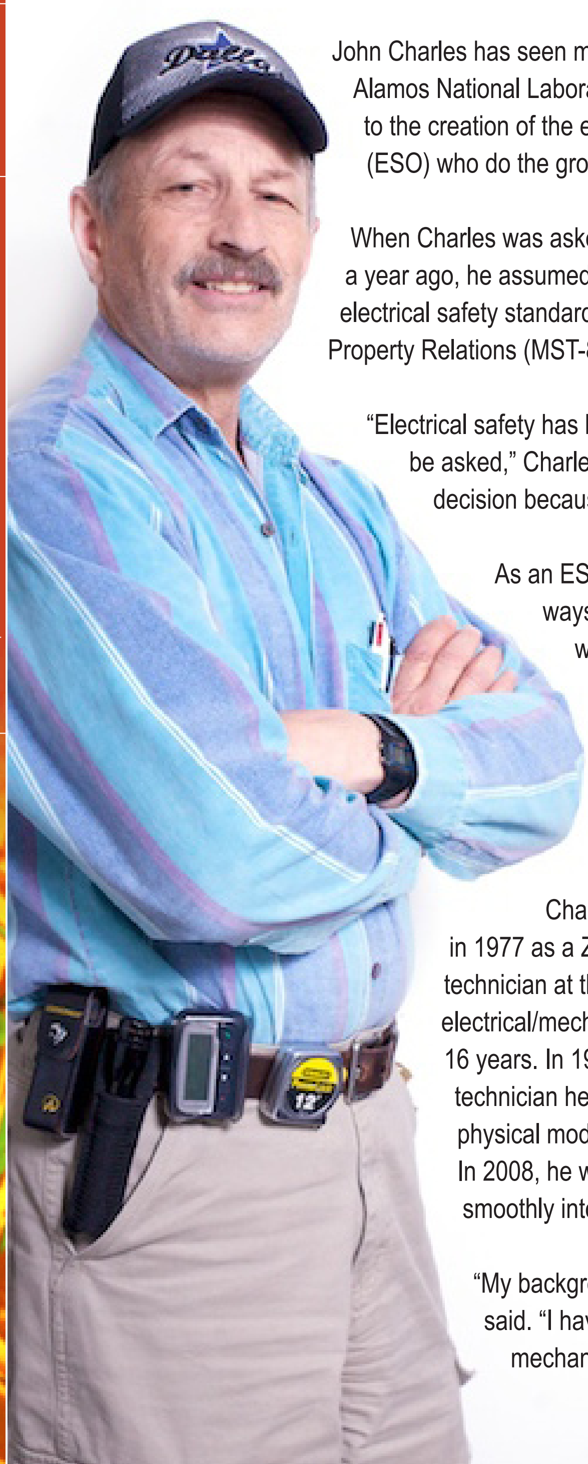
MST eNEWS
April 2011

INSIDE

John Charles

Energized to improve electrical safety

By Francisco Ojeda
ADEPS Communications



John Charles has seen much improvement in electrical safety in his 27 years at Los Alamos National Laboratory, especially so in the last 10—something he attributes to the creation of the electrical safety program and the electrical safety officers (ESO) who do the ground work.

When Charles was asked to become the Polymers and Coatings (MST-7) ESO a year ago, he assumed responsibility for continuing to improve the Laboratory's electrical safety standards. He also recently became acting ESO for Structure/Property Relations (MST-8).

"Electrical safety has become a high priority at the Lab so it was a privilege to be asked," Charles said of the MST-8 addition to his duties. "It was an easy decision because I have a lot of experience in the electrical arena."

As an ESO Charles said his goal is to educate workers about ways to prevent electrical fires, injuries, and fatalities at the workplace. He spends about 30 percent of his time on his ESO duties, which includes serving as the primary group-level focal point for electrical safety, providing consultation, assistance, and facilitation for safe electrical work within MST-7 and MST-8, and assisting in providing an electrically safe workplace.

Charles began amassing his wealth of electrical experience in 1977 as a Zia Company refrigeration, heating, and air-conditioning technician at the Laboratory. In 1983, he joined Los Alamos as an electrical/mechanical technician, working for several groups over the next 16 years. In 1999, he joined Materials Engineering (WST-6) as a lead technician helping with a rapid prototyping process, which produced physical models directly from computer-aided design solid models. In 2008, he was the lead technician in helping the group transition smoothly into MST-7.

"My background gives me a pretty firm grip on safety issues," Charles said. "I have experience as a technologist and handling electrical and mechanical equipment. I have done all kinds of things."

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From Denieceʼs Desk

Work at the TA-55 Plutonium Facility (PF-4) is not just manufacturing pits and performing surveillance. The role of MST-16 is to characterize new and aged pit construction materials, develop technologies for advanced actinide materials analysis, and perform actinide materials science investigations. Today, I want to tell you about small-scale plutonium experiments at TA-55. Campaigns 1 and 2 define and fund experiments which characterize the strength, damage and equation-of-state (EOS) properties of plutonium alloys as well as execute integrated performance experiments at Los Alamos and other facilities across the nuclear weapons complex. The last, and perhaps most important task, is to fully characterize all plutonium source material used in the samples and test components to fully understand the properties and/or variability.

Strength, damage, and EOS experiments are performed both quasi-statically and dynamically in PF-4 using an MTS load frame, a Kolsky bar apparatus and a 40-mm gas/powder gun. To enhance the capability test space, MST-16 is upgrading both the quasi-static load frame and the 40-mm gas/powder gun. The load-frame currently operates over a range of temperatures from room temperature to 350˚C at strain rates of 10-4 to 10-1. This year a liquid nitrogen feedthrough is being added to allow for testing at temperatures down to -80˚C. We have also implemented a video extensometer system to more accurately measure strain during testing at temperature. Traditional strain gauges or clip-on extensometers are difficult to use in a glovebox or at elevated temperatures. The video extensometer collects higher quality data with easier set-up and handling than traditional extensometry. For the 40-mm gun, we are installing the capability to preheat samples to 600˚C prior to shooting. A phase doppler velocimeter (PDV) is being installed to measure surface velocity of the flyer plate. PDV provide better velocity measurements over a longer period of time than the current VISAR.

Integrated performance experiments such as Bacchus and Barolo are manufactured and assembled at Los Alamos then tested at Nevada National Security Site. MST-16 performs characterization on all plutonium source material for integrated experiments. MST-16 also assembles the samples needed for the Z machine (tested at Sandia National Laboratories) and diamond anvil cells (tested at the Advanced Photon Source at Argonne National Laboratory). The sample and assembly preparation for these experiments is very precise and challenging. For example, the diamond anvil cell samples are about 50 micrometers on a side and weigh less than 100 micrograms. These tiny pieces of plutonium are smaller than a grain of fine sand and are loaded into the cells with a microscope.

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Understanding the chemistry and properties of the plutonium used in experiments is crucial to analyzing the data and/or modeling the shot. Characterization techniques include standard metallographic capabilities (sectioning, mounting, grinding, polishing, etching, optical imaging) and electron microscopy utilizing SEM, microprobe, FEGSEM, and XRD. Other material property analysis techniques are immersion density, resonant ultrasound (RUS), dilatometry, differential scanning calorimetry (DSC), and quasistatic thermomechanical testing.

Performing experiments in PF-4 is challenging. It is a highly regulated, nuclear facility. All plutonium operations are performed in gloveboxes or in a few cases, an open front hood. What may seem to be a straightforward analytical experiment becomes more complex and tedious when performed in a glovebox. Operations that take a few minutes in a normal environment can take hours in PF-4. PF-4 is also a unique facility that is critical to national security. There is no other place in the country and perhaps the world where you can perform these types of experiments. Despite the obstacles and difficulties we are meeting the challenges. I am proud to be part of the organization performing these high-quality science experiments on such a fascinating and important material.

MST-16 Group Leader Deniece Korzekwa

Charles . . . As an MST-7 research technologist, Charles conducts mechanical load frame testing of materials as well as manages and repairs research equipment. A recent project involved helping to build, troubleshoot, and test a set of solvent vertical column extractors to remove plutonium from residue materials dissolved in hydrochloric acid media.

"He has extensive experience building instrumentation packages and thus has a wealth of practical knowledge regarding best practices (in electrical safety)," MST-7 Group Leader Ross Muenchausen said.

To promote electrical safety, Charles started a weekly newsletter for MST-7 and MST-8. "Electrical Safety Moments" contains topics of the week, a summary of recent electrical safety issues, and a video on electrical safety dos and don'ts.

"It makes people aware in the back of their minds and gets them thinking," Charles said of the newsletters, for which he has received positive feedback.

"It keeps us on our toes," said Manny Chavez (Nuclear Materials Science, MST-16), who worked with Charles for five years. "Many people don't pay attention to some of these electrical safety things and this makes them aware of them. It's nice to have that."

"If it's anybody who I trust to handle that stuff, it's him," Chavez said. "The electrical and mechanical stuff are his specialty. He's been doing that a long time so he knows a lot."

Electrical safety tips

As an ESO John Charles likes to remind employees of the common mistakes and misuses of R&D electrical equipment around the Laboratory. These include:

- Daisy-chaining surge protectors, the practice of connecting multiple surge protectors rather than using one directly connected into the wall outlet
- Using extension cords for an extended period of time
- Not noticing frayed or bad plug-in cords
- Not having foot heaters inspected before usage
- Resetting breakers themselves rather than having an electrical worker perform the task
- Not ensuring equipment is Nationally Recognized Testing Laboratory (NRTL) approved or ESO approved

"If you have to deal with electricity at all, you have to be authorized and trained," Charles said. "There are plenty of trained electrical workers around who can help you out. Just ask your ESO who they are. Be safe out there."

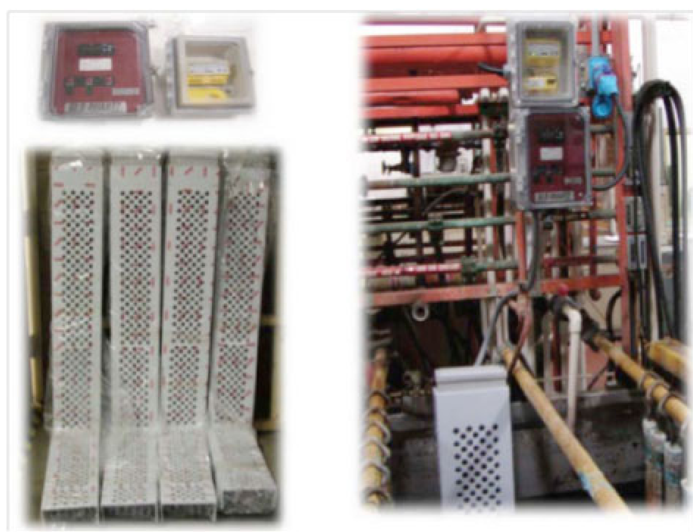
MST earns NNSA Pollution Prevention Award

Materials Science and Technology members recently received 2010 "Best in Class" Pollution Prevention Awards from the National Nuclear Security Administration.

Dane Knowlton, Jennifer Lillard, Mike Mauro, Tim Tucker and Randall Edwards (Materials Technology-Metallurgy, MST-6), and Robert Wingo and Stephen Trujillo (both Chemical Diagnostics and Engineering, C-CDE) were recognized for their contributions to the "Sigma Electroplating Discharge Reduction" project. Replacing a vacuum pump used in a rinse water recycle system and eliminating the steam heating of the electroplating baths resulted in significant energy, water, and waste savings for the Sigma Electroplating Laboratory. This activity saved enough energy to heat more than 14 homes for a year. Additional improvements will allow the team to recycle and reuse about 250,000 gallons of water annually, saving $1.2 million in treatment costs.

These awards recognize pollution prevention-related projects and activities that have reduced pollution, enhanced operations, saved money, or reduced environmental impacts. The recipients were recognized at the LANL 2011 Pollution Prevention Awards Ceremony, held on Earth Day, April 21.

Best in Class winners from the NNSA competition are entered into the DOE EStar complex-wide competition, which acknowledges leadership in environmental sustainability practices and promoting best practices throughout the nuclear security enterprise.



The electric heaters have replaced steam heaters in the chemical tanks of the Sigma Electroplating Laboratory.

Temperature dependence of lattice disorder in argon-irradiated magnesia single crystals

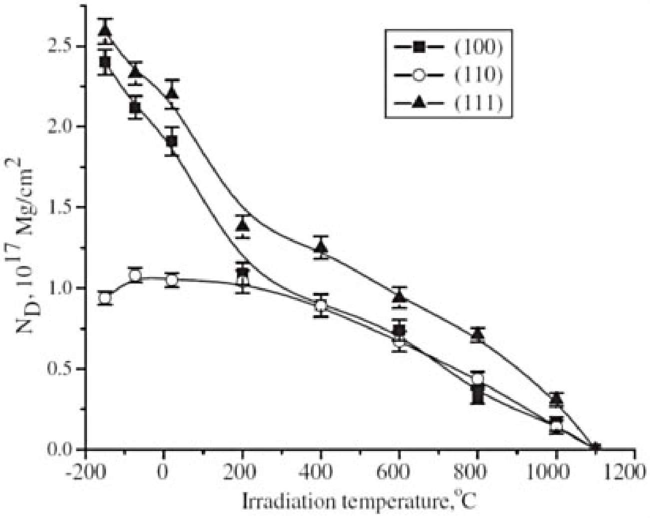
Magnesia (MgO) is a promising material for application in advanced nuclear fuel forms. An important criterion for selection of materials suitable for incorporation into nuclear fuels is their tolerance to a combination of irradiation-induced damage (produced primarily by fast neutrons and fission fragments) and elevated temperatures. During normal operating conditions in a nuclear reactor, the surface temperature of a fuel pellet is 800–1000 °C. Radiation damage evolution in MgO at these elevated temperature range has not been studied extensively.

To better understand dynamic annealing processes in ion-irradiated MgO single crystals of three low index crystallographic orientations, MST-8) researchers Igor Usov, James Valdez, and Kurt Sickafus investigated argon (Ar) ion radiation damage evolution at LANL's Ion Beam Materials Laboratory. The researchers used Rutherford backscattering spectroscopy combined with ion channeling to analyze lattice damage. Damage recovery with increasing radiation temperature proceeded via two characteristic stages separated by 200 °C. The scientists observed strong radiation damage anisotropy at temperatures below 200 °C, with (110) MgO being the most radiation damage tolerant. The researchers attributed first stage damage recovery to radiation and/or ionization enhanced diffusion processes induced by the Ar ion bombardment. Above 200 °C damage recovery was isotropic, and almost complete recovery was reached at 1100 °C for all crystallographic orientations of MgO. The scientists conclude that thermally activated point defect migration processes begin to contribute to the recovery of lattice damage at the elevated temperatures. Lattice recovery in MgO induced by high temperature irradiation is more efficient than recovery upon post-irradiation annealing.

Reference: "Temperature Dependence of Lattice Disorder in Ar-irradiated (100), (110) and (111) MgO Single Crystals," *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms* **269**, 288 (2011).

DOE's Office of Basic Energy Sciences - Division of Materials Sciences and Engineering, DOE's High Temperature Superconductivity Program, and DOE's Advanced Fuel Cycle Campaign and Fuel Cycle R&D Program funded the research. The work supports the Laboratory's Energy Security mission area and the Materials for the Future capability.

Technical contact: Igor Usov



Damage parameter, ND, versus irradiation temperature, Tirr, for MgO single crystal of three low-index orientations [(100), (110) and (111)] irradiated with 100 keV Ar ions to a fluence of 1 x 10^{15} Ar/cm^2. Error bars indicate statistical uncertainty.

Growth of defects on inertial confinement fusion capsules

On December 2, Laboratory researchers successfully executed experiments to measure the growth of isolated defects driven by the ablative Richtmyer-Meshkov instability. Defects (bumps or divots) on inertial confinement fusion (ICF) capsules are thought to cause jetting of heavy material into the hot spot during an implosion, an undesirable consequence of late stage Rayleigh-Taylor growth. The Richtmyer-Meshkov instability growth associated with radiation ablation sets the initial conditions for subsequent Rayleigh-Taylor growth. Therefore, the ablative Richtmyer-Meshkov instability must be understood and controlled to optimize late time behavior. The ablation process stabilizes the early stage growth and is even predicted to decrease the amplitude of the initial perturbation. Ignition attempts will utilize tailored driving pulse shapes designed to minimize the perturbation amplitude at the onset of Rayleigh-Taylor growth. Experiments conducted at the Omega Laser Facility (Laboratory for Laser Energetics, University of Rochester, NY) are determining the time at which bump amplitudes approach zero.

Scientists used nine laser beams from Omega to create a moderate temperature (60 eV) radiation environment inside a gold hohlraum (see figure below), ablating and driving the ablative Richtmyer-Meshkov instability growth of a two dimensional array of Gaussian shaped bumps. On-axis area backlighting x-ray radiography measured the bump areal density at different times following the driving laser pulse by recording the transmission of the 2.8 keV Cl He-alpha line (saran) through the bumped target with an x-ray framing camera in the H3 position of the figure top, next page. Preliminary analysis shows that evolution of 12 micron tall and 32 micron wide full width at half maximum (FWHM) bumps fit

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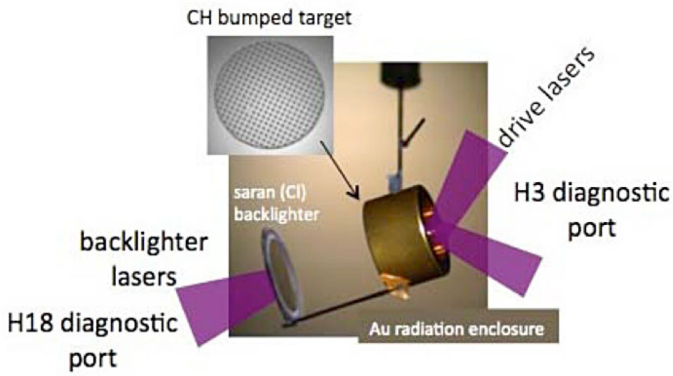
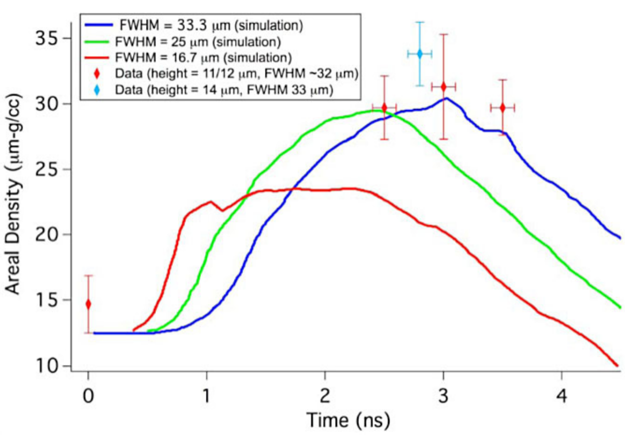


Experimental set-up for bump radiography at Omega. X-ray emission from a Cl plasma (saran) created by lasers around the H18 axis was recorded with an x-ray framing camera at 22x magnification.

Growth . . . predictions made by radiation hydrodynamic simulations remarkably well (see figure below). A peak areal density of 30 micron-gm/cc occurs at 3 ns. Because the simulations agree to within the error bars of the experiments at the times measured, the researchers are confident that the simulations are accurate in predicting the inversion time (approximately 8 ns). Their future experiments will explore this late time behavior.

The scientists employed standard interferometric techniques (VISAR) to examine shock speeds in the plastic targets. The measured shock speed of approximately 10 km/s agrees with the predictions. Principal investigator for this campaign is Eric Loomis (Plasma Physics, P-24). Scott Evans and Tom Sedillo (P-24), Jim Williams (Polymers and Coatings, MST-7), and Steve Batha (Physics Division, P-DO) participated. Derek Schmidt, Deanna Capelli, and Kimberly Defriend-Aubrey (MST-7) manufactured and metrologized targets, and General Atomics fabricated bump and stepped targets. Otto Landen and Dave Braun (Lawrence Livermore National Laboratory) were the project leader and designer, respectively. NNSA Campaign 10 (Steve Batha, LANL Program Manager) funds the work, which supports the Lab's Nuclear Deterrence and Energy Security mission areas.

Technical contact: Aaron Koskelo



Experimental and simulated bump evolution for Gaussian-shaped bumps.

HeadsUP!

Cyber security reminder

Be careful when opening attachments from friends outside of LANL. Do not open unknown e-mail attachments or click on suspicious links. Contact your OCSR.

Cyber e-mail incidents

No matter how careful we try to be with our e-mail communications, sometimes we inevitably find ourselves involved in e-mail cyber incidents.

The steps to take if you accidentally send or receive classified e-mail on an unclassified system:

1. Inform the Security Inquiry Team (SIT) 5-3505 of the suspected problem. Be sure to limit your conversation to unclassified details. Plan to meet with someone from SIT in person if necessary. If the incident occurs after hours or on the weekend call the Associate Director for Security and Safeguards (ADSS) on-call duty officer at 699-4094 or send a page to 949-0156.
2. Isolate the compromised information system. If using a workstation or laptop, unplug the RJ45 cable from the computer or the wall.
3. Let your line manager know what has happened and where you are in the decontamination process. Contact the Division Security Officer (DSO) 664-0641, local Organizational Cyber Security Representative (OCSR) and the information System Security Officer (ISSO), for classified systems.
4. The DSO needs to know the basic facts surrounding the incident including what was sent and to whom.
5. The DCS administrator and OCSR will sanitize the system using a check sheet.
6. The DSO working with SIT will tell users when the system is clean and ready for use.

MST support contacts

Organizational computer security representatives:
MST-6 – Barry Bingham: 667-4378
MST-7 – Brian Patterson: 606-0831
MST-8 – Esther Palluck: 665-3576
MST-16 – TBD (Kathleen Paul 6-0509)
MST-DO – Kathleen Paul

System Administrators:

Corey New: 665-3606	Renee Valerio: 667-9529
Division ISSO	Kathleen Paul: 606-0509
Alternate ISSO	Brian Patterson: 606-0831
Division Security Officer	Beverly Neal-Clinton: 664-0641

MST has strong showing at TMS annual meeting

From the perspective of MST-8 Group Leader Anna Zurek

From President Rusty Gray's welcoming reception to a special symposium honoring Carlos Tome, from technical sessions featuring groundbreaking materials research done by Los Alamos scientists to an awards ceremony with Laboratory recipients, MST was all over the recent TMS (The Minerals, Metals & Materials Society) annual meeting in San Diego, Calif.

Gray (MST-8) was a whirlwind of activity, presiding over the President's Welcoming Reception, serving as judge for the student poster contest, speaking at the annual meeting of the membership, and handing out awards at the TMS-AIME (American Institute of Mining, Metallurgical, and Petroleum Engineers) Awards Banquet. That's quite a feat, as word on the street is that Gray was hosting nightly soirees in the hotel's presidential suite-events that twice drew the hotel's security to request the hundreds of guests lower the din.

Tome (MST-8) delivered the keynote presentation at an honorary symposium recognizing his contributions to the field of mechanical behavior of polycrystalline materials. Ricardo Lebensohn (MST-8) was one of the organizers of the event, which featured more than 90 presentations and 35 invited lectures by distinguished speakers. A symposium dinner celebrated Tome's 60th birthday.

At the TMS-AIME Awards banquet, honoring leaders in the world of materials science and technology, Samrat Choudhury (MST-8) was presented with the 2011 Young Leader Professional Development Award, created to enhance the professional development of dynamic young people from TMS's five technical divisions. Choudhury is a member of the Electronic, Magnetic, and Photonic Materials Division. Dan Thoma (INST-OFF) was presented with the AIME Distinguished Service Award and Amit Misra (MPA-CINT) received the Materials Processing & Manufacturing Division Distinguished Scientist/Engineer Award. Long-time Los Alamos and MST friend Tony Rollett, professor of materials science and engineering at Carnegie Mellon University, was named a TMS Fellow. Amy Clark (MST-6) and Eric Brown (P-23) were student career forum panelists.

Helping to organize the week-long event, which drew more than 4,200 attendees and featuring more than 3,300 presentations, were TMS Board of Directors members Ellen Cerreta and Carl Cady, Donald Brown, Jian Wang, Ming Tang, David Andersson (all MST-8), as well as James Foley (MST-6), Bjorn Claussen (LANSCE-LC), and Irene Beyerlein (T-3), in addition to Gray, Lebensohn, Tome, and Misra.

Above, Rusty Gray with new TMS Fellow Tony Rollett. At right, Carlos Tome at the syposium held in his honor. Photos courtesy of TMS.

Celebrating service

Congratulations to the following MST Division employees celebrating service anniversaries this month:

Steve Vigil, MST-16	25 years
Ellen Cerreta, MST-8	10 years

MST e NEWS

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