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ENVIRONMENTAL RESEARCH AND EDUCATION FOUNDATION

EREF NEWS

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FROM THE PRESIDENT
MICHAEL J. CAGNEY

The vigorous pursuit of excellence and willingness to change in order to grow have been hallmarks of the Environmental Research and Education Foundation since its beginning in 1992. The mission of the foundation to develop environmental solutions for the future embodies the commitment of the foundation's board to strive for even more as we remain a vital resource for the waste services industry.

In the next few weeks you'll be getting a letter from the EREF Chairman, Ron McCracken. I hope you take the time to read it because the letter will broaden your understanding of the tremendous impact your support can have if you choose to help the foundation with a tax deductible contribution at year end.

I believe that the foundation's strongest tradition has been the quality of our projects and the extraordinary dedication of our small staff and board of directors. Your thoughtful generosity will enable us to build on the best of our past as we forge a dynamic program for the future.

I hope you will place the highest possible value on supporting the quality projects and people who make up the EREF family – we need annual help from all who have vision and all who have cared and continue to care about good environmental science and the advancement of waste technology.

Together we can make a difference!

IN THIS ISSUE...

EREF BIOREACTOR LANDFILL PROJECT UNDER WAY

by Ed Repa, EREF
Director, Environmental Programs

According to a recent study sponsored by the foundation, the U.S. generates some 545 million tons of non-hazardous waste that is managed off-site. Almost 346 million tons is disposed of in landfills and this amount continues to grow.

Federal regulations under the Resource Conservation and Recovery Act (RCRA) require municipal solid waste (MSW) landfills to be environmentally secure. In order to meet federal requirements, landfills are designed with impermeable liners and leachate collection systems to prevent groundwater contamination, a low permeability cap to prevent liquid intrusion after closure, and a landfill gas extraction system to prevent air emissions. In addition, owners and operators of landfills are required to maintain their landfills for 30 years or more after final closure and provide financial assurance for these activities.

The RCRA requirements have resulted in MSW landfills becoming "dry tombs" (i.e., lacking water) for waste placed in them. The waste degradation process in a dry tomb landfill proceeds at a slow rate because water availability becomes a limiting factor in waste degradation. Therefore, the landfill can be biologically active for more than 30 years producing air and water emissions that must be monitored, controlled, and treated.

In order to deal with the shortcomings of dry tomb landfills, bioreactor landfills offer a promising approach.

In a bioreactor landfill, the buried waste is actively managed such that its organic content decomposes at an accelerated rate. This is accomplished by the addition of liquids under controlled conditions, which can include the the recirculation of leachate as a method to

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EREF's bioreactor project received its first lift of waste in August 2002.

Bioreactor Project
continued from page 1

treat leachate and avoid treatment costs. A bioreactor landfill essentially becomes a waste processing facility much like a compost facility.

The potential benefits of a bioreactor landfill appear to include:

- Shorter time periods over which air and water emissions are generated;
- Shorter post-closure care periods;
- Greater waste densities; and
- Quicker return of the property to a productive end-use.

Settlement profilers are lowered within the first lift of waste.

Because of the increased interest in operating bioreactors, the U.S. Environmental Protection Agency (EPA) has initiated a review of its landfill regulations when bioreactor operations are used. Also, EPA has initiated a project to track bioreactor landfills. The data collected will be used to determine whether new projects address new areas of research or are duplicative of previous research. However, basic bioreactor landfill research and full-scale demonstration are needed because the science is not fully understood. Presently, there is a need to understand the basic chemical, biological and physical processes in order to define where the bioreactor will work. Additionally, the bioreactor technology needs to be better demonstrated at full scale for technology acceptance in a risk adverse industry. Most existing bioreactor landfills are retrofits of dry tomb landfills and are not instrumented to produce performance data. A full-scale system allows direct evaluation of design and operating parameters.

Weather monitoring station is installed on the perimeter of the bioreactor cell.

In the fall of 2001, EREF awarded a grant to Michigan State University (MSU) for the development and operation of a bioreactor cell at the Northern Oaks Recycling and Disposal Facility (owned by Waste Management, Inc.) in Harrison, Michigan. EREF's 1.5-acre bioreactor cell constructed at the landfill has a capacity of 160,000 yd^3. The cell is equipped with horizontal leachate recirculation and gas extraction pipes within each ten-foot lift.

Handheld monitoring devices are used to observe moisture and temperature content within the cell.

Within each lift of waste, monitoring systems have or will be installed to evaluate moisture, temperature, gas, leachate, and waste settlement. Also, leachate and liquid additions and removal will be recorded as well as the pH and conductivity. Weather data will be continuously monitored with an on-site weather station. Periodically, liquid and gas samples will be analyzed for both organic and inorganic constituents. Gas samples will also be periodically collected and analyzed for gas composition and production rate.

The status of EREF's bioreactor project is:

Leachate sump and monitoring equipment is routinely tested and inspected.

- Base construction (liner and leachate collection system) was completed February 2002;
- Filling of first lift was completed in August 2002;
- Installation of monitoring devices within first lift was finished in October 2002; and
- Filling of the second lift started in November 2002.

The data and samples collected from the site will be analyzed in an MSU lab.

Data from the site will start to become available in early 2003. However, monitoring the bioreactor cell will be a long-term project that will provide data to answer some of the basic questions about this technology.

For additional information on the foundation's bioreactor project and an interest in becoming a project partner, contact Ed Repa at 703.299.5139 extension 11.

See Page 6 or visit our website for details about other projects.

Bioreactor project team (standing left to right)**: Reem Musleh (MSU), Prof. Thomas Voice (MSU), Dr. Xianda Zhao (MSU; Project Manager), Dr. Milind Khire (MSU), and Dr. Ed Repa (EREF).** (Kneeling)**: Seth Maher (MSU).** (Missing)**: Dr. Syed Hashsham.**

Photos courtesy of Xianda Zhao, Ph.D., P.E, Dr. Syed Hashsham and EREF staff.

FROM THE CHAIRMAN

RONALD J. MCCRACKEN

AUCTION DONOR
WASTEC MEMBER

WASTEC MEMBER EQUIPMENT AND INVENTORY CAN HELP... (AND CONGRESS AGREES)

How can a garbage truck, compactor, or roll-off container prompt research and learning and benefit our industry?

The federal tax laws encourage contributions to charitable organizations in recognition that such gifts provide a history of enhancing the health and safety of the general public.

Over the past 8 years WASTEC equipment donations have helped the Environmental Research and Education Foundation (EREF) raise almost $4 million for waste research and education projects and general operating expenses. Congratulations and thanks to WASTEC!

New equipment donations are prominently displayed at WasteExpo and are auctioned off at the foundation's Absolute Auction each Wednesday of the show. Donations entitle WASTEC members to deduct the fair market value of their gifts.

EREF's auction is the easiest way for WASTEC members to become active with a foundation directly benefiting the waste services industry – your industry. And because many WasteExpo attendees make it a point to visit the auction site and attend the auction, your direct involvement is a good business decision.

So join us. For those who have attended the auction, either as a donor, sponsor or curious bystander, you know that we draw an incredible crowd.

WASTEC donations are listed on the foundation's website several months prior to the auction, as well as pictured prominently in its official auction booklet.

Extra! Extra!

EREF's Annual Waste Equipment Absolute Auction and Charity Raffle

will be held at WasteExpo '03 on Wednesday, June 4, in the Ernest N. Morial Convention Center, New Orleans, Louisiana. Proceeds benefit waste and recycling research and education and operating expenses.

Specialty items and new equipment, such as front and rear loaders, commercial containers, lifts, and much more, will be available for inspection starting Monday, June 2, in the foundation's exhibit space.

Want details? Interested in registering to bid? Call us at 703.299.5139.

Visit our website for news about last year's events. A list of 2003 auction items will be placed on EREF's website (www.erefdn.org/auction.html) by early May.

EREF CALENDAR

December 12-13, 2002
EREF Annual Board Meeting

April 2003 (TBD)
EREF General Meeting

June 4, 2003
Waste Equipment Absolute Auction and Charity Raffle at WasteExpo

Ernest N. Morial Convention Center
New Orleans, Louisiana

DON'T FORGET TO CHANGE YOUR DATABASE...

EREF's headquarters have moved to

120 S. Fayette Street, Alexandria, Virginia 22314

Main Line: 703-299-5139
Fax: 703-299-5145

Our website address remains as www.erefdn.org - be sure to visit this site for updates on our research and education projects and special events.

mcagney@erefdn.org
erepa@erefdn.org
abrauer@erefdn.org

MEETING OF THE BOARD

EREF's fall Board meeting was held on September 24-25 in Houston, Texas.

Committee and other meetings occurring on September 24 were:

- **Strategic Planning**
- **Investment Management**
- **Finance**
- **Scholarship**
- **Project**

The foundation wishes to thank Waste Management, Inc. for hosting the fall meeting at their corporate conference center in Houston.

SCHOLARSHIPS COMPLETED

Dr. Molly Costanza-Robinson *(Fiessinger Scholar-2000)*

Dr. Costanza successfully completed her Ph.D. program in May 2001 and is now working as a postdoctoral Research Specialist at Northern Arizona University.

Dr. Robert Klee *(Fiessinger Scholar – 1999)*

EREF's second Fiessinger Scholar, Dr. Robert Klee obtained his Ph.D. in 2001 and subsequently entered the Law School at Yale, focusing on Environmental Law.

Dr. Kerry Howe *(Fiessinger Scholar – 1998)*

Our first Fiessinger Scholar, Kerry J. Howe, finished his Ph.D. in Environmental Engineering at the University of Illinois at Urbana-Champaign in August of 2001. His doctoral thesis won an honor award in the University Research category of the Excellence in Environmental Engineering competition sponsored by the American Academy of Environmental Engineers.

The results of Dr. Howe's research were presented in the journal *Desalination* and at several conferences, both nationally and internationally, and were featured in the cover article of the journal *Environmental Science and Technology*. He is now working as an assistant professor in the Civil Engineering department at the University of New Mexico in Albuquerque, New Mexico, teaching classes in water treatment processes and starting a research program focused on membrane filtration and other water and industrial waste treatment processes.

CONGRATULATIONS SCHOLARS!

FRANCOIS FIESSINGER SCHOLARSHIPS

Scholarships are awarded by EREF to recognize excellence in Ph.D. or post-doctoral environmental research and education. Awards are given in memory of Francois Fiessinger, Ph.D., P.E., a graduate of Rutgers University who was a founding director of EREF. Dr. Fiessinger passed away at age 53 on March 11, 1997.

NEW FIESSINGER SCHOLAR SELECTED

During its September meeting in Houston, Texas, the foundation's Board approved funding for a 2002 Fiessinger Scholarship:

Mira Stone Olson, University of Virginia, Charlottesville, Virginia, was awarded this year's Francois Fiessinger Scholarship. Her research focuses on groundwater remediation, examining how chemotaxis (the movement or orientation of an organism along a chemical concentration gradient) affects the transport of bacteria for bioremediation through low permeable materials.

Ms. Olson received a B.S. in Mechanical Engineering and a B.A. in Environmental Science and Engineering from Rice University (Houston, Texas) in 1998, and a Masters in Civil Engineering (Environmental) from the University of Virginia (Charlottesville, Virginia) in May 2000. She is also an athlete, linguist, and accomplished violinist.

The foundation's Scholarship Committee received an impressive seventy-nine applications for consideration this year – the largest number of submissions ever received. Ms. Olson was the first Francois Fiessinger Scholarship applicant to receive the highest rating from each of EREF's Scholarship Committee members, as well as the highest combined rating by professors submitting recommendations.

Please join us in congratulating our newest scholarship winner! Scholar progress reports are posted annually on our website at www.erefdn.org/scholarshipsall.html.

Did you know you could specify that your Honorarium or Memorial contribution be applied to EREF's scholarship fund?

When completing your personalized Honorarium or Memorial, which will be printed in our upcoming newsletter, simply check the box labeled "Fiessinger Scholarship Program" *(see our form on Page 7).*

Calling All WASTEC Members!

Got Parts Inventory? Got Equipment? Planning to exhibit at WasteExpo '03 in New Orleans?

EREF, the solid waste industry's foremost research foundation, will turn your parts or equipment donation to its Waste Equipment Absolute Auction into good that will benefit you and your community.

Our auction, held annually at WasteExpo, generates funds for important waste services research and education projects…and we make sure that WASTEC donors receive the recognition they deserve.

Please join us this year as a donor. The auction will be held on Wednesday, June 4, in the Ernest N. Morial Convention Center in New Orleans, Louisiana.

EREF provides pre-auction advertising and includes corporate recognition on its website, in its exhibit space, and in its various publications - reaching thousands of industry professionals worldwide.

Unable to make an equipment donation this year?
Consider sponsoring our pre-auction reception.

Mark your calendars now, then give Michael or Anne a call at 703.299.5139.

Auction participation details and registration information is also available on our website at www.erefdn.org/auction.html.

WHAT OUR SCHOLARS ARE UP TO

Mr. Alexander Orlov
Cambridge University
United Kingdom
(Fiessinger Scholar - 2001)

Coming from the University of Michigan to Cambridge (United Kingdom) was quite an experience. An over seven centuries old University, proud of being associated with the scientific accomplishments of such people as Isaac Newton, Charles Darwin, Stephen Hawking, and over sixty Nobel Prize winners — this humbles you quite a lot. You also realize where the roots of the American educational system are, as John Harvard, the first benefactor of Harvard University, was one of the famous alumni of Cambridge University.

This amazing reputation in Natural Sciences was one of the motivations of going from the Engineering Department at the University of Michigan, to the Chemistry Department in Cambridge, where my main focus is in Physical and Environmental Chemistry. Nevertheless, my project is collaboration between Chemistry and Engineering Departments, so it is an interdisciplinary effort in both fundamental and applied research.

My current project is focused on the development of new catalysts for photocatalytic degradation of such groundwater pollutants as MTBE, and chlorophenols. The project has two distinct areas: firstly, it focuses on the application of new catalysts, such as titanium dioxide modified with metal nanoparticles; secondly, it focuses on developing a novel in-situ photocatalytic system. It is work in progress, which started a little more than a year ago, and the on-going experiments are still trying to find a more active and stable catalyst than conventional catalysts. One of the most exciting parts of the interdisciplinary research is a possibility to learn new techniques and methods. Several surface science techniques I am working with are frequently employed for industrial catalyst development, but are not very common in the environmental engineering area. Looking at these techniques from an engineering point of view gives me a unique opportunity to develop applications of them towards environmental issues. I am very grateful to the foundation, which made this incredible education experience possible.

Mr. Richard Statom
Colorado School of Mines
Golden, Colorado
(Fiessinger Scholar – 2001)

The contamination of groundwater by leachate from municipal solid waste landfills is a well-documented phenomenon that is found throughout the world. The remediation of groundwater at these facilities can involve a variety of technologies, depending on factors such as the type, concentration, and physical extent of the contamination. A remediation alternative that has gained popularity in recent years is known as natural attenuation. Natural attenuation is the reduction in concentration of contaminants in groundwater by natural processes. These processes can be geochemical and biological, and are dependent on factors such as the cation exchange and sorption capacity of the aquifer material, dilution, the microbial population, microbial carbon sources and nutrients, and the type and quantity of the contaminant to be attenuated.

Landfills can be continuous sources of contamination for many years, therefore, in order to evaluate an aquifer's capacity for natural attenuation of groundwater contamination from landfill leachate, the chemical characteristics of the leachate need to be defined for the present and the future. Prediction of future changes in leachate chemistry usually requires the use of a geochemical model, and such models should be calibrated to actual data before employed in a predictive mode. Thus, the monitoring of leachate chemistry and evaluation of the data over the life of a landfill is needed to formulate and calibrate a model that can make long-term predictions on the nature of the leachate.

In general, previous studies conducted to determine the temporal changes in leachate chemistry were based on simulated landfill cells, small numbers of lysimeters, or landfills of different ages involving relatively short (4 years or less) sample periods. In this phase of my research, over 12 years of quarterly leachate chemistry data from a lined landfill cell in Florida was investigated and the changes in concentrations of various parameters that are commonly analyzed by landfill operators were evaluated. By analyzing the data from a single landfill cell over an extended period of time, the variability of factors inherent in studying simulated landfills and landfills of different ages (such as geography, climate, waste composition, landfill volume, geometry, and moisture content) are not a concern, and do not complicate the analysis of the influence of landfill age on leachate chemistry.

This line of research has already revealed some interesting temporal trends in leachate chemistry, including decreasing concentrations for many parameters with increasing landfill age, covariance of several parameters over time, and the apparent affect of closure of the landfill on leachate chemistry.

A preliminary report of this investigation was presented at the 2002 Rocky Mountain Section of the Geological Society of America meeting and is listed in the GSA Abstracts. The final report was presented at the 2002 Annual meeting of the Geological Society of America in Denver, Colorado in late October.

(Mr. Statom's landfill related publication info is now available at www.ererfdn.org/rpts_summary_ordrs/statom2002.htm)

PROJECT COMPLETIONS... SEVERAL PROJECTS FUNDED BY EREF REACHED SUCCESSFUL COMPLETION THIS YEAR

BURY, BURN OR RETURN: WINNING THE WAR AGAINST WASTE

EREF's 40-minute documentary on the recycling, reuse, reduction, treatment and disposal of municipal solid waste, accompanied by a teaching lesson, was requested by nearly 3,200 middle schools throughout the United States and was used in their science classes at the start of the 2002-2003 school year.

This exceptional program was produced by Bill Kurtis Productions of Chicago, Illinois. It is well aligned with several benchmarks from the American Association for the Advancement of Science (AAAS) for the 8th grade, most notable in Earth Science, and provides an excellent resource for middle school science. It deals with both the human and science sides of waste-related issues, presenting solutions and encouraging participation in environmental initiatives.

Companies interested in helping cover the cost of distribution to middle schools in their states (and in building up positive community relations) should contact Anne Brauer at 703.299.5139 x10 for details. A letter acknowledging your generosity will be sent to your schools of choice.

EREF RECEIVES GRANT RENEWAL FOR ERGONOMICS TRAINING AND EDUCATION

On September 24, 2002, EREF was awarded additional funding to extend its current Susan Harwood Training Grant from the U.S. Occupational Safety and Health Administration (OSHA). Under the terms of this $56,330 renewal, EREF will:

- Translate the handouts from its 2001-2002 ergonomics training sessions into Spanish and make them available, at no cost, to solid waste employers and employees in both printed form and in downloadable format via its website; and
- Develop checklists of ergonomics issues, in English and Spanish, for solid waste employers and employees to use as part of their overall safety programs and training.

According to the U.S. Department of Labor's 2001 Annual Average Employment Status report (www.bls.gov/cps/cpsa2001.pdf), approximately 12.7% of "garbage collectors" in the U.S. are of Hispanic origin. By providing training and education materials in both English and Spanish, the foundation is ensuring that valuable ergonomics information reaches those who need it most.

Also covered under this grant will be continued supervision of the development of the solid waste industry's Best Management Practices (BMPs) for preventing ergonomic injuries to solid waste employees, and the maintenance of an interactive web page concerning ergonomics and the solid waste industry, applicable regulatory guidance, and the ability to ask questions that receive prompt and informative responses.

ELECTRONIC NOSE TECHNOLOGY APPLIED TO LANDFILL ODORS

Case Western Reserve University completed its EREF-funded portion of electronic nose technology research in June 2002 and presented its findings during the Solid Waste Association of North America's (SWANA) 7th Annual Landfill Symposium held June 17-19, 2002 in Louisville, Kentucky. University staff used the Cyrano Sciences Cyranose 320 Electronic Nose as the basis for their research, which provided both a "fingerprint" and the concentration of various landfill odors at the Garfield Heights landfill (Garfield Heights, Ohio) during the fall of 2001.

A downloadable pdf version of the EREF-funded study is available at www.erefdn.org/rpts_summary_ordrs/ElectronicNose.pdf).

SOLID WASTE INDUSTRY INTERNET-BASED ERGONOMICS TRAINING COURSE NOW AVAILABLE

EREF is pleased to announce that its internet-based ergonomics training course for solid waste employers and employees is now available for use. Effective November 1, the training program and accompanying educational materials were accessible via the "Seminars and Training Programs" link on the right-hand side of EREF's homepage – www.erefdn.org.

This valuable training course was made possible by a grant to EREF from the Occupational Safety and Health Administration's (OSHA) Susan Harwood Training Program (Susan Harwood Training Grants provide funds to nonprofit organizations to conduct health and safety training in the workplace). EREF contracted with the Environmental Industry Associations (EIA) for development of the training program because of their expertise in ergonomics education. A link to the program can also be found on their website www.envasns.org.

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Would you like a specialist in your company to receive quarterly updates about specific EREF research projects? Send his or her full name, title and e-mail or postal address to Anne Brauer at abrauer@erefdn.org or fax to 703.299.5145. Be sure to specify the type of project information your specialist should receive (landfill or recycling technology, training programs, etc.).

EREF AND YOU —

REMEMBERING YOUR LOVED ONES, FRIENDS, COLLEAGUES AND EMPLOYEES ...

Pay tribute to someone special and at the same time give back to your industry! Support the foundation and its funding of waste and recycling research and education by means of a contribution* in honor of a personal milestone or award, or in memory of a beloved family member or friend.

Please make your contribution payable in U.S. dollars (checks to be drawn on a U.S. bank) to "EREF" and send it with the completed form below to: Environmental Research and Education Foundation, 120 S. Fayette Street, Alexandria, Virginia 22314.

** Tax deductible to the extent allowed by law.*

APPLY DONATION TO: ☐ RESEARCH AND EDUCATION PROJECTS ☐ FIESSINGER SCHOLARSHIP PROGRAM

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DEEDS, NOT STONES, ARE THE TRUE MONUMENTS OF THE GREAT. *J. L. Motley*

There are many motivations for giving one's money for charitable purposes –

• satisfying feelings of value or responsibility to our communities • perpetuating a viewpoint • memorializing or honoring a friend, loved one or colleague • taking advantage of considerable tax deductions

But many donors also feel it is important to support viable research and education that will benefit their industry and personal livelihood, and contribute because they want to feel better connected with others who share their vision.

Anne M. Brauer
Director of Development and Communications

As a waste services professional, supporting EREF means you are supporting efforts in which you believe. When you give to a public foundation such as ours, you are helping solve community and regional problems and working to improve the overall quality of life — not only for yourself, but also for the public good.

We hope you will consider EREF as your Charity of Choice when you plan your annual giving and become a partner in discovering and advancing environmental solutions for tomorrow.

Thank you.

HONORARIUMS AND MEMORIALS

MEMORIAL GIFTS IN THE LAST YEAR:

Mrs. Corley
(John Corley, Jr.'s Mother)
Michael J. Cagney

EREF LISTED AS A CHARITY OF CHOICE ON LEGACY.COM.

Legacy.com is an online service that provides memorials in the form of a Guest Book (for sharing memories or paying respect), Legacy Notice (a temporary announcement), or Legacy Life Story (a lasting article that can include a biography, photos, letters, and keepsakes). In accordance with family wishes, Notices and Stories can provide a link to the website of a specific charity, or to a list of charities, that could be designated to receive donations in memory of the deceased.

We wish to thank Legacy.com for recognizing the foundation by allowing donors to select EREF as their Charity of Choice.

KINDNESS, EVER FLOURISHING

Thank you to Van Ooteghem Bros. Farm & Greenhouse, Essexville, Michigan, for their generosity in donating several flats of beautiful flowers this past summer to decorate EREF's new headquarters. You certainly made us feel at home.

ENVIRONMENTAL
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www.erefdn.org

**120 S. Fayette Street,
Alexandria, Virginia 22314**

PLEDGES AS OF OCTOBER 2002

CHAIRMANS CIRCLE CLUB
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ENVIRONMENTAL RESEARCH AND EDUCATION FOUNDATION

Developing environmental solutions for the future.

EREF NEWS

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Internet-Based Ergonomics Training

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The ergonomics program includes streaming video and audio, PowerPoint™ slides, photographs and other visual aids. Participants will be provided with access codes allowing them to complete the 2-hour training program in either one sitting or over the course of several sessions.

In accordance with the terms of this OSHA grant, the proceeds generated from the sale or use of ergonomics information or training under this grant will be used to cover maintenance of the training and education website, and the production of additional ergonomics training materials.