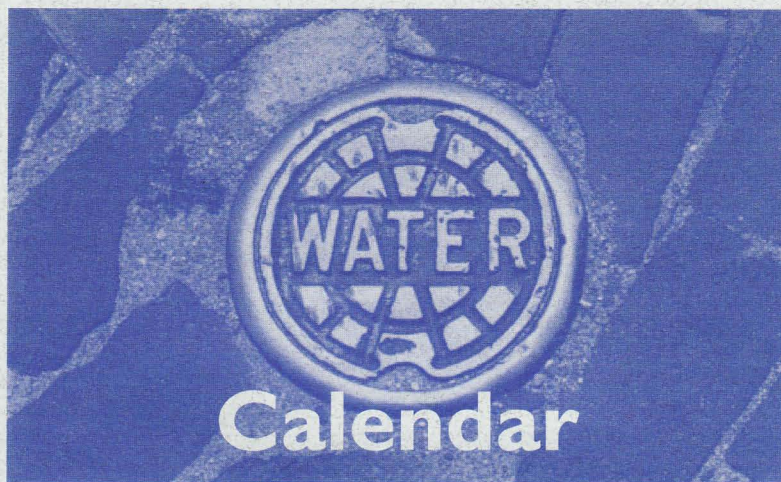
**24-27:** Groundwater Protection Council 2000 Annual Forum, Ft. Walton Beach, FL. Contact GWPC at (405)516-4977 or <http://gwpc.site.net/meetings.htm>.

**27-29:** Alliance for Environmental Conservation: A Comprehensive Approach (to Nutrient Management), St. Louis, MO. Contact Wanda Linker at (334)265-2732 or e-mail [wanda@apea.the-link.net](mailto:wanda@apea.the-link.net).

## OCTOBER

**8-11:** The Natural Rural Water Association Management and Technical Conference, Kansas City, MO. For further information, contact The National Rural Water Association at (580)251-9081 or e-mail [mail@nrwa.org](mailto:mail@nrwa.org).

**12-15:** National Small Farm Conference, St. Louis, MO. Contact Cyremple Marsh at (573)682-5550.



## NOVEMBER

**6-9:** Annual Water Resources Conference presented by the American Water Works Association, Miami, FL. For information, contact Michael J. Kowalski, AWRA director of operations at (540)687-8390 or e-mail [mike@awra.org](mailto:mike@awra.org).

**13-15:** "Asking the Right Questions: Evaluating the Impact of Groundwater Education," The Groundwater Foundation fall conference and Groundwater Guardian designation, Lied Conference Center, Nebraska City. For information, e-mail [cindy@groundwater.org](mailto:cindy@groundwater.org) or phone (800)858-4844 or (402)434-2740.

**28-Dec. 1:** National Water Resources Association, Annual Conference, San Diego, CA.

**16-18:** WEFTEC 2000, 73rd annual conference of the Water Environment Federation, Anaheim Convention Center, Los Angeles, CA. Phone (703)684-2456/2480 for information.

**17-21:** Spanning Cultural and Ecological Diversity Through Environmental Education: The 29th Annual Conference of the North American Association for Environmental Education, South Padre Island, TX. Information is on the internet at [www.naaee.org](http://www.naaee.org).

**26-28:** National Carbon Sequestration Conference, Missoula, MT. Contact Karen Reiter or Ted Dodge at (406)587-6965 or e-mail [kreiter@mt.nrcs.usda.gov](mailto:kreiter@mt.nrcs.usda.gov).

**31-Nov. 4:** Combined Conferences of the American Society of Agronomy, Crop Science Society of America and Soil Science Society of America, Salt Lake City, UT. Information on the internet at [www.asa-cssa-sssa.org/olr99/](http://www.asa-cssa-sssa.org/olr99/).

## We're Updating!!

We are updating our mailing list. If you have a change of address, title and/or name, or would like to have your name added to or removed from the *Water Current* mailing list, please let us know. Also, if you know of anyone who might be interested in receiving our publications, please give us their names and we will be glad to add them to our mailing list.

Change my address ☐ Delete me from your list ☐ Add to your list ☐

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FAX (402)472-3574  
or e-mail [changes@sress1@unl.edu](mailto:changes@sress1@unl.edu)



## New Method For Detecting Trace Amounts of MTBE (continued from page 1)

trace quantities. Separations Chemist Dave Cassada, Laboratory Manager Dan Snow and Graduate Student Yi Zhang add simple salt to the SPME method to increase the detectability of both MTBE and ethanol.

The method enables the UNL laboratory to accurately detect and quantify ethanol at the low ppb level and MTBE and similar ether-based oxygenates at the low ppt (parts per trillion) level, Cassada explained.

Though a number of factors that can improve the method's accuracy and efficiency remain to be investigated, the California Partnership for MTBE is so confident in the UNL-developed method that they published it several months ago. It also was recently accepted for publication in *The Journal of Analytical Chemistry*.

The method forms the basis of applications that could become a very ambitious multi-year assessment of the occurrence of ethanol and MTBE in groundwater and surface water, as well as the fate and transport of other contaminants present in gasoline that may be effected by ethanol.

"Leaking underground storage tanks and spills from normal refueling operations and leaky vehicles are probably the most common sources (of contamination)," Spalding said, though atmospheric deposits, urban runoff and powered watercraft also play a role in introducing them to water supplies.

In determining the extent of this on the Interstate 80 corridor in Nebraska and Colorado, Zhang's research focuses on sampling shallow groundwater aquifers for ethanol, MTBE and other oxygenates. He will investigate how vehicle emissions impact shallow groundwater quality along I-80 between Grand Island and Denver and study the natural levels of these oxygenates in isolated rural areas. The rural control sites are near Shelton and Central City, locations where UNL researchers have ongoing agricultural and environmental research projects.

A portion of this project is Zhang's doctoral degree research.

"This is the first major doctoral dissertation on the trace occurrence, fate, and transport of ethanol in surface and groundwater sources," Spalding said.

Both oxygenates can enter groundwater and surface water from several sources, Spalding explained.

Investigating the presence of ethanol in groundwater near leaking underground storage tanks (known to researchers as LUSTs) is an important aspect of the study. Non-radioactive tagged compounds will be injected in the LUSTs to make it possible for researchers to track ethanol.

"These compounds will be intercepted in special groundwater samplers and the data will be used in the assessment of the fate of many of the previously observed oxygenates and gasoline additives. The data will then be modeled and used in determining the transport of these compounds in sand and gravel groundwater aquifers," said Research Hydrologist Xun-Hong Chen, who is involved in this portion of the study.

Before California fully accepts substituting ethanol for MTBE, research results from this study are necessary to evaluate the fate of toxic gasoline compounds such as benzene, toluene, ethyl benzene and xylene in gasohol leaks from LUSTs.

"Now that we have a reliable means to detect these contaminant compounds in trace quantities, this research holds the promise that the gasoline additives we count on to help keep our air clean will no longer pose an unsolvable risk to the water we drink since we will be able to locate the contamination and clean it up," Spalding said.

The research is being sponsored by NU's Agricultural Research Division, Institute of Agriculture and Natural Resources and Water Center. Additional cooperation and potential support is coming from The National Water Research Institute, American Petroleum Association, The Association of California Water Agencies, Oxygenated Fuels Association, Western States Petroleum Association, Williams Energy Co., Cargill, Chief Ethanol Fuels and AGP.

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### WATER CENTER/ENVIRONMENTAL PROGRAMS

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