

# Safety & Health News

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**AIChE**AMERICAN INSTITUTE OF  
HEMICAL ENGINEERS

SAFETY AND HEALTH DIVISION

[www.shdiv.aiche.org](http://www.shdiv.aiche.org)

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WINTER 2007/2008

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## DON'T LET HISTORY REPEAT ITSELF

John F. Murphy, PE

You would think that we would learn from past process safety incidents by investigating their root causes and implementing recommendations that would remove the root causes and thus prevent their reoccurrence. This system of investigation has been in place in the chemical and petrochemicals industries for two decades. My thirty years in the chemical processing industries and five years as a lead investigator with the U. S. Chemical Safety Board (CSB) has convinced me that this is often not the case. My analysis of the nine investigations that I participated in at the CSB has led me to the following observations:

- The hazards involved were well known
- There were warning signs leading up to each incident
- There were management system problems
- Incidents occur in companies of all sizes
- Many chemical related incidents took place in business outside of chemical manufacturing
- Incidents often happen during start up, shutdown or maintenance rather than during normal operation
- Regulations were often inadequate or not enforced
- Management thought they had a good (process) safety program.
- There were often safety culture issues
- They were all preventable

Safety & Health News is issued quarterly by the Safety and Health Division of the American Institute of Chemical Engineers (AIChE). It is available on the Division web site: [www.shdiv.aiche.org](http://www.shdiv.aiche.org). Since news items of interest to members of the Division of Chemical Health and Safety (CHAS) of the American Chemical Society (ACS) are included, this Newsletter is also available on the CHAS web site: <http://membership.acs.org/c/chas/>.

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Let's discuss several of these observations. A complete discussion of the ten observations can be found in the August 2007 edition of *Chemical Engineering Progress*.

The hazards in all these incidents were well known. The Reactive Hazard Investigation discovered that 90 % of the 167 reactive chemical incidents that had occurred in the twenty year period under investigation involved reactive hazards that are documented in publicly available literature easily available to the chemical processing and handling industries. Other examples include the Bethlehem Steel incident where a fire occurred killing two and injuring four when a flammable liquid was released and ignited during the removal of a valve during a line opening operation. The hazards of line opening and the flammability of coke oven condensate are well known. In the Georgia Pacific incident, two contract employees were killed and eight others injured when hydrogen sulfide gas was inadvertently released from a sewer man way when two incompatible chemicals were mixed in the sewer system releasing hydrogen sulfide gas. The reaction of sulfuric acid and sodium hydrosulfide to form hydrogen sulfide gas is also well known.

The problem is that the knowledge of the hazard is not always known to the people who need to know it when they need to know it. One of the keys to incident prevention is the effective dissemination of existing knowledge of the hazards through on going communication and training. New approaches like the *Process Safety Beacon* published by the Center for Chemical Process Safety and the animation videos provided by the U. S. Chemical Safety Board can help with the communication of known hazards.

Many times there are warning signs leading up to the incident. In the DPC Festus, Missouri incident where 48,000 pounds of chlorine gas was release during a tank car unloading operation this was the case. There was visible evidence that wet chlorine had corroded the piping assembly used to connect the chlorine rail cars to the process, but there were no efforts to replace the pipe, find the source of the wet chlorine, or test the emergency shutdown system by verifying the shut off valves on the rail car actually closed. When the hose failed on the day of the incident, the emergency shut off valves did not close properly because of the accumulation of corrosion products in the valve seats, resulting in the release of 48,000 pounds of chlorine gas causing three workers and 63 nearby residents to seek medical treatment.

In the Hayzes Lemmerz incident, it was discovered that the plant had a history of duct work fires involving aluminum dusts, but aluminum dust was allowed to accumulate throughout the building that housed the chip reprocessing equipment. On the day of the incident the accumulated dust found a source of ignition, resulting in an explosion and fire that killed one worker and injured six.

Management and engineers need to pay more attention to abnormal situations and use near miss reporting and investigations to correct small problems before they become major incidents. When abnormal situations occur, we must ask why.

Looking back on the incidents that I was involved in, I can say that they were all preventable. There were no acts of God! The U. S. Chemical Safety Board and the chemical processing industries must continue to investigate all incidents, including near misses, so future incidents can be prevented. Most incidents have happened to someone else before. We need to continue to share lessons learned so others can learn. We need to find new effective ways to communicate the known hazards to the right people at the right time.

## **AICHE SAFETY AND HEALTH DIVISION UPDATE**

**RON WILLEY, CHAIR**

### **Process Safety – A University Professor’s Perspective**

#### **An Acknowledgement for Division Support and Activity**

As my term of chair of the Safety and Health Division comes to an end, I want to thank everyone, especially Bob Benedetti and Bob Johnson for their help in keeping the Division strong. I remind the membership of a division activity. Each year we give four safety awards (one is named for Ephraim A. Scheier and another is named for Ted Ventrone) for best incorporation of process safety principles into student’s solutions submitted for the National AIChE student design problem competition. These awards bring awareness about our division to approximately 1,000 chemical engineering students annually at the Student Brunch. I encourage the division to continue reaching out in this manner.

#### **Some thoughts about Process Safety from a university professor’s perspective.**

##### **The Student**

The students you hire are exceptional. I am amazed by their intellectual ability. However, they are inexperienced. They are, after all, coming directly from academia at the ages of 21 to 23 years old. Think back. How much experience did you have at age 21? They do not know what an automotive distributor is. Nor, how to change the oil in their car. However, they will know what “Halo 3” means. They are a visually simulated group. The accident at Bhopal happened before they were born. Further, their defining event is related to terrorism, not a major industrial accident. Finally, many have been sheltered by parents who we in academia label “helicopter parents”. Few have been exposed to the risks that many of us who grew up in rural and farm settings faced in the 50’s and 60’s. Even the nature of Boy Scouts and Girls Scouts have changed dramatically in the past 20 years with more focus on indoor activities.

##### **Create a Mentoring Program**

So, what do we do about this lack of experience? My reply – implement mentoring programs. When I joined International Paper (IP) in 1974, I was placed in a training program under the senior engineer at the paper mill. I spent approximately one week in each section that included raw material receiving, pulping, production, and technical service. I also was allowed into accounting. Each week, I reported back to my mentor with a crudely hand written report. Later, these were typed for me by the mill’s secretary (oh for those good old days!). A collection of these reports eventually were sent up to the company president with a note from our division vice president attesting to the promise of a young engineer at the Hudson River Mill. A recollection that I have of this experience were the warnings that I received related to personal safety at each location I visited. Manager and operator alike had their say. Often, the conversation began with a tale of someone who lost his life by being in the wrong place at the wrong time. Confined space entry was continually preached. If I witnessed someone going down in a confined space, my course of action WAS NOT TO GO IN AFTER HIM. It was to go and notify someone else, who would

arrange proper rescue. This training did not immediately pay back IP; however, it created an attitude in me. It reinforced the safety culture around the paper mill. The employees had a new trainee to impact with all of their wisdom. Sure that wisdom included company gossip and other extraneous topics; however, personal safety was at the forefront, and further, doing things in a manner that protected fellow employees and the public were an expectation. Overall, IP's training program has kept the company operating safely over these 30 years hence. If your company doesn't have something in place, consider putting a comprehensive new hire training/mentoring program in place for the long-term stability of your company.

### **What do Professors Focus On?**

When I returned to academia for my Ph.D., I was shocked at the lack of safety awareness across the department. No monthly safety meetings. Never a mention about people who were killed because of an inadequate relief system. Instead, I had to become familiar with terms like "a Newton Raphson Method". How often have you had to resort to a Newton Raphson method to solve a problem in your work? I don't intend to mislead you. University professors generally don't have industrial experience. This leads me to my second recommendation to the division. Hire professors, especially chemistry professors, during the summer periods to work on company problems. This melding of the two groups will benefit both parties. Professors love challenges, especially ones, that can lead to publication or further funding. Industry needs to translate its safety culture to academia. By combining the two groups together, this will begin the seed for changes needed in creating an academic safety culture.

### **The State of the Graduate Students and Post Docs**

Finally, what are graduate students observing in our academic laboratories? Unfortunately, it is busy faculty who must continually search for research dollars. Many faculty cannot spend more than a few hours each week with these students. Thus, the students are left to their own training. They commit safety violations, unaware, such as eating in their laboratories, leaving unlabelled waste on benches, or simply poor housekeeping (something insisted upon in every industrial research laboratory that I have visited). If the student's laboratory spaces were inspected by a large corporation S&H expert, I suspect that very strong reprimands would result. Further, some would be fired. Academia seldom fires graduate students and almost never fires faculty. In fact I know of only one academic who lost a job in academia because of a laboratory safety violation.

### **Who is to blame?**

Academic administration is to blame for this. The reward system is heavily biased towards grantsmanship, national recognition, and publication. From a business point of view, it makes sense. Who would you hire? Someone who can bring in \$100,000 in overhead annually, or someone who can make sure every step maintained in a laboratory complies with regulations and addresses all safety issues? Obviously, these are not mutually exclusive; however, the lure of overhead dollars carries a lot of weight in hiring, tenure, and promotion decisions. So how do we, as a division, approach this problem? One is for our corporate leadership, when they are on visiting committees, and board of trustees, to remind college presidents and deans of the need for inclusion of a person's safety and compliance record in the consideration of a tenure and promotion decision. That further donations to the university be tied to support of compliance and safety training, to create a "safety culture" within the university. That the university's mission

statements include words such as “to promote environmental, health, and safety awareness of individuals associated with our learning process.” Then, hold universities accountable with follow up audits and questions.

### **A New Division Project Proposal**

Lastly, I have a new Division project to propose. Let's consider creating a web site for graduate students and post docs working in academic laboratories. Have an easy domain name – “collegesafety.org”. Let our opening page be the 10 steps towards operating a safe laboratory. For each step there would be a link to help the graduate student. Let's offer a “Contact an Expert Link” where division members volunteer their time to take email questions from graduate students across the country. What do you think? I look forward to discussing this idea at our Spring meeting in New Orleans. Maybe we can bring in the ACS on this as well. I'm looking for a champion. Maybe that person is you.

Ron Willey  
Chair  
AIChE Safety and Health Division

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## **MESSAGE FROM THE CHAIR DIVISION OF CHEMICAL HEALTH AND SAFETY AMERICAN CHEMICAL SOCIETY**

**Barbara L. Foster, Chair**

It is with great pleasure that I assume my responsibilities as Chair of the American Chemical Society Division of Chemical Health and Safety. By way of an introduction, I currently serve as the Safety Director at the C. Eugene Bennett Department of Chemistry at West Virginia University. The department was the recipient of the 2001 CHAS College/University Safety and Health Award.

All departmental personnel work together to continue the legacy of safety excellence for our students and employees. On a daily basis, safety is our first priority, both in our academic and research laboratories. It is with a keen sense of responsibility that we prepare our students for their careers in laboratory settings in academia, industry, government, law enforcement, and the health sciences. We realize that what our students learn about safety in our laboratories will have a significant impact on all of the people who will share their work environments in the future.

Additionally, I serve as the Safety Coordinator for the Forensic Program and the Departments of Biology, Chemistry, Geology and Geography, and Physics within the Eberly College of Arts and Sciences at West Virginia University. On both the college and departmental level, I review and update Chemical Hygiene Plans, design and implement the laboratory safety programs, provide interpretation of federal codes and regulations, oversee all aspects of hazardous materials management, and develop and oversee accident reporting forms and investigations. Additionally, I serve on various Safety Committees, coordinate annual chemical inventory updates, maintain a library of safety reference books, consult with architects and engineers regarding building designs

or renovations, handle emergency situations, and serve as the college and departmental liaison with various WVU offices.

I am often asked, "How can we avoid incidents and accidents in the laboratory?" You can reduce the number and severity of accidents by building a solid safety program that includes enforcement of the Chemical Hygiene Plan policies and Safety Rules in laboratories, thorough laboratory inspections, and annual chemical inventory updates.

I encourage you to strengthen your laboratory safety program by joining the ACS Division of Chemical Health and Safety. Our division includes 1500 members with various scientific, industrial, and academic backgrounds. Added member benefits include six issues per annum of the Journal of Chemical Health & Safety, lively discussions with safety colleagues on the DCHAS-L, and you will remain up-to-date and knowledgeable on compliance issues. You can join our organization by completing and submitting the division membership application form (in interactive PDF format). Please contact me if you should have questions or require additional information regarding the Division of Chemical Health and Safety.

Instill a philosophy of safety in your laboratory and workplace. Set a good example every day by following the safety rules, enforcing the safety rules, and providing a safe and healthy learning environment for you and your colleagues.

Teach safety and work safely!

Barbara L. Foster  
Chair, ACS Division of Chemical Health and Safety

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## THANK YOU, SAM WEST

Sam West has retired as editor of *Safety and Health News* after many years of service. On behalf of all of the members of the Safety and Health Division of AIChE, and the Division of Chemical Health and Safety of ACS, thank you, Sam for your informative and interesting newsletters for these many years. We all wish you the best of health and best wishes in all of your future endeavors.

John Murphy and Dennis Hendershot, both past chairs of the AIChE Safety and Health Division, have agreed to take over editing the *Safety and Health News*, and we now are beginning to appreciate exactly how much work Sam put into this newsletter. We also have a volunteer from ACS DivCHAS to join us as co-editor, who we expect to join us with the next issue. We welcome any input and contributions to *Safety and Health News* from all members of the AIChE Safety and Health Division, and the ACS Division of Chemical Health and Safety.

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## WALTON-MILLER AWARD

There were no nominees for the Walton-Miller Award in 2007, presented by the AIChE Safety and Health Division in recognition of outstanding chemical engineering contributions and achievements

in the Loss Prevention, Safety and Health fields. For this reason, the award was not presented in 2007. We believe that there are many people deserving of consideration for this award, and we encourage any member of the Safety and Health Division to nominate candidates for consideration by the Executive Board of the Division. The following summarizes the criteria for the award.

The Norton H. Walton/Russell L. Miller Award in Safety/Loss Prevention is given by the Safety and Health Division of AIChE in recognition of outstanding chemical engineering contributions and achievements in the Loss Prevention, Safety and Health fields. Its objective is to encourage the continuation of such contributions and enhance the visibility, recognition and value of the Division within AIChE. The following rules shall govern the granting of this award:

- a. It shall be awarded at the discretion of the Division's Executive Committee but not more frequently than once each calendar year.
- b. It shall be awarded to a member of the Institute. There is no age limit. The award shall be for outstanding contributions and achievements to promote Safety, Loss Prevention and Health in chemical engineering activities.
- c. Nominations are to be submitted by members of the Division to the Chairman of the Division by December 31st of each year.
- d. The award will consist of an appropriate framed certificate and will be presented at a Division event.

You can find information on how to nominate somebody for the Walton-Miller Award on the Safety and Health Division web site at <http://www.chem.mtu.edu/org/aiches&h/awards.html>.

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## WILLIAM H. DOYLE AWARD

The Loss Prevention and Process Safety Programming Group (Area 11a of the AIChE Safety & Health Division, on behalf of the AIChE National Program Committee) presents this award in memory of Bill Doyle for the best paper presentation at the previous year's Loss Prevention Symposium. Bill Doyle was a founder of the AIChE Loss Prevention Symposium series and contributed greatly to the knowledge and understanding of loss prevention in the chemical industry for over 50 years. Selection criteria include: 1) The paper is clearly written and well presented. 2) The paper has a wide applicability to chemical industry loss prevention efforts. 3) The paper adds substantial knowledge to the field of loss prevention. 4) The paper engages the intellect of the audience. At the 2007 Loss Prevention Symposium, the Bill Doyle Award was presented to Dr. Ron Willey of Northeastern University for his paper "The Accident in Bhopal: Observations 20 Years Later", presented at the 2006 Loss Prevention Symposium. This paper was published in the September 2007 issue of *Process Safety Progress*, pages 180-184.

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## IN MEMORIUM

### **Sandy Schreiber (1925–2007)**

Sandy Schreiber joined CCPS in 1986 after a 28-year career with Allied-Signal where he was Director of Corporate Safety and Loss Prevention. Sandy's early development of the twelve technical elements that must be part of any chemical process safety management program was a

ground-breaking concept. These were published in the initial CCPS document, A Challenge to Commitment, and set CCPS on a path of influence and success. The subsequent development of process safety guidelines, including the recent book, *Risk Based Process Safety*, owes a debt to Sandy's vision. We have lost a good friend, and the industry has lost a pioneer.

#### **F. Owen Kubias (1927–2007)**

Owen Kubias died July 30, 2007 in Rocky River, Ohio. He was 80 years old. Owen contributed significantly to our Chemical Engineering profession and AIChE, actively contributing right up to his death. He will be missed by his coworkers as well as his family. Owen worked for the US Navy during W.W. II, followed by Mallinckrodt and Glidden. At Glidden, Owen was Loss Prevention Manager and, after retiring, he continued to work in AIChE, making significant contributions in the area of process safety. Owen was the first chair of the Safety and Chemical Engineering Education (SACHE) committee, during the committee's formative years. Later he became the CCPS staff consultant and led the SACHE activities such as faculty workshops and the production of safety products for professors. This work will continue to positively influence the safety of our chemical industry. He was an active member of the SACHE committee to the end.

#### **Gary J. Powers (1945-2007)**

Dr. Gary Powers, Professor of Chemical Engineering at Carnegie-Mellon University, died on July 23, 2007. Gary was presented with the Walton-Miller Award by the Safety and Health Division in 2005 for his extensive contributions to process safety, particularly in developing new methods for construction of fault trees, application of these methods in industry, and for teaching fault tree methodologies to a generation of chemical engineers through his continuing education courses. Dr. Powers was also active in many other areas of chemical engineering research, and he was a pioneer in the area of process synthesis. He was an excellent teacher, and was a frequent recipient of student awards for the best teacher at Carnegie-Mellon. For more information on Dr. Powers career, please see the obituary on page 18 of the December 2007 issue of *Chemical Engineering Progress*.

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## **ACS AND AIChE CO-LOCATED SPRING 2008 MEETINGS** **Sunday, April 6 — Thursday, April 10, 2008** **New Orleans, LA USA**

In the spring of 2008, ACS and AIChE will have co-located meetings in New Orleans, April 6 through April 10. The AIChE meeting will include the 4<sup>th</sup> Global Congress on Process Safety, which includes the 23<sup>rd</sup> CCPS International Conference, the 42<sup>nd</sup> Loss Prevention Symposium, and the 10<sup>th</sup> Process Plant Safety Symposium. The ACS Division of Chemical Health and Safety will also have 5 program sessions at the ACS meeting. Registered attendees from both societies can attend technical symposia at either meeting and can also visit the ACS Exposition, held in conjunction with the ACS meeting.

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## ACS Division of Chemical Health and Safety Programming Scheduled for the New Orleans Meeting – April 2008

**Program Chairs:** D. M. Decker, Office of Environmental Health & Safety, U of California, Davis, One Shields Ave., Davis, CA 95616, (530) 754-7964, dmdecker@ucdavis.edu; S. Wawzyniecki Jr., Dept. of Environmental Health & Safety, U of Connecticut, 3102 Horsebarn Hill Rd., Unit 4097, Storrs, CT 06269, (860) 486-1110, fax (860) 486-1106, stefan.w@uconn.edu.

**“Chemophobia” & The Public.** R. B. Stuart, Dept. of Risk Management, U of Vermont, Environmental Safety Facility, 655 Spear St., P.O. Box 50570, Burlington, VT 05405, (802) 656-5403, fax (802) 656-5407, rstuart@esf.uvm.edu; J. G. Palmer, Dept. of Chemistry & Biochemistry, U of California, San Diego, 9500 Gilman Dr., MS-0332, La Jolla, CA 92093-0332, (858) 534-5906, fax (858) 534-6255, jpalmer@ucsd.edu; E. A. Talley, Environmental Health & Safety, Weill Medical C of Cornell U, 1300 York Ave., Box 354, New York, NY 10021, (212) 746-6201, fax (212) 746-8288, ert2002@med.cornell.edu

**Bioreactor Pilot Plant Scale-Up.** B. J. Wong, EHS Dept., U of California, San Diego, 9500 Gilman Dr., MS-0920, La Jolla, CA 92093-0920, (858) 534-6059, fax (858) 534-7982, bwong@ucsd.edu

**Building & Laboratory Design for Sustainability.** P. A. Ceas, Chemical Hygiene Officer, Saint Olaf C, 180 Science Ctr., Northfield, MN 55057, (507) 646-3560, fax (507) 646-3870, ceas@stolaf.edu

**Risk Assessment & Assessment of Toxicology Using Control Banding.** K. B. Jeskie, Physical Sciences Directorate, Oak Ridge Natl. Laboratory, P.O. Box 2008, MS-6230, Oak Ridge, TN 37831-6230, (865) 574-4945, jeskiekb@ornl.gov; J. Kapin, Advanced Chemical Safety, 7563 Convoy Ct., San Diego, CA 92111, (858) 874-5577, Jim@chemical-safety.com

**Teaching Safety: Lessons Learned.** G. H. Wahl Jr., Dept. of Chemistry, North Carolina State U, Raleigh, NC 27695-8204, (919) 515-2941, fax (919) 515-5486, george\_wahl@ncsu.edu; T. Murdock, Environmental Health & Safety, Medtronic World Headquarters, 710 Medtronic Pkwy., Minneapolis, MN 55432, (763) 505-4562, thomas.o.murdock@medtronic.com

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## 4th Global Congress on Process Safety AIChE Spring Meeting New Orleans, LA, April 6-10, 2008

The Center for Chemical Process Safety (CCPS), the Loss Prevention Symposium (LPS), and the Process Plant Safety Symposium (PPSS) are coordinating conferences again in 2008 to present the 4<sup>th</sup> Global Congress on Process Safety. This annual event is the primary forum for practitioners from the chemical and allied industries, academia, and government to share practical and technological advances in all aspects of process safety. As industry works to adapt to a changing business environment and limited resources, strategies such as Risk-Based Process Safety (RBPS) can be effectively used.

Risk-Based Process Safety (RBPS) is a management approach to design, correct, and improve process safety management activities, commensurate with the risk-based need for these activities, the availability of resources, and the existing process safety culture. The four main concepts of RBPS that we hope to address throughout this conference are: Committing to Process Safety, Understanding Hazards and Risks, Managing Risks, and Learning from Experience.

### **23<sup>rd</sup> Center for Chemical Process Safety (CCPS) Annual Conference**

- Process Safety Metrics including Leading and Lagging Indicators
- Management of Organizational Change
- Addressing Facility Siting Issues
- Human factors
- Audits, Inspections, and Assessments
- Reactivity and Inherent Safety
- Process Safety as applied to Capital Projects and Pre-Startup Safety Reviews
- Non-SIS and Layers of Protection
- Case Histories and Lessons Learned

CCPS Chair: Cheryl Grounds, Cheryl.Grounds@bp.com

### **42<sup>nd</sup> Annual Loss Prevention Symposium (LPS)**

- Electrostatic Hazards and Control
- Fire, Explosion and Reactive Hazards
- Advances in Fire and Explosion Suppression
- Laboratory and Pilot Plant Safety
- Hazards of Alternative Fuels Technologies
- Case Histories and Lessons Learned

LPS Chair: David G. Clark, david.g.clark@usa.dupont.com

### **10<sup>th</sup> Process Plant Safety Symposium (PPSS)**

- Hazard Identification and Risk Assessment Tools
- Conduct of Operations for Process Safety
- Plant Process Safety Management Systems
- Applications of Safety Culture
- Maintaining Instrument and Mechanical Integrity
- Case Histories and Lessons Learned

PPSS Chair: Jack Chosnek, 281-538-0220, jc@knowledge1.net

Papers have been selected and detailed program information is currently being developed. Please check the Global Congress web site at <http://www.aiche.org/Conferences/Spring/GCPS/CFP.aspx> for more information.

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