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Water Current

Researchers seek to clean up hazardous legacy of bomb production

More than 50 years ago, thousands of workers produced more than 3 million bombs at the former Nebraska Ordnance Plant near Mead. Today, researchers examine ways to clean up soil and water contamination stemming from the bomb production.



LINCOLN — The Nebraska Ordnance Plant at Mead was decommissioned in 1960, but hazardous evidence of its bomb production days remains at the site and others like it across the state and the nation.

A University of Nebraska-Lincoln research team is examining chemical and biological cleanup of the contaminated soil at the site as cheaper and more environmentally acceptable alternatives to incineration. Incineration is the most common treatment for munitions-contaminated soil.

"Cleaning up munitions-contaminated soil is of vital interest since many of the contaminants are carcinogenic or otherwise toxic to humans and the environment," said

Steve Comfort, a soil chemist.

The interdisciplinary team led by Comfort and Pat Shea, residue chemist, began its research two years ago. Team members include Tyler Kokjohn, microbiologist; Garald Horst, crop physiologist; and Bill Powers, soil physicist. Comfort and Kokjohn are members of the Nebraska Water Research Initiative Water Quality Research Team.

More than 50 years ago, thousands of workers produced more than 3 million bombs at the plant, which is located 30 miles north of Lincoln in Saunders County.

The plant was a military loading,

See TNT.

Continued on Page 3.

VOL. 27 No. 3
JUNE 1995

- 2 DIRECTOR'S NOTE
- 4 DEEP SOIL PROBING
- 5 NEBRASKA WATER NEWS
- 6 CALENDAR
- 7 CONTAINER RECYCLING
- 8 ANNUAL WATER TOUR

Annual water resources tour promises on-site education



Bob G. Volk

from the
DIRECTOR

It's time again for the Annual Water Resources Tour. This year's tour will have a very strong educational focus, and participants will have the opportunity to hear discussions on weed management, protection of Nebraska's groundwater, farm policy and the environment. They will also be able to see the newest technologies in variable fertilizer rate application. Tour dates are July 18 and 19, and we will stay in Grand Island.

Congratulations are in order for Bettina Heinz Hurst, communications associate and editor of the *Water Current*. She has won first places in the Nebraska Press Women's contest in newsletter, news release and feature release categories. We knew she was doing an outstanding job for the Water Center/Environmental Programs unit, and these awards confirm that.

The National Institutes for Water Resources (NIWR) have just released their publication database. This database on diskette contains almost 10,000 research reports from 1984 to 1995 produced by NIWR.

Included software allows the user to search the database by key words in the publication's title, other descriptive key words and phrases, state, author, type of publication and year. Search criteria may be easily

developed from any combination of these database elements, and the on-screen results may be further selected and then printed on paper, printed to a file or used to create a new database.

For additional information, please contact the National Institutes for Water Resources, Massachusetts Water Resources Research Center, Blaisdell House, University of Massachusetts, Amherst, MA 01003-0820.

My recent meetings in Washington with representatives of federal agencies that fund water resources research indicate that there will be budget reductions. How much and in what area of research is just about anyone's guess. One comforting note is that water resources research is a high priority with the United States Department of Agriculture.

At these meetings, I had the opportunity to visit with water resources researchers from other north-central states.

It appears we all are concerned about the same research topics: feedlot waste management to prevent surface and groundwater contamination, nitrogen management, overall surface and groundwater contamination, whole farm/system planning, and development of new technologies such as variable rate fertilizer application.

Water Current

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See TNT. Continued from Page 1.

assembling and packing facility during World War II and the Korean War. During production, some buildings on the 26-square-mile-area were routinely washed out with water. Runoff water carried contaminants such as TNT and RDX to the drainage ditches and soil.

Most of the contamination occurs in the drainage ditches next to the buildings, Comfort said. About 8,400 cubic yards of contaminated soil are in immediate need of remediation.

The plant is one of 10 Nebraska sites on the Superfund National Priorities List. Its cleanup falls under the responsibility of the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency.

The team is also investigating ways to make bioremediation part of its treatment.

In 1993, the Corps removed soil and concrete contaminated with PCBs from the Mead site and disposed of it at an Idaho site. To clean up the soil contaminated with TNT and RDX, the Corps is planning to install a temporary incinerator and burn four feet of top soil at a cost of \$14 million in 1996.

Chemical Cleanup

Incineration has economic, environmental and political drawbacks, Comfort and Shea said. Their efforts focus on chemical treatment of the soil.

"Our goal is to degrade the toxic compounds to carbon dioxide and water," Comfort said. "If we can't do that, altering the structure of the compounds will help microorganisms present at the site to degrade them more easily."

The altered molecules may bind strongly to soil matter and become stabilized organic matter.

"If it can't be mineralized or directly biodegraded, then perhaps

it can be allowed to become a part of the soil organic matter," Shea said. If a compound becomes indistinguishable from soil organic matter, it may be considered detoxified, Shea said, because it is no longer available to the environment as a toxin.

Comfort and Shea are using two chemical reactions to break down the TNT and RDX compounds.

One reaction involves adding iron and hydrogen peroxide, another involves adding iron only. Using iron and hydrogen peroxide, the researchers have been able to break down 90 percent of the TNT and RDX into carbon dioxide and water within 24 to 48 hours. The remaining 10 percent of the compound end up as a harmless organic acid.

"Both methods are very quick and efficient," Comfort said.

Although these techniques have been demonstrated in the field, they have not been used for the cleanup of munitions contamination and have only rarely been used with soils.

Biological Treatment

The team is also investigating ways to make biological cleanup, or bioremediation, part of its treatment.

Kokjohn has isolated a microorganism, *Pseudomonas savastanoi*, from the contaminated soil. This organism transforms TNT into a different compound.

"Although it doesn't completely degrade TNT, it gives us an idea of how another organism might help us degrade TNT into carbon dioxide and water," Kokjohn said.

Team members also pursue another approach related to bioremediation. Horst looks at the use of grass species to contain the contaminants on the site and promote their degradation.

"The idea is to use the water balance created by the plants to keep the contaminants from moving with the water into the groundwater, or at least slowing it down so that microorganisms have more of a chance to transform it," Horst said.

The researchers found that tall fescue, a high water user, already grew in some areas of the site. Efforts

to establish the grass on contaminated soil samples have worked in the laboratory; the next step is to confirm this in the greenhouse.

"We're also looking at the possibility of using these plants as remediators themselves," Horst said.

Biological methods only work in areas where the contamination level is relatively low because if toxic levels are too high, they slow down bioremediation. Comfort and Shea believe a combination of chemical and biological methods might work best in highly contaminated soil.

The researchers hope their alternative techniques can be tested and used at other sites in lieu of incineration.

Team members hope the Corps and the EPA will show interest in their methods. Last year, Comfort and Shea attended a public meeting on the proposed incineration project sponsored by the Corps and submitted comments.

The researchers hope their techniques can be tested and used at other sites in lieu of incineration. So far, they have not received any response from the Corps.

"We would like to be involved in some field scale studies at munitions-contaminated sites if we can get cooperation from the Army and the EPA," Comfort said.

The project is supported by the Great Plains-Rocky Mountain Hazardous Research Center, the U.S. Army Cold Regions Research and Engineering Laboratory, the Nebraska Water Research Initiative, the Agricultural Research Division, and Water Center/Environmental Programs, Institute of Agriculture and Natural Resources, UNL.

— **Bettina Heinz Hurst**, *communications associate, Water Center/Environmental Programs*

DEEP Soil Probing

Cooperative Extension project helps create nitrate awareness

LINCOLN — Nitrogen fertilizer has long been cheap health insurance for corn, sorghum and other Midwestern row crops.

Nitrogen enriches plants in its converted nitrate form. However, crops can't use excess nitrates which, over the decades, have seeped into groundwater supplies. That nitrates can escape crop usage surprised some Eastern Nebraska farmers.

"I had no idea," said Keith Jurgensen, who raises corn and soybeans near Ashland. "I just thought the corn was using it all."

Cooperative Extension's Metro Programming Unit of Douglas, Saunders, Sarpy and Lancaster counties conducted a deep soil probing project in 1991-92 to alert agricultural producers and agribusiness to the residual nitrate factor.

The recently released report should have additional impact this year since nitrogen fertilizer prices are nearly double, said Keith Glewen, Monte Stauffer and Dave Varner, extension educators in Saunders, Sarpy and Lancaster counties. Twenty-five percent of the 88 fields deep probed showed residual nitrate-nitrogen in excess of 100 pounds per acre.

"You don't know what you have for nitrates unless you deep sample," Glewen said.

Done properly, deep soil probing

examines nutrient content in the soil to a depth of 4 feet. Traditional soil testing only probes the soil's top 6 or 8 inches, which works well for other, more stabilized nutrients. Nitrates, because of their water solubility, are more mobile and can more readily leach into the groundwater.

Dryland crop roots, which reach for water, normally grow to 4 or 6 feet. Roots of irrigated crops grow about half that distance because moisture is more readily available.

Extension's deep probing found nitrates sprinkled throughout each foot of soil in nearly all fields tested. Except for former feedlot sites, the highest carryover level was 482 pounds of nitrogen per acre or 130 parts per million in the top four feet. Adding more nitrogen on top of what's already available is wasteful, costly and creates health threats in drinking water, Glewen said. The federal maximum contaminant level for nitrate-nitrogen in public water systems is 10 ppm.

Memphis farmer Ron Raikes experiments with timing of nitrogen application, a recommended management practice.

"I would like to be able to use all the nitrogen I put out there," said Raikes, who raises corn, soybeans, grain sorghum and wheat. He has experimented with high and low nitrogen application rates before planting and when the crop is up.

Raikes found no yield difference between the 110 and 160 pound-per-acre application rates in his 1994 corn crop. Both produced 170 bushels in irrigated fields, which meant that anything over 110 pounds was "too much," Raikes said.

Normally 1.1 pound of nitrogen is applied for every bushel expected to be produced. Raikes believes sidedressing nitrogen to the growing

crop is the most effective because that's when plants need it. However, the threat of rain makes it difficult to get into the field at that time. Fall or spring application may be advanta-



geous from the labor standpoint, but creates potential for nitrate leaching.

Nitrate mobility also depends on soil type and moisture availability, making deep soil probing even more important. It provides a more accurate picture of the soil nutrient profile, but requires more equipment, time and care.

Deep soil probing has been available in Nebraska for about 20 years. Typically, it's offered by crop consultants. Producers who deep soil probe usually do so every year and subsequently either reduce or eliminate fertilizer application, said Jerry Mulliken, owner of JM Crop Consulting in Nickerson.

As producers become more conscious about water quality and better nitrogen and irrigation practices, they're doing a better job than in the past, Glewen noted.

"Let's keep moving forward," he said. "We're going to be hearing about nitrates in groundwater for years to come."

The project was funded by a USDA Cooperative Extension grant through the Water Center/Environmental Programs unit, University of Nebraska-Lincoln.

— Cheryl Alberts, news writer,
Institute of Agriculture and Natural
Resources, UNL

Twenty-five percent of the 88 fields deep probed showed residual nitrate-nitrogen in excess of 100 pounds per acre.



Nebraska Water News

UNL faculty receive USGS grants

Five University of Nebraska-Lincoln faculty members have received funding for 1995 from U.S. Geological Survey funds administered through the UNL Water Center/Environmental Programs unit. The projects funded are:

Dennis D. Schulte, Department of Biological Systems Engineering, *Measuring Groundwater Quality Impacts from Feedlot Runoff Retention Ponds and Waste Lagoons Using Integrated Geophysical and Bottom Sampling Methods*, \$18,261;

Thomas G. Franti, Department of Biological Systems Engineering, *Predicting Pesticide Runoff Losses from Four Tillage-Pesticide Management Practices*, \$16,618;

Blair D. Siegfried, Department of Entomology, *Mechanisms of Atrazine Selective Toxicity in Freshwater Algae*, \$15,500;

Tian Zhang, Department of Civil Engineering, *Sulfur-Limestone Autotrophic Denitrification System for Remediation of Nitrate Contaminated Groundwater*, \$14,000;

Rhae Drijber, Department of Agronomy, *Analyzing the Effects of Atrazine on Long Term Soil Microbial Populations*, \$8,500.

Niobrara study out

The National Park Service, Niobrara/Missouri National Scenic Riverways, has issued a 90-page special resource study on the Niobrara. The document was prepared to comply with a portion of the Niobrara Scenic River Designation Act of 1991, which calls for a study for a potential Niobrara-

Buffalo Prairie National Park in Nebraska.

The report outlines several alternatives for managing the area. It takes no stand on which alternative, if any, should be pursued.

To obtain a copy of the report, contact the National Park Service, Niobrara National Scenic Riverways, P.O. Box 591, O'Neill, NE 68763.

Bookmarks produced

The Water Center/Environmental Programs unit at UNL has produced bookmarks that encourage readers to read about water and adopt conservation and protection behaviors. The bookmarks also list addresses of contacts for questions on water. Teachers, librarians and other individuals may request limited amounts of the free bookmarks by contacting Water Center/Environmental Programs, University of Nebraska, 103 Natural Resources Hall, Lincoln, NE 68583-0844, (402) 472-3305, e-mail bhurst@unlinfo.unl.edu.

Publication on BMPs for wheat available

A limited number of "Best Management Practices for Wheat," a guide to profitable and environmentally sound production, is available at no cost from the Water Center/Environmental Programs unit, UNL.

The 120-page guide is a joint effort of the Cooperative Extension System and the National Association of Wheat Growers Foundation.

The first half of the book is devoted to the principles of erosion and water quality protection. The second half of the book presents some practical application of best

management practices (BMPs). Each BMP addresses the principles of erosion or water quality in a particular setting. To obtain a copy, the contact Water Center/Environmental Programs unit.

Task force issues recommendations

The Center for Rural Affairs, Walthill, has issued a Water Resources Task Force Report. In regard to water resource policy in Nebraska, the task force recommends supporting the public trust doctrine as a guide. It suggests responsibility should be focused at the state level by consolidating certain water planning and management functions. The task force recognizes the need to move toward a state conjunctive use policy and suggests the state consider adopting a conjunctive use and integrated management program.

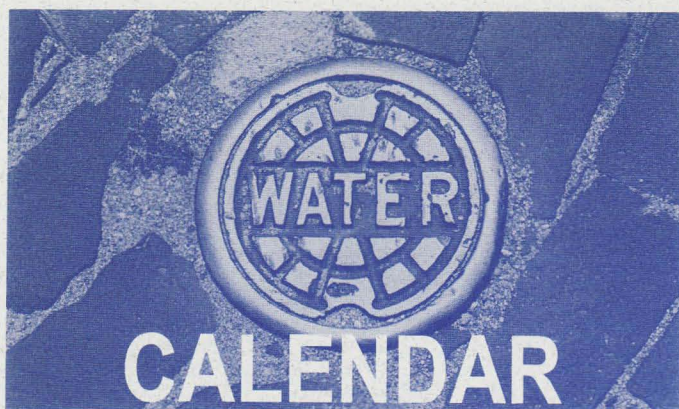
For more information on or for a complete copy of the task force report, contact George Piper, Center for Rural Affairs, P.O. Box 406, Walthill, NE 68067, (402) 846-5428.

Festivals effective

The Groundwater Foundation, Lincoln, has released results of a yearlong study examining change in children's behavior and attitudes as a result of participation in its Groundwater Festival.

Results showed that students and teachers adopt new behaviors after attending the festival, and that some students still practice those behaviors six years later.

For more information or to obtain a copy of the results, contact The Groundwater Foundation at (402) 434-2740.



JUNE

June 18-22: Annual American Water Works Association, Anaheim, CA. Contact AWWA, (303) 347-6190.

June 22-23: Groundwater Graduate School. Contact The Groundwater Foundation, Lincoln, (402) 434-2740.

June 25-28: "Water Resources and Environmental Hazards: Emphasis on Hydrologic and Cultural Insight in the Pacific Rim," Honolulu. Contact American Water Resources Association, (703) 904-1225.

June 25-28: "Automating to Improve Water Quality," Minneapolis, MN. Water Environment Federation Specialty Conference. Call WEF at 1-800-666-0206 for more information.

JULY

July 8-10: Discovery Workshop: How To teach Youth About Trees and Environmental Stewardship. Lied Conference Center, Arbor Day Farm,

Nebraska City. Contact Susie Wirth, National Arbor Day Foundation, (402) 474-5655.

July 16-19: Interdisciplinary Conference: "Animal Waste and the Land-Water Interface." Fayetteville, AR. Contact: Arkansas Water Resources Center, University of Arkansas, 113 Ozark Hall, Fayetteville, AR 72701, (501) 575-4403.

July 17-19: North Central Regional Meeting, American Society of Agronomy, "Agricultural Management to Protect Water Quality," Grand Island, College Park.

July 18-19: Annual Nebraska Water Resources Tour. Sites in central and south-central Nebraska. Contact Water Center/Environmental Programs, University of Nebraska-Lincoln, 103 Natural Resources Hall, Lincoln, NE 68583-0844, (402) 472-3305.

July 23-26: Water Environment Federation/American Water Association Joint Residuals Management/Biosolids Conference, Hyatt Regency Crown Center, Kansas City, MO. Call WEF at

1-800-666-0206 for more information.

July 23-29: First International Conference on Objective Decision Support Systems for Land, Water and Environmental Management, Honolulu.

AUGUST

Aug. 3: University of Nebraska Panhandle Research and Extension Center Field Day, Scottsbluff.

Aug. 6-9: 50th Annual Meeting, Soil and Water Conservation Society, Des Moines, IA.

Aug. 10: University of Nebraska South Central Research and Extension Center 25th Anniversary Field Day, Clay Center.

Aug. 13-16: "Environmental Laboratories: Testing the Waters." Cincinnati. Call WEF at 1-800-666-0206 for more information.

Aug. 17: University of Nebraska Center for Sustainable Agricultural Systems Sustainable Ag Tour, Mead. Contact Center for Sustainable Ag Systems, (402) 472-2056.

Aug. 25-Sept. 4: Nebraska State Fair, Lincoln.

SEPTEMBER

Sept. 9: Festival of Color, University of Nebraska Agricultural Research and Development Facility, Mead. 9 a.m. to 4 p.m. Contact Amy Greving, (402) 472-1640.

Sept. 12-14: Husker Harvest Days, Grand Island.

Sept. 22-23: "Priming the Pump: A Water Festival Workshop." Lied Conference Center, Nebraska City. Contact The Groundwater Foundation, 1-800-858-4844.

Sept. 30: Nebraska Water Conference Council Fall Meeting. East Campus Union, University of Nebraska-Lincoln. Contact Water Center/Environmental Programs, (402) 472-3305.

OCTOBER

Oct. 16-18: 40th Annual Midwest Groundwater Conference, Columbia, MO.

Oct. 18: Annual Groundwater Symposium of The Groundwater Foundation. "Source Water Protection: Making the Connection from Aquifer to Tap." Ramada Hotel, Lincoln. Contact The Groundwater Foundation, (402) 434-2740.

Oct. 23-27: WEFTEC '96: The Water Environment Federation's 68th Annual Conference and Exposition. Miami. Contact WEF at 1-800-666-0206.

NOVEMBER

Nov. 19-20: Groundwater Guardian Conference. Oak Brook, IL. Contact The Groundwater Foundation, Lincoln, at 1-800-858-4844.

more and more producers recycle pesticide containers

LINCOLN — The Nebraska pesticide container recycling program, now in its fourth year, keeps producing records.

Since the program's inception in 1992, the number of participating counties has increased from two to 27. The number of sites available across the state has grown from two to 54.

In the first year, producers recycled 8,000 containers. That number increased to 21,000 in 1993, and by last year, it had grown tenfold to an estimated 80,000 containers recycled.

"The Nebraska project is being touted by the Environmental Protection Agency as a model for other states," said Larry Schulze, pesticide coordinator at the University of Nebraska-Lincoln. "The project has been an outstanding example of cooperative efforts of many people."

Of the 54 sites, seven are available yearlong, 26 will be available season-long, and 21 will be available only at specific dates and times, said Schulze, a member of the Water Center/Environmental Programs



The number of pesticide containers collected for recycling at sites such as this one in Nebraska has increased from 8,000 in 1992 to more than 80,000 in 1994.

unit at UNL. Local Cooperative Extension offices can inform the public on exact dates and locations.

The EPA funded the first two years of the project. Since then, the project has been self-supporting.

Before containers can be accepted, they must be inspected to determine if they have been properly rinsed. Producers may either triple-rinse or pressure-rinse the containers. Guidelines are available from Cooperative Extension offices. Once the containers have been inspected and collected, they are recycled into new ones.

The Nebraska Pesticide Container Recycling Committee, a coalition of eight agriculture and agricultural chemical organizations and four state and federal agencies, coordinated the program when it began.

The Agricultural Container Research Council, a national coalition of agri-chemical manufacturers, inspects containers a second time and supports the cost of grinding and transporting the containers and reusing the plastic.

Yearlong collection sites are located in Antelope, Buffalo, Burt, Cuming, Dawson, Dodge and Scotts Bluff counties.

Collection sites that are open during the use season are located in Adams, Butler, Cass, Cherry, Holt, Johnson, Lancaster, Lincoln, Nemaha, Otoe, Richardson and Saunders counties.

Sites that are open at specific dates only are located in Cass, Dakota, Gage, Jefferson, Lancaster, Saline, Sarpy, Saunders, Seward, Thurston and Washington counties.

For a complete list with locations, dates and times, contact the Water Center/Environmental Programs unit, University of Nebraska, 103 Natural Resources Hall, Lincoln, NE 68583-0844, (402) 472-1632.

Mailing List Update

We are updating our mailing list. If you have a change of title, name, and/or address, or would like to have your name added or removed from the Water Current mailing list, please complete this form. If you know of individuals who might be interested in receiving our publications, please submit their names.

☐ revise my address ☐ delete me from your list ☐ add to your list

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Send update to:

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Water tour to explore central Nebraska

Sign up now to take part in the 1995 Water Resources Tour. Timely topics in water resources research and policy will be explored through talks, discussions and on-site demonstrations.

"I'm very pleased with the strong educational focus of this year's tour," said Bob Volk, director of the Water Center/Environmental Programs unit at the University of Nebraska-Lincoln.

This year's tour will take place July 18-19 in Grand Island. It will begin on Tuesday, July 18, with four presentations. Jim Schepers, USDA-ARS soil scientist, will speak on "Research in Crop Management to Protect Ground Water Quality."

Tom Franti, surface water management engineer at UNL, will present "Reducing Herbicide Losses From Tile-Outlet Terraces to Surface Water." Sen. Bob Kerrey, D-Neb., will deliver the keynote address, "Washington Update: The Environ-

ment and U.S. Farm Policy." Dave Mortensen, UNL weed scientist, will speak on "Site-Specific Weed Management and Spatial Distribution of Weed Species."

In the afternoon, buses will rotate between three sites: a variable rate application technology site, a Mid-Nebraska Water Quality Demonstration site and the Nebraska Management Systems Evaluation Area site.

In the evening, a dinner and tour will be offered at the Stuhr Museum in Grand Island.

On Wednesday, July 19, participants will tour a number of sites in central Nebraska: the Diamond Plastics plant in Grand Island, the seed corn handling plant and production fields at Pioneer Hi-Bred facilities in Doniphan, Chief Ethanol Fuels in Hastings, T-L Irrigation in Hastings and the U.S. Meat Animal Research Center at Clay Center.

Deadline for registration is June 30. Participants can choose from

registration options ranging in cost from \$65 to \$140. Participants will be able to ride a bus to Grand Island from Lincoln or join the tour in Grand Island.

All subscribers to the Water Current will receive a registration flier in the mail. For questions on the tour content, please contact Dayle Williamson at (402) 471-2081. For questions on registration, please contact Karen E. Stork at (402) 472-7530.

This year's tour takes place in conjunction with the American Society of Agronomy-North Central Branch meeting and the Four States Irrigation Council's Tour. The water tour is sponsored by the Nebraska Water Conference Council, the Nebraska Natural Resources Commission, the Conservation and Survey Division, the Water Center/Environmental Programs unit and the Institute of Agriculture and Natural Resources, UNL.

WATER CENTER/ENVIRONMENTAL PROGRAMS

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