
2014
FCOG
Safety
Analysis
Workshop
Science for
the Future
October 11 – 16, 2014
Four Points Sheraton
Pleasanton, California
Lawrence Livermore
National Laboratory

2014 EFCOG Safety Analysis Workshop

Science for the Future

Lawrence Livermore National Laboratory

LLNL-PROC-660595
Lawrence Livermore National Laboratory is operated by Lawrence Livermore National Security, LLC, for the U.S. Department of Energy, National Nuclear Security Administration under Contract DE-AC52-07NA27344.

From Safety Analysis Working Group Chair, Mark Mitchell...

Welcome to sunny California! We are blessed with so much the natural beauty ranging from the splendor of Yosemite to pristine Lake Tahoe to the giant redwoods and the majestic sea shores. California abounds with birds and animals, flora and fauna, plus a rare safety analyst or two.

LLNL is proud to celebrate the science of the future. This workshop highlights great scientific achievements, the discovery of new elements and science of the stars being explored at the National Ignition Facility (NIF). As safety analysts and researchers, we play a supporting role in this endeavor. I've had the unique privilege of knowing the Manhattan Project generation greats, Dr. Seaborg and Dr. Teller. Both were strong supporters of training the next generation of nuclear scientists and engineers. Both deeply inspired and encouraged me and my generation. Now it's our turn to pass along the science of the future as we train the next generation.

We are helping DOE and its contractors work smarter in a time of decreasing budgets, optimally utilizing reduced resources in areas of nuclear safety. SAWG is presenting specific recommendations and strategies to maintain a strong nuclear safety posture in the face of resource constraints and the continuing dissemination of new requirements and expectations. This includes constructive engagement with DOE program and Health, Safety, and Security counterparts on planning, development, and implementation of directives.

The Safety Analysis Working Group (SAWG) has added value, and continues to enhance the DOE Complex. This is a time of transition. We will flourish together as we navigate a successful path forward. I welcome you to a wonderful SAWG Safety Analysis Workshop, an opportunity for the safety analysis community to come together to share lessons learned, deliver tangible products to the customer, and save the taxpayers' money. Let's continue to do our great work, come up with innovative new ideas to train the next generation, and maintain this unique technical capability for the DOE Complex to America keep safe.

Mark Mitchell,
SAWG Chair

Conference Host

Lawrence Livermore National Laboratory

Michael Merritt
Associate Director, Nuclear Operations
Lawrence Livermore National Laboratory

Michael is the Associate Director (AD) for Nuclear Operations at Lawrence Livermore National Laboratory (LLNL), which includes responsibility for nuclear and non-nuclear safety basis, criticality safety, system engineering, packaging & transportation, conduct of operations, and other nuclear safety disciplines. He has more than 32 years of substantive experience in nuclear operations, including Federal government service and within contractor organizations. Michael has led several initiatives to improve the nuclear safety process and increase effectiveness and compliance in LLNL nuclear facilities. As the AD, he has managed efforts to enhance the nuclear safety posture of LLNL nuclear facilities and led the Nuclear Operations efforts for re-verification of Integrated Safety Management as the Functional Area Manager for nuclear operations, conduct of operations, and packaging and transportation.

Michael has led LLNL's efforts to establish nuclear safety training by constructing the Inherently Safe Subcritical Assembly (ISSA) at LLNL, which is utilized to provide hands-on training for nuclear safety professionals in multiplying systems, reactor physics, and neutron kinetics. Michael has also led and participated in international experiments related to testing and development of nuclear accident dosimetry.

Prior to joining LLNL, he served as the LLNL Site Representative for the Defense Nuclear Facilities Safety Board (DNFSB) and was responsible nuclear safety oversight and representing the DNFSB to DOE/NNSA, government officials, and the public. Previously, he was a member of the DNFSB's senior staff in Washington, DC responsible for operations to safely stabilize nuclear material across the DOE complex; including plutonium stabilization operations at the Savannah River Site, Rocky Flats, and Hanford. Prior to joining the DNFSB, Michael worked within the Naval Nuclear Propulsion Program (Naval Reactors) as a project manager and senior nuclear engineer at the Knolls Atomic Power Laboratory (KAPL) supporting the overhaul and refueling of nuclear reactor prototypes. Prior to his assignment at KAPL, Michael was a Nuclear Construction Engineer at General Dynamics – Electric Boat Division, supporting the construction of OHIO Class (Trident) nuclear submarines.

Michael earned his master's degree in nuclear engineering from Rensselaer Polytechnic Institute and his bachelor's degree in ocean engineering from the Florida Institute of Technology. He is a member of the American Nuclear Society, the Heath Physics Society and the Alpha Nu Sigma - Nuclear Engineering Honor Society.

2014 SAWG Workshop Planning Committee

As the host of the 2014 EFCOG SAWG, I would like to acknowledge, with gratitude, the support of the following individuals. Without their dedication, this conference would not have been possible.

Workshop Chair — Kevin Carroll
Nuclear Operations Engineering Manager, Lawrence Livermore National Laboratory

Technical Chairs — David Pinkston/Mark Mitchell
Safety Basis Division, Lawrence Livermore National Laboratory

Technical Session Chair — James J. Kuropatwinski
Technical Project Manager — Nuclear Criticality Safety, Los Alamos National Laboratory

Exhibitor Chair — Rob McKeehan
Facility Safety Team Lead, UT-Batelle, Oak Ridge National Laboratory

Administrator — Cathy Sowash
Nuclear Operations Directorate, Lawrence Livermore National Laboratory

Administrative Support — Hazel Holloway
Safety Basis Division, Lawrence Livermore National Laboratory

Resource Analyst — Theresa McDonald
Financial Services, Lawrence Livermore National Laboratory

Michael Merritt,
Associate Director for Nuclear Operations
Lawrence Livermore National Laboratory

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Workshop Website

For the most up to date information, go to the workshop's website at *http://www.efcog.org/wg/sa/events/SAWG_14_Workshop/sawg-2014workshop.htm*.

Workshop Exhibitors

Every year the Safety Analysis Workshop is sponsored by strong leaders in the nuclear industry, and this year is no exception. It is with much appreciation and great thankfulness that we acknowledge their involvement and due diligence in pushing safety of the nuclear industry to new heights.

Workshop Host

Lawrence Livermore National Laboratory

Exhibitors

Silver — NuclearSafety Associates

Bronze — HukariAscendent

URS Professional Solutions

About EFCOG

The Energy Facility Contractors Group (EFCOG) is a self-directed group of contractors of U.S. Department of Energy (DOE) facilities.

The purpose of the EFCOG is to promote excellence in all aspects of operation and management of DOE facilities in a safe, environmentally sound, secure, efficient, and cost-effective manner through the ongoing exchange of information and corresponding improvement initiatives.

The four primary objectives of EFCOG are:

- Promote, coordinate, and facilitate the active exchange of successful programs, practices, procedures, lessons learned, and other pertinent information of common interest that have been effectively utilized by DOE contractors and can be adapted to enhance operational excellence and cost effectiveness for continual performance improvement by other DOE contractors.

- Identify and address issues of common interest (redundant with scope). Focus on active personal exchanges of management and technical information among contractors (redundant with scope).

- Utilize interfaces with organizations such as, but not limited to, the Nuclear Energy Institute (NEI), Electric Power Research Institute (EPRI), Institute of Nuclear Power Operations (INPO), Training Resources and Data Exchanges (TRADE), Association for Excellence in Reactor Operations (AERO), Nuclear Security Information Exchange (NSIE), to promote cooperation and interchange information, as appropriate, and minimize duplication of efforts.

- Interact with DOE in ways that produce value-added change for both DOE and the contractor community.

www.efcog.org

EFCOG Membership

3M
ABS Consulting, Inc.
Advanced Technologies and Laboratories Int'l
Alliance & Sustainable Energy, LLC (NREL)
American DND, Inc.
AnovaWorks, PLLC
ARES Corporation
AREVA Federal Services LLC
Argonne National Laboratory
Aspen Resources Limited, Inc.
Babcock & Wilcox Technical Services Group
Bechtel Group, Inc.
Bechtel Waste Treatment Plant
Booz Allen Hamilton
Boston Government Services, Inc.
Brookhaven National Laboratory
Bruns & McDonnell Engineering
CB&I Federal Services
CH2M Hill, Inc.
CH2MHill - B&W West Valley LLC
CH2MHILL Plateau Remediation Company
CH2M-WG Idaho, LLC
Colleague Consulting LLC
Consolidated Nuclear Security, LLC
Container Products Corporation
Dade Moeller & Associates
DevonWay
DM Petroleum Operations Company
Enercon Federal Services
Energy Solutions, LLC
Epsilon Systems Solutions, Inc.
ESI International
Fermi National Accelerator Laboratory
Fluor B&W Portsmouth LLC
Fluor Government Group
G4S Government Solutions
Greenberry Fabrication
Honeywell FM&T, LLC
HukariAscendent
I.C.E. Service Group, Inc.
Idaho National Laboratory
Jacobs Engineering Group
Kurion, Inc.
L&L Associates, Inc.
LATA Environmental Services of Kentucky
Lawrence Berkeley National Laboratory
Lawrence Livermore National Laboratory
Lockheed Martin Corporation
Los Alamos National Laboratory
McCarthy Building Companies, Inc.
MCR Federal, LLC
Merrick & Company
MHF Services
Mission Support Alliance, LLC
National Security Technologies
Navarro Research and Engineering, Inc.
Navarro-Intera, LLC
Neptune and Company, Inc.
New World Environmental Inc.
Newport News Shipbuilding
n-Link Corporation
North Wind Group
Northrop Grumman Information Systems
Oak Ridge Associated Universities
Pacific Northwest National Laboratory
PacTec, Inc.
Parsons Brinckerhoff
Parsons Corporation
Perma-Fix Environmental Services
Portage, Inc.
Pro2Serve
Project Time & Cost, Inc.
Sandia National Laboratories
Savannah River Nuclear Solutions
Savannah River Remediation LLC
Schneider Electric
Securiguard, Inc.
SLAC National Accelerator Laboratory
Spectra Tech, Inc.
Strategic Management Solutions, LLC
Strategic Packaging Systems, LLC
Tecolote Research, Inc.
TerranearPMC, LLC
Tetra Tech, Inc.
The Whitestone Group, Inc.
Triple Canopy, Inc.
Turnkey Technical Services LLC
URS Corporation
UT-Battelle
Visionary Solutions LLC
Washington Closure Hanford
Washington River Protection Solutions
Waste Control Specialists
Wastren Advantage, Inc.
Wastren-EnergX Mission Support, LLC

(August 13, 2014)

About SAWG

The Safety Analysis Working Group (SAWG) is a self-directed working committee whose intent is to facilitate the objectives of the Energy Facility Contractors Group (EFCOG) and meet the challenges of contractors implementing Nuclear Safety Regulations, Directives, Technical Standards, and Guides as related to the area of Safety Analysis. The purpose of the working group is to promote excellence in the Department of Energy (DOE) nuclear safety and safety analysis programs through technical exchange, training, and application of lessons learned.

The objectives of the SAWG are to:

- Provide planning and actions necessary to see that the overall objectives of the EFCOG come to fruition in the area of nuclear safety and safety analysis.

- Promote, coordinate, and facilitate the active exchange of successful safety analysis programs, practices, procedures, lessons learned, and other pertinent information of common interest on safety analysis, which have been effectively utilized by DOE contractors.

- Promote training on safety analysis by sharing of management and technical information among contractors through mechanisms such as workshops, subgroups, interest groups, formal training, and written material.

- Interact with EFCOG Working Groups and DOE in ways that produce value-added change for both DOE and the contractor community.

www.efcog.org/wg/sa

General Workshop Information

Registration Hours – The registration desk, located in the lobby of Four Points Sheraton, will be open for registration and information:

- Friday, October 10, 5:00pm to 8:00pm
- Saturday through Thursday, October 11 – 16, 7:00am to 5:00pm

Session Breaks – Breaks are scheduled for each morning and afternoon of the workshop.

Meals – Several dining options are available to suit your needs. Please refer to subsequent pages for more information. A hosted lunch is provided on Wednesday and Thursday.

Location of Meetings and Training Sessions – All meetings and training sessions will take place in the FourPoints Sheraton. The latest information on the workshop schedule, including any changes in paper presentations, is available at the registration desk.

Transportation – Transportation will be provided for those registered for the LLNL tour. Tours will leave from the registration table.

Online Information –
https://www.efcog.org/wg/sa/events/SAWG_14_Workshop/sawg2014workshop.htm

Training

DOE-STD-3009 (Day 1)

Saturday, October 11, 2014, 8:00am – 5:00pm

Ron Selvage, Los Alamos National Laboratory

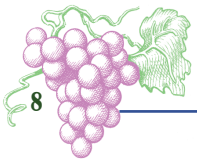
This two-day course is designed to provide safety analysts with the knowledge and skills needed to develop a non-reactor nuclear facility Documented Safety Analysis (DSA) in accordance with requirements of 10 CFR 830, DOE Safe Harbor Standard 3009-94, and concepts from DOE Guide 421.1-2, Implementation Guide for Use in Developing Documented Safety Analyses to Meet Subpart B of 10 CFR 830.

All Things Pu

Saturday, October 11, 2014, 8:00am – 5:00pm

Dr. Kiel Holiday, LLNL

This class was developed for the Department of Homeland Security, National Technical Nuclear Forensics Center to educate non-experts in plutonium processing. The class consists of an overview of plutonium properties and its chemistry followed by each step of its production as it goes from a minor contaminant in spent nuclear fuel to a pure metal or oxide. The production process is broken up into four discrete steps or modules. The first is separation, which deals with how the plutonium is separated from the other components of spent fuel. The second is concentration. Because the separation process produces a dilute plutonium solution, it must be concentrated before the third operation of isolating the material. This third module discusses the various ways the concentrated solution may be precipitated into a solid form. Lastly, conversion to metal is discussed in the fourth module. This method of discussing the process in discrete steps has proven to be the best way to illustrate the many options within plutonium processing and how they may be used together.



Fire Severity
Saturday, October 11, 2014, 8:00am – 5:00pm

Dr. Allan Coutts, URS Professional Solutions

This training course presents techniques that can be used to judge the expected radiological consequences resulting from an accidental fire. The training begins with an overview of fire phenomena, which includes discussions on individual fuel package behavior, compartment fire severity and the importance of ventilation on fire behavior. The course material will then recommend methods to estimate the five source-term equation factors (ST = MAR·DR·ARF·RF·LPF) based on the fire severity estimates. The course will conclude with several specialty topics including: coordinating the DSA with a fire hazard analysis, establishing robust fire events and evaluating the effectiveness of fire barriers.

DOE-STD-3009 (Day 2)

Sunday, October 12, 2014, 8:00am – 5:00pm

Ron Selvage, Los Alamos National Laboratory

This two-day course is designed to provide safety analysts with the knowledge and skills needed to develop a non-reactor nuclear facility Documented Safety Analysis (DSA) in accordance with requirements of 10 CFR 830, DOE Safe Harbor Standard 3009-94, and concepts from DOE Guide 421.1-2, Implementation Guide for Use in Developing Documented Safety Analyses to Meet Subpart B of 10 CFR 830.

DOE Roadshow on 3009-2014 (Gap Class)
Sunday, October 12, 2014, 8:00am – 5:00pm

Garrett Smith, DOE AU-31

Revised DOE-STD-3009-2014 is expected to be finalized and issued before year end. This session will review the significant changes between the current approved version (STD-3009-94, CN 3) and the new revision. The session will address applicability of DOE-

STD-3009-2014 and its impact on new facilities, existing facilities, and major modifications. The session will provide observations and insights, and stimulate discussions on the following:

- Significant changes to the requirements in the Standard;
- Changes to requirements for consequence calculations;
- Changes to worker protection requirements;
- Changes to chemical protection requirements;
- Defense-in-depth; and
- Hierarchy of controls.

DOE Roadshow on Proposed Revised TSR Guide

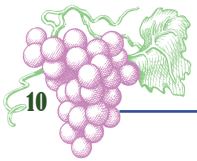
Sunday, October 12, 2014, 8:00am – 5:00pm

Mike Hillman, DOE AU-31

DOE Guide 423.1 was developed and issued in 2001 in support of Subpart B of 10 Code of Federal Regulation (CFR) 830, Safety Basis Requirements, and provides guidance in meeting the Technical Safety Requirements provisions defined in 10 CFR 830.205, Technical Safety Requirements.

In 2013 the then Office of Health, Safety and Security (HSS) (now AU) began a revision of the Guide to incorporate lessons learned identified by program offices since the Guide's last full revision in 2006. Lessons learned incorporated in the revised Guide include: 1) addressing development and use of Specific Administrative Controls; 2) applying Knowledge Management principles, capture and document in the Guide more 'how to' type guidance on how to develop TSRs; 3) reorganizing and reformatting the Guide for readability and usability; and 4) addressing numerous discrete improvements that sites have discovered as they had implemented the Guide over the years.

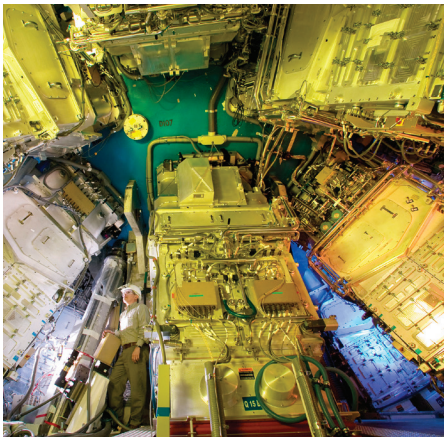
In September the proposed revision of the Guide was placed into RevCom. The purpose of this workshop will be to review and discuss the proposed revisions to the guide as well as comments received to date on the revisions in RevCom and potential resolution of those comments.



Tour Information

National Ignition Facility

Lawrence Livermore National Laboratory is home to the National Ignition Facility, the world's largest and highest-energy laser. Since becoming operational in May 2009, NIF has been conducting experiments to focus the intense energy of 192 giant laser beams on a BB-sized target filled with hydrogen fuel – fusing, or igniting, the hydrogen atoms' nuclei. This is the same fusion energy process that makes the stars shine and provides the life-giving energy of the sun. NIF is a program of the U.S. Department of Energy's National Nuclear Security Administration.



National Release Advisory Center

Using unique expertise and tools, NARAC maps the spread and impacts of hazardous materials accidentally or intentionally released into the atmosphere. Timely, accurate plume predictions help emergency managers and responders protect the public and the environment.

Harnessing Science and Technology to Meet National Security Challenges

As one of Lawrence Livermore National Laboratory's signature facilities, NARAC is an example of the lab's ability to harness the power of science and technology and multi-disciplinary teams to deal with critical and complex national security challenges. The center was founded in 1979 during the Three Mile Island nuclear power plant accident. Since that time, NARAC has been serving the nation by preparing for, and responding to, other nuclear power plant and processing facility accidents (including Chernobyl and Fukushima Daiichi), industrial chemical spills and fires, radiological exercises and incidents, planetary mission launches involving radioactive materials, and natural disasters such as volcanic eruptions. The center's scope and capabilities are continually enhanced by cutting-edge research and improvements in computer software and hardware.

Preparing for and Responding to Emergencies

NARAC serves thousands of users from several hundred federal, state, and local agencies, emergency response teams, operations centers, and international organizations. In a typical year, the center fulfills 10,000 airborne-plume simulation requests for emergency preparedness, participates in 100 major emergency response exercises, and responds to 25 incidents. NARAC also maintains multiple websites for requesting and distributing plume predictions and sharing information during events.

NARAC is the Department of Energy/National Nuclear Security Administration (DOE/NNSA) plume modeling center for radiological/nuclear incidents, providing predictions and analyses for DOE/NNSA's national operations center; regional, national, and international emergency response teams; and DOE sites across the country. The Naval Nuclear Propulsion Program (NNPP), various DoD facilities, and the National Aeronautics and Space Administration (NASA) also use NARAC for emergency preparedness and response. In addition, DOE/NARAC serves as the primary provider of radiological/nuclear plume modeling for the Department of Homeland Security-led Interagency Modeling and Atmospheric Assessment Center, whose role is to coordinate federal dispersion modeling and hazard prediction products during actual or potential incidents requiring federal coordination.

24/7 Model Predictions and Analyses

NARAC's 24/7 operations center can respond to multiple simultaneous events occurring anywhere in the world. NARAC's maps and graphical plots contain information on:

- Airborne and ground contamination areas
- Affected populations, including potential casualties and fatalities
- Areas exceeding dose, health effect, and protective action guide levels for sheltering, evacuation, relocation, worker protection, and agricultural product controls
- Damage estimates from explosions
- Geographical features, maps, aerial photos, and building footprints
- Updates to model predictions and analyses that incorporate field measurement data and other information as they become available

Services and Tools to Help Emergency Responders

NARAC's expert staff works closely with first responders, emergency operations centers, monitoring and sampling teams, and technical experts from a variety of federal, state, and local agencies. NARAC personnel have expertise in atmospheric dispersion, meteorology, hazardous material (radiological, chemical, biological) properties, physics, chemistry, health physics, numerical modeling, geographical information systems, computer science, software engineering, and computer graphics. The center provides authorized users with high-fidelity modeling, analysis and geographical information tools, including the following:

- State-of-the-science 3-D atmospheric flow and dispersion modeling system
- Data acquisition systems and databases of global meteorological observations, weather-forecast model results, terrain elevation, land cover, population density, and maps
- Web browser access for authorized users to request, receive, and share NARAC predictions
- Sophisticated computational hardware and software that allow users to perform fully automated simulations in minutes on LLNL computers
- Stand-alone software for rapid plume predictions on users' computers
- 24/7 access to NARAC experts who provide quality-assurance, detailed plume model analyses, product interpretation and training

Research and Development to Advance Capabilities

NARAC conducts cutting-edge research in many topics related to airborne transport and fate, such as:

- Atmospheric turbulence and diffusion
- Boundary layer meteorology
- Urban flow and dispersion modeling
- Dense-gas transport in complex environments
- Indoor exposures
- Nuclear fallout
- Data-driven simulations for source estimation and event reconstruction
- Regional and urban meteorology and dispersion field experiments

Plenary Speakers

National Nuclear Security Administration

Nicole Nelson-Jean
Acting Manager,
National Nuclear Security Administration,
Livermore Site Office
Department of Energy

Nicole Nelson-Jean is the Acting Manager at the Department of Energy (DOE) National Nuclear Security Administration (NNSA) Livermore Site Office (LSO) where she oversees a Federal team of 85 employees and provides oversight for the management, security, contract and quality assurance, environment, health, safety, nonproliferation and national security activities at Lawrence Livermore National Laboratory (LLNL). LLNL employs 6,300 people and has an annual budget of approximately $1.6 billion and government-owned assets of almost $10 billion that support the DOE NNSA mission.

Nicole's 23 years of experience includes environmental management, infrastructure, nuclear safety, nuclear security, nuclear energy, nonproliferation, business and contract management. Nicole began her career at Los Alamos National Laboratory in the Office of Environmental Management and then moved to the Office of Nonproliferation and International Technology where she supplied technical analysis to the U.S. government regarding civil, military, and commercial technological advances in foreign countries.

Since becoming a Federal employee, Nicole has held several positions, domestically and abroad, for the DOE NNSA. Prior to becoming the Acting Manager at LSO, Nicole served at the Los Alamos Site Office in Los Alamos, NM as the Senior Advisor to the Acting NNSA Administrator, Bruce Held. Nicole has also served as the Energy Attaché to the United States Ambassador of the Mission to International Organizations in Vienna, Austria where she coordinated and oversaw the DOE NNSA support to the International Atomic Energy Agency (IAEA) nuclear security programs from a policy, technical, and programmatic standpoint. Before her position in Vienna, Nicole was an Office Director within the Global Threat Reduction Initiative (GTRI). She was responsible for the removal and security of high-risk nuclear and radiological materials and equipment in North and South America that pose a potential threat to the U.S. and the international community. She was also in charge of the GTRI Reactor Conversion Program which supports the minimization of the use of Highly Enriched Uranium (HEU) in civilian research or testing involving nuclear applications worldwide through cooperatively working with countries to convert those reactors from HEU to Low Enriched Uranium (LEU). Prior to joining GTRI, she served as the Energy Attaché to the United States Ambassador of Japan and Director of the DOE NNSA Asia Office. In this

position she provided oversight of the DOE NNSA interests in Asia and the Pacific Rim concerning oil, natural gas, nuclear energy, nuclear safety and nonproliferation issues. She provided continuous contact with Japanese, Chinese, Korean and other Pacific Rim nations to remain abreast of all current and prospective nonproliferation, economic and energy related developments, concerns and issues. Before moving to Japan, Nicole served as a Deputy Office Director within the DOE NNSA's Material Protection, Control and Accounting (MPC&A) Program where she oversaw nuclear security upgrades at more than 50 civilian and military nuclear storage sites belonging to entities in the Russian Federation's Ministries of Atomic Energy, Transportation, Economics and Defense. While working in Russia, Nicole initiated and led the integrated DOE NNSA National Laboratory team that designed and built the first DOE NNSA funded nuclear security technical and training facility in the Kola Murmansk region, the Kola Technical & Training Center of the Russian Navy.

Nicole has been awarded the Service to America Medal from the Partnership for Public Service and was recognized by Senator Ted Kaufman (D-DE) in the Senate Congressional Record for her nuclear security work in Russia. She has also been featured in the Washington Post's "The Federal Coach" discussing leadership in the public service and Nicole was highlighted as a Patriotic Steward, Visionary, Relationship Builder, and Team Leader in the Hay Group study about leading Innovation in Government.

Nicole has a B.A. in political science from Grambling State University, M.A. in liberal arts from St. John's College and M.A. in strategic security studies from National Defense University. She also completed the Leadership for a Democratic Society Program at the Federal Executive Institute.

Lawrence Livermore National Laboratory

Charlie Verdon
Principal Associate Director, Weapons
and Complex Integration
Lawrence Livermore National Laboratory

Dr. Charlie Verdon is the Principal Associate Director (AD) for Weapons and Complex Integration (WCI) at Lawrence Livermore National Laboratory (LLNL). He is responsible for the management and coordination of weapons program activities within LLNL. Charlie was the Principal Deputy Principal Associate Director for WCI from 2009 to 2013, Program Director for the Secondary Nuclear Design Program, and the AX Division Leader, a position he assumed in 2003. In this role he was responsible for the management of the Laboratory's Secondary Nuclear Design Program, whose mission is to ensure national and global security by maintaining scientific and technical leadership in all aspects of thermonuclear weapon physics design and operation. As the AX Division Leader, Charlie was responsible for the management of a scientific effort that is at the core of the Secondary Nuclear Design Program and the scientific grand challenge effort of achieving ignition at the National Ignition Facility.

Charlie earned his Ph.D., his master's degree, and his bachelor's degree in nuclear engineering from University of Arizona, Tuscon. He is a member of the American Physical Society (APS) and was selected as a Fellow in 1997.

In 1995 Charlie was awarded the Excellence in Plasma Physics Research Award from the APS for outstanding theoretical work, computational design and analysis, and experimental work leading to quantitative and predictive understanding of the Rayleigh-Taylor instability in high energy density plasmas. He has chaired numerous committees and served as Associate Editor of Physics of Plasmas from 1998–2004.

Lawrence Livermore National Laboratory

P. Jeffrey (Jeff) Wisoff
Principal Associate Director, NIF & Photon Science Directorate
Lawrence Livermore National Laboratory

Dr. Jeff Wisoff is the Principal Associate Director (PAD) for the NIF and Photon Science (NIF&PS) organization at Lawrence Livermore National Laboratory (LLNL). As the PAD for NIF&PS, Jeff is responsible for ensuring the safe operation of the NIF as a world-class user facility in support of the NNSA Stockpile Stewardship mission; partnering with LLNL capabilities to establish leadership in Stockpile Stewardship science associated with ICF and High Energy Density (HED) physics; overseeing the development of advanced laser systems, related optical and target systems, control systems and systems engineering capability for research, commercial, and government agencies; and maintaining close partnerships with DOE/NNSA, DARPA, DTRA, MDA, DHS, academia, and private industry.

Jeff came to LLNL and NIF in the fall of 2001 as a Deputy Associate Project Manager for systems engineering. In 2003, he became the Associate Project Manager for the small optical systems on NIF, which included responsibility for the front end of the laser and laser diagnostics. In 2005, he became the Deputy for Operations and then served as the Principal Deputy from 2007-2013.

Prior to joining LLNL, Jeff was part of the faculty of the Electrical and Computer Engineering Department at Rice University. His research focused on the development of new vacuum ultraviolet and high intensity laser sources. In addition, he also collaborated with researchers from regional Texas Medical Centers on the applications of lasers to the reconstruction of damaged nerves.

Jeff earned his Bachelor's degree from the University of Virginia and his Master's and Ph.D. degrees from Stanford University. He is a veteran of four Space Shuttle flights, having been selected as an astronaut by NASA in 1990. He has received a number of honors with NASA, including the NASA Distinguished Service Medal and four NASA Space Flight Medals.

Office of Environment, Health, Safety and Security

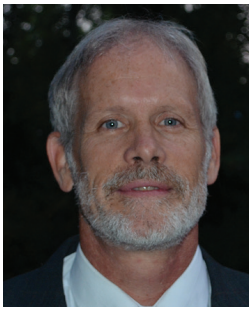
Matthew B. Moury
Associate Under Secretary for Environment, Health, Safety and Security
United States Department of Energy

Mr. Matthew Moury is the Acting Associate Undersecretary for Environment, Health, Safety and Security. The office provides corporate leadership and strategic approaches for protecting DOE's workers, the public, the environment and national security assets. This is accomplished through developing corporate policies and standards; sharing operating experience, lessons learned, and best practices; and providing assistance and supporting services as DOE's environment, health, safety and security advocate.

Prior to his current position Mr. Moury was the Deputy Assistant Secretary for Safety, Security, and Quality Programs within the Office of Environmental Management (EM). The mission of the office is to manage EM-wide Integrated Safety Management and Integrated Safeguards and Security Management implementation oversight activities. The office provides standards assurance for major project planning, executes operational safety and awareness programs, and oversees quality assurance programs. The office is also responsible for tracking Defense Nuclear Facilities Safety Board (DNFSB) recommendations and issues.

Mr. Moury has 30 years of experience in the nuclear field, including almost 20 years at the DNFSB. He was selected for the Senior Executive Service in 2002. Prior to joining EM, Mr. Moury served as the DNFSB's Group Lead for Nuclear Weapon Programs, leading the DNFSB's effort in its statutory mission to ensure that DOE operations that directly support the nuclear stockpile and defense nuclear research are conducted in a manner that ensures adequate protection of the health and safety of the workers and the public. While at the DNFSB, Mr. Moury held other senior leadership positions including the Group Lead for Nuclear Programs and Analysis, Group Lead for Nuclear Facility Design and Infrastructure and the Engineering Group Lead. He also was the lead on a wide variety of safety-related areas such as: Integrated Safety Management, facility design and construction, DOE directives, facility startup activities, and quality assurance.

Mr. Moury began his career as a nuclear-trained submarine officer where he retired at the rank of Captain in the Navy Reserves. He has a Master of Science degree in Reliability Engineering from the University of Maryland; a Master of Business Administration degree from the University of Maryland; and a Bachelor of Science degree in Ocean Engineering from the U.S. Naval Academy.



Office of Environment, Health, Safety and Security

James B. O'Brien
Director of the Office of Nuclear Safety
United States Department of Energy

Dr. James O'Brien has over 30 years' experience in nuclear engineering, operations, and safety. In this role as Director of the Office of Nuclear Safety, he develops and maintains the Department of Energy (DOE) nuclear safety Directives and Standards and provides assistance to DOE Program and Field Offices in implementing the nuclear safety requirements and sharing best practices. As part of his current duties, Dr. O'Brien has led the development of several significant Nuclear Safety Directives, including DOE's Nuclear Safety Policy, which provides the framework for safe operations at DOE's nuclear facilities. While at DOE, he also served in the Office of Independent Oversight where he performed reviews of DOE's emergency management and nuclear safety programs at DOE sites.

Prior to working at DOE, Dr. O'Brien worked for nine years at the Nuclear Regulatory Commission (NRC). At the NRC, he was responsible for the development of nuclear safety requirements and standards related to renewing commercial nuclear power plant licenses and emergency preparedness. He also supported the NRC's review of plant-specific probabilistic risk assessments and performed inspections of emergency preparedness programs at commercial nuclear power plants and research reactors. As part of his duties, Dr. O'Brien developed key regulatory documents related to assessing of the environmental impact of continued operation of nuclear power plants as a result of renewing their operating license and the response to potential emergency conditions at nuclear power plants.

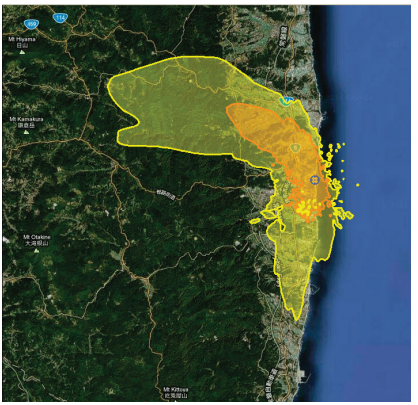
Dr. O'Brien started his professional career working at a commercial nuclear power plant where he served as a shift supervisor, reactor engineer, and project engineer. Dr. O'Brien spent 10 years working at the plant and was involved in several critical activities including the completion of startup testing at the nuclear plant and bringing the plant to initial criticality and commercial operation. He also served as refueling floor coordinator for the first refueling of the reactor.

Dr. O'Brien holds a Bachelor of Science degree in Nuclear Engineering from North Carolina State University, a Master of Science degree in Materials Engineering from Drexel University, and a Doctor of Philosophy degree in Nuclear Engineering from the University of Maryland. He is a registered Professional Engineer.

Luncheon Speakers

NARAC Modeling Post-Fukushima

The Lawrence Livermore National Laboratory played two critical roles as part of the DOE response to the Fukushima disaster.



First, almost immediately after the start of the disaster, our National Atmospheric Release Advisory Center (NARAC) was activated. For several months, NARAC provided a variety of technical assessments such as estimates of possible doses in Japan, predictions of possible arrival times and dose levels in the U.S., estimates of the source term and even daily weather forecasts to support mission planning by the field teams that arrived in Japan a few days later. At home, LLNL served as the lead Consequence Management Analytical Support laboratory and analyzed hundreds of gamma spectra from the field and performed thousands of analysis of physical samples returned to LLNL by the field teams over much the same period. This presentation will briefly review many of our technical contributions to the overall response.

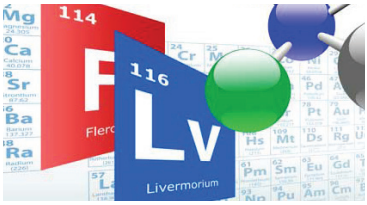
Steven Kreek
Program Leader for Nuclear Detection and Countermeasures, N Program, Global Security
Lawrence Livermore National Laboratory

Steve is Program Leader for Nuclear Detection and Countermeasures Research, directing efforts to develop, improve, and deploy new implementation strategies and technologies to strengthen U.S. capability to detect, interdict, and respond to attempted use or actual incidents/accidents involving nuclear or radiological weapons.

His interests span the nuclear counterterrorism and nonproliferation arenas. He strives to expand the view of possible solutions beyond traditional radiation detection to include alternative/complementary methods that support both missions. He works to help the international Comprehensive Test Ban Treaty implementation community to develop a credible onsite inspection regime. He is leveraging LLNL expertise and experience gained in support of the U.S. crisis-phase response to the Fukushima reactor disaster to create a nuclear/radiological resiliency and recovery R&D program at LLNL and support post-Fukushima cleanup.

The Search for New Elements

Dawn will provide a general overview of the heavy element discovery here at LLNL.



Recently, scientists of the Lawrence Livermore National Laboratory (LLNL)-Dubna collaboration proposed the names as Flerovium for element 114, with the symbol Fl, and Livermorium for element 116, with the symbol Lv, late last year. Flerovium (atomic symbol Fl) was chosen to honor Flerov Laboratory of Nuclear Reactions, where superheavy elements, including element 114, were synthesized.

Livermorium (atomic symbol Lv) was chosen to honor Lawrence Livermore National Laboratory (LLNL) and the city of Livermore, Calif. The IUPAC states Livermorium was chosen because over the years scientists at Livermore have been involved in many areas of nuclear science: the investigation of fission properties of the heaviest elements, including the discovery of bimodal fission, and the study of prompt gamma-rays emitted from fission fragments following fission; the investigation of isomers and isomeric levels in many nuclei; and the investigation of the chemical properties of the heaviest elements.

Livermore also has been at the forefront of investigations into other areas related to nuclear science such as cross-section measurements, nuclear theory, radiochemical diagnostics, separations chemistry including rapid automated aqueous separations, actinide chemistry, heavy-element target fabrication and nuclear forensics.

The creation of elements 114 and 116 generate hope that the team is on its way to the "island of stability," an area of the periodic table in which new heavy elements would be stable or last long enough for applications to be found.

Dawn Shaughnessy
Group Leader, Experimental Nuclear and Radiochemistry, Chemical Sciences Division
Lawrence Livermore National Laboratory

After completing her postdoc in 2002, Dawn accepted a term position at Lawrence Livermore National Laboratory in the Stockpile Radiochemistry Group. She has recently been appointed group leader for the newly created Experimental Nuclear and Radiochemistry Group. In addition, she is the project leader of the LLNL heavy element program, which announced discovery of element 117 in April of 2010. Dawn's general research interests include actinide and heavy element chemistry, chemical automation, nuclear forensics methods and radiochemical diagnostics. Most recently she was awarded the DOE Office of Science Outstanding Mentor Award (2010), the Gordon Battelle Prize for Scientific Discovery for the discovery of element 117 (2010), and was inducted into the Alameda County Women's Hall of Fame for Scientific Discovery (2012).

Friday, October 10, 2014

Time	Event
5:00pm – 8:00pm	Registration/Information

Training Schedule

Saturday, October 11, 2014

Time	Event
7:00am – 5:00pm	Registration/Information
	Exhibitor Tables/Booths
	LLNL Posters and Posters for Presentation Papers
8:00am – 5:00pm	DOE-STD-3009 Training Class, Day 1 Instructor: Ron Selvage and David Pinkston
8:00am – 5:00pm	All Things Pu Class Instructor: Dr. Kiel Holiday
8:00am – 5:00pm	Fire Severity Class Instructor: Dr. Allan Coutts

Sunday, October 12, 2014

Time	Event
7:00am – 5:00pm	Registration/Information
	Exhibitor Tables/Booths
	LLNL Posters and Posters for Presentation Papers
8:00am – 5:00pm	DOE-STD-3009 Training Class, Day 2 Instructor: Ron Selvage and David Pinkston
8:00am – 5:00pm	3009 CN4 Gap Class Instructor: Garrett Smith
8:00am – 5:00pm	DOE Roadshow on Proposed Revised TSR Guide Instructor: Mike Hillman

Subgroup Meetings Schedule

Monday, October 13, 2014

Time	Location
7:00am – 5:00pm	Registration/Information
	Exhibitor Tables/Booths
	LLNL Posters and Posters for Presentation Papers
8:00am – 12:00pm	USQ Subgroup Meeting Lead: Phil Montgomery
8:00am – 12:00pm	AA Subgroup Meeting (with H2SIG) Lead: Roger Lanning with Kevin O'Kula (H2SIG)
8:00am – 12:00pm	Criticality Safety Subgroup Meeting Lead: Andy Pritchard
1:00pm – 5:00pm	SB Subgroup Meeting Lead: Nathan Cathey
1:00pm – 5:00pm	NSR&D Subgroup Meeting Lead: Mukesh Gupta

Subgroups Meetings Schedule

Tuesday, October 14, 2014

Time	Event
7:00am – 5:00pm	Registration/Information
	Exhibitor Tables/Booths
	LLNL Posters and Posters for Presentation Papers
	Breakout Room (Ask to reserve)
8:00am – 10:55am	Welcome and Plenary Session 1. N. Nichole Nelson-Jean – Livermore Field Office Manager 2. Charles Verdon – Principal Associate Director for Weapons and Complex Integration 3. Peter Wisoff – Principal Associate Director for National Ignition Facility 4. Matt Moury – Associate Undersecretary for Environment, Health, Safety and Security 5. James O'Brien – Director, Office of Nuclear Safety Lead: Michael Merritt
11:00am – 12:00pm	Panel on DOE Directives Status (3009, 1104, 3007, etc.) Panel Lead: Mike Greutman
12:00pm – 1:30pm	Lunch Break

Workshop Schedule

Tuesday, October 14, 2014, continued

Time	Event
1:30pm – 3:15pm	DOE-STD-1189 Discussion Leads: Garrett Smith and Pranab Guha
3:15pm – 3:30pm	Break
3:30pm – 4:30pm	Panel on DOE Directives Issues and Impacts Panel Lead: Mike Greutman
4:30pm – 5:30pm	Paper Session (DSAs & MMD) Paper Lead: Nathan Cathey • Lessons Learned from Development of DOE-STD-1189 (Bob Lowrie and Brad Evans) • Best Practices in Performing DSA Legacy Reviews (Mark Mitchell) • Implementation of Recommendations from the One System Comparative Evaluation of the Hanford Tank Farms and Waste Treatment Plant Safety Bases (Richard Garrett)
7:00pm	SAWG Steering Committee

Workshop Schedule

Wednesday, October 15, 2014

Time	Event
7:00am – 5:00pm	Registration/Information
	Exhibitor Tables/Booths
	LLNL Posters and Posters for Presentation Papers
	Breakout Room (Ask to reserve)
8:15am (Assemble)	Tour LLNL – NIF Only
8:00am – 9:00am	Panel on DNFSB topics Panel Lead: Matt Moury
9:00am – 10:00am	Paper Session (Hazard Categorization) Paper Lead: James Kuropatwinski • Recent experiences relocating Special Nuclear Material and reclassifying former nuclear facilities, Sandia NL and Los Alamos NL (Thomas Beckman) • Hazard Categorization Modern Dosimetry Threshold Quantities (William Walker) • An Industrial Facilities Perspective of the Nuclear Facility Downgrade Process (Kelsey Curren)
10:00am – 10:15am	Break
10:15am – 11:15pm	Paper Session (USQ, TSRs & IVRs) Paper Lead: Ron Selvage • Margin of Safety (Phil Montgomery, Jim O'Neil, and Greg Jones) • WIPP — A USQ Perspective Before and After Radiological Release Event (Patty Hollen) • Methodology for Developing a USQ Workbook to Assist Entry Level and Under-performing USQ Analysts (S. Elizabeth Gilbertson)

Workshop Schedule

Wednesday, October 15, 2014, continued

Time	Event
11:15am – 1:15am	Lunch Provided Lunch Speaker on NARAC monitoring post-Fukushima, Dr. Steve Kreek
1:30pm – 2:30pm	Panel on DOE O 420.1C Panel Lead: Pranab Guha
2:30pm – 3:00pm	Panel continued (DOE-STD-1020 and DOE-STD-1066) Panel Lead: Pranab Guha
3:15pm – 3:30pm	Break
3:30pm – 5:00pm	Paper Session (Topics Related to HAs) Paper Lead: Nathan Cathey • Application of Risk Matrices in Hazard Analysis (John Farquharson) • Determination of the Flammable Content of Positively-Buoyant Plumes of Fuel Gas (John Hargreaves) • Combustible Material Loading to Limit the Designed Fire Size (Ron Beaulieu) • Design Verification Methodology for Safety Instrumented Systems Used in DOE Nonreactor Nuclear Facilities (Pranab Guha)

Workshop Schedule

Thursday, October 16, 2014

Time	Event
7:00am – 5:00pm	Registration/Information
	Exhibitor Tables/Booths
	LLNL Posters and Posters for Presentation Papers
	Breakout Room (Ask to reserve)
8:15am (assemble)	Tour LLNL – NIF & NARAC
8:00am – 9:00am	Panel on Fukushima — the Event and the Aftermath Panel Lead: Rob McKeehan
9:00am – 9:45am	Panel on OE-1 Post-Fukushima Response Panel Lead: Rob McKeehan
9:45am – 10:00am	Break
10:00am – 11:30am	Paper Session (AA including AA Handbook, NPH, BDBEs) Paper Lead: Roger Lanning • Effect of deposition models on plume depletion (Akshay Gowardhan) • Evaluation of Near Field Atmospheric Dispersion around Nuclear Facilities Using a Lorentzian Distribution Methodology (Gavin Hawkley) • Sludge Treatment Project – Spray Leak Methodology (Ralph D. Crowe)
11:30pm – 1:15pm	Lunch provided Lunch Speaker on Search for New Elements Dr. Dawn Shaughnessy

Workshop Schedule

Thursday, October 16, 2014, continued

Time	Event
1:30pm – 2:30pm	Panel on WIPP Events and Current Status Panel Lead: Greg Stephens, URS-PS Vice President Consulting Solutions
2:30pm – 3:30pm	Paper Session (3009 Impact on CCRs, if time also Emerging Topic & Misc. Papers) Paper Lead: Andy Prichard • Insights from a Detailed Analysis of a Potential Criticality Accident (Nathan Cathey) • Pseudo-Evaporation of High Specific Activity Alpha-Emitting Materials (Mark Mitchell) • Risk and Reliability Data for Nonreactor Facility Applications: Current Status and Proposed Improvement Options (Kevin O'Kula) • CSSG and relationships between ANS, EFCOG, NCSP activities (Fitz Trumble)
3:30pm – 3:45pm	Break
3:45pm – 4:15pm	Panel Deposition Velocity Panel Lead: David Pinkston
4:15pm – 5:00pm	Paper Session (Looking Forward) Paper Lead: Charles Carathers • Expanding Nuclear Safety R&D through Existing Facilities, a Possibilities Study of Sandia National Laboratories (Peter Subaiya) • Implementation Lessons Learned with DOE-STD-1189, INTEGRATION OF SAFETY INTO THE DESIGN PROCESS (Kevin Kimball) • The Challenges of Achieving Consistency of the Safety Basis Programs of Y-12 and Pantex • Alternate Safety Basis Methodology for DOE Research Reactors (Charles Carathers)
5:00pm – 5:15pm	Closing Remarks and Announcement of Next Safety Analysis Workshop Lead: Mark Mitchell and Mark Joseph

Paper Session Summaries

Tuesday, October 14

Lessons Learned from Development of DOE-STD-1189

Bob Lowrie
URS Professional Solutions
Bob.Lowrie@urs-ps.com

Brad Evans
Pacific Northwest National Laboratory
Brad.Evans@pnnl.gov

The objective of this paper is to identify and document lessons learned from the development of DOE-STD-1189, Integration of Safety into the Design Process. While the entire process of developing this DOE Technical Standard occurred during calendar years 2005-2008, these lessons learned are nonetheless timely in their ability to inform current planning for the development and revision of DOE Standards and Directives.

The safety analysis processes used by DOE contractors are largely governed by the requirements and recommendations (i.e., expectations) of DOE Directives and Technical Standards. These expectations affect the design of new facilities, major modifications of existing facilities, and the development of safety basis documentation, including hazards and accident analysis. Therefore, application of lessons learned from the development of a Standard that covers, design, analysis, and controls can enhance the practice of safety analysis in general.

Lessons learned from evaluation of DOE-STD-1189 development include the following:

- Development team members – of whom should the team be composed
- Process – what is the model for developing a new or revised Standard or Directive
- Scope – what does the development team do to control the scope of the

document that include the practitioners and clients of the processes described
- Internal review – to whom and when does the development engage stakeholders in reviewing the product prior to release in to RevCom
- Active Vetting – Internal challenges by the team based on individual site issues to assess impacts of the direction the Standard or Directive is taking
- Implementation evaluation – how to know the effect of implementing new expectations, including identification of other Standards or Directives impacted by the change

The recognition is that many of the basic concepts identified in the standard for successfully completing a new facility or a major modification is not significantly different from the effective development of a Standard or Directive.

Best Practices in Performing DSA Legacy Reviews

Mark Mitchell
EFCOG SAWG Chair, LLNL Safety Basis Deputy Division Leader
(925) 422-8600, mitchell36@llnl.gov

Brief Description of Best Practice: This is a toolbox of best practices developed for reviews of legacy issues that may be present in Documented Safety Analyses (DSAs). These best practices for DSA Legacy Reviews have been found to efficiently and effectively review DSAs to improve quality and ensure compliant implementation with 10 CFR 830. This collection spans a variety of techniques and provides a toolbox for reviewers. Techniques include:

- comprehensive DSA legacy reviews on a per-facility basis,
- focused/targeted reviews on a topical, cross-facility basis (e.g., SACs), and
- interface with other processes (e.g., TSR implementation, safety basis development procedures, training).

Why the best practice was used: DOE sites need to monitor DSA quality and compliance to ensure a 10 CFR 830 Compliant DSA development

process. Legacy issues can be a result of the initial rush to develop compliant DSAs after 10 CFR 830, associated learning curve, maturation of the DSA development process, better understanding of issues over time, and/or facility-specific situations. Examples of legacy issues may include legacy assumptions, safety basis parameters or conditions, issues with control flow down, inconsistent controls. Accordingly, this toolbox provides a variety of reviews and assessment methodologies ranging from comprehensive assessments on a per-facility basis to focused/targeted reviews on a topical, cross-facility basis. Additionally, these reviews interface with other processes (e.g., TSR implementation) and may result in the need to revise safety basis development procedures and/or associated training or lessons learned. This best practice paper will aid in assessing, verifying and documenting that the DSAs have been reviewed for legacy issues and quality improvements.

These tools provide a method to ensure that necessary actions are taken to: (1) support the reviews, including providing clear guidance as to expectations; (2) conduct the reviews appropriately; (3) provide recommendations to revise DSAs as appropriate; and (4) provide feedback of lessons learned to safety analysts and facility management. These tools help the safety basis subject matter expert (SME)/Functional Area Manager (FAM) assess trends, develops lessons learned, and provides feedback resulting from the reviews.

What are the benefits of the best practice: SAWG believes that the proposed recommendations will help ensure Compliance, proactively find DSA legacy issues and highlight opportunities for improvement while streamlining the review process, increasing its efficiency, effectiveness, and timeliness. This best practice can help improve consistency across facilities on common topics and minimize DSA legacy issues.

What problems/issues were associated with the best practice: Opportunities exist to review DSAs for legacy issues that some contractors may not be aware of, and thus may be vulnerable for DSAs with quality or implementation issues. This best practice highlights review topics for consideration.

How the success of the Best Practice was measured: This best practice paper has helped to minimize DSA legacy issues, ensure Compliant DSAs, optimize the DSA development process, while streamlining the review process,

increasing its efficiency, effectiveness, and timeliness. Improvements have included:

- Improved consistency across facilities on common topics,
- Minimized legacy issues,
- Optimized DSA revision processes,
- Developing revised safety basis procedures based upon DSA legacy reviews,
- Developing and revising safety basis training,
- Management/DSA Interfaces.

Description of process experience using the Best Practice: See attached documentation of best practices which are templates for:

- Comprehensive DSA Legacy Reviews on a per-facility basis, and
- Focused/targeted reviews on a topical, cross-facility basis (e.g., SACs).

Comprehensive reviews of a specific DSA are a best practice to find DSA legacy issues (e.g., legacy assumptions, safety basis parameters or conditions) associated with references (e.g., safety basis calculations), flow down of controls, and other topics. Lessons learned from several DSA Legacy Reviews highlight that advanced selection of calculations proved beneficial (i.e., first find all calculations referenced in the DSA, track down the actual calculations, and review the calculations for relevance and priority).

Comprehensive reviews of a specific topic across DSAs are also a best practice to find DSA legacy issues. Reviews of specific topical areas are also when issues repeatedly arise in an topical area or when a specific topical area has not recently received a fresh look. Topics may include chapters (e.g., DSA safety management program chapters), broad topics (e.g., site natural phenomena hazards), or specific topics (e.g., Specific Administrative Controls (SACs)).

Implementation of Recommendations from the One System Comparative Evaluation of the Hanford Tank Farms and Waste Treatment Plant Safety Bases

Richard L. Garrett
(Washington River Protection Solutions, LLC)
and Fred Beranek (URS)
Belinda Niemi and Ingle Paik –WRPS; Jeffrey Buczek – AREVA Federal Services LLC ;
Mukesh K. Gupta, Jeffrey Lietzow, Frank McCoy – URS Professional Solutions LLC
Richard_L_Garrett@rl.gov

Objective - The One System Integrated Project Team (IPT) organization was established in October 2011 with core staff identified and assigned from Hanford Waste Treatment and Immobilization Plant Project (WTP) and Tank Operations Contract (TOC) organizations. The IPT serves to integrate between the WTP and TOC organizations and coordinate their respective contracts. The IPT integrates complementary functions to achieve One System goals, while eliminating redundant functions of the two contractors and increases the likelihood of achieving early low-activity waste (LAW) operations and Initial Plant Operations (IPO). The four organizations of the One System IPT and associated functions are described below:

- DOE-ORP – Overall management, integration, and oversight of the Hanford River Protection Project (RPP)
- Waste Treatment and Immobilization Plant Contractor – Execution of the WTP project, including engineering, procurement, and construction (EPC) activities followed by cold and hot commissioning through WTP IPO
- Tank Operations Contractor – Execution of tank farms operations, including pretreatment and feed systems design, construction, and operation to provide feed and waste/product management to WTP for LAW-only commissioning and WTP IPO
- One System Integrated Project Team – Cost-effective integration of WTP and tank farms facilities and commissioning/support work scopes, relative to the One System mission-focused goals including technical interfaces, integrated system modeling and planning, waste qualification, nuclear

safety, plant engineering, environmental permitting, and assuring readiness for commissioning

Summary of the Work Done - A Comparative Evaluation was conducted for the One System Integrated Project Team to compare the safety bases for the WTP and TOC by an Expert Review Team. The evaluation had an overarching purpose to facilitate effective integration between WTP and TOC safety bases. It was to provide One System management with an objective evaluation of identified differences in safety basis process requirements, guidance, direction, procedures and products (including safety related controls, key safety basis inputs and assumptions, and consequence calculation methodologies) between WTP and TOC. The evaluation focused on the following main areas:

- Hazard Analysis
- Control Selection, Classification, and Qualification
- Accident Analysis Methodology (e.g., Dispersion Coefficients, Event Durations)
- Accidental Event Evaluation (e.g., Transfer Line Breaks, H2 Deflagrations, NPH, Chemical Release)
- Programmatic Requirements for Key Input and Assumptions
- General Considerations (e.g., Site Description and Safety Management Programs)

The Evaluation Plan was structured to compare those portions of the overall safety bases that have a direct TOC to WTP interface. The evaluation resulted in 25 Recommendations to address differences in safety basis related documents. It also identified differences in drivers (including program and process requirements, guidance, direction, and procedures).

Cross-functional teams were established to determine the consensus resolution of each of the 25 recommendations and presented those resolutions to the One System Nuclear Safety Steering Committee (NSSC). The resolutions, in accordance with Nuclear Safety Culture principles, were accomplished in a fully transparent manner by:

- Identifying, listing and evaluating boundaries and interfaces (e.g., physical, human, control) and the impact of the recommended actions on them,

- Reviewing the pros and cons for the specified approaches through an NRC guidance based Options Analysis (to include value of change, backfit considerations, regulatory impact, need for consistency, sustainability considerations, future DOE directives consideration, DOE complex-wide considerations) for each recommendation,
- Building consensus through evaluation of the options analysis, documenting the consensus and presenting consensus to Steering Committee for concurrence,
- Developing, documenting and presenting to the Steering Committee for concurrence specific implementation plans for the consensus (scope and schedule).

Importance of the work to the DOE - A consistent WTP and TOC Safety Bases would result in significant cost savings during the commissioning (i.e., ORR) with the two contractors and operation of the two facilities by a single contractor (e.g., at SRS tank farms and vitrification facilities are operated by a single contractor).

Results – The consensus for the 25 recommendations were achieved and approved by NSSC. Implementation plans for 16 recommendations were developed and approved by the NSSC. The consensus for the remaining 9 recommendations did not require implementation plans because the recommendations were resolved by other ongoing activities by personnel who were aware of the issues and able to make the necessary changes in the normal work process. A Recommendation Disposition Report was developed that contains the consensus resolutions and implementation plans that include the implementation activities and integrated schedules.

Application/Benefit to Others - The methodologies developed for analysis could be applied at other DOE facilities to ensure consistency across the DOE Complex.

Wednesday, October 15

Recent experiences relocating Special Nuclear Material and reclassifying former nuclear facilities, Sandia NL and Los Alamos NL

Presented to the 2014 EFCOG Safety Analysis Workshop
Thomas Beckman, PE, Safety Basis Engineer
(tdbeckm@sandia.gov)
Sandia National Laboratories
In association with:
Dr. Chris James, Deputy Associate Director
LANL Nuclear & High Hazard Organization
Michael Greutman, Manager
Nuclear Safety Analysis Dept., SNL
And:
Bruce White, Safety Basis Engineer; Dan Schmitt, Safety Basis Engineer
Los Alamos National Security, LLC

The recent past has seen an ever increasing number of 'footprint reduction' projects focused on consolidating mission and downgrading facilities, especially facilities categorized as Nuclear Haz Cat 2 or 3. This paper is a snapshot of recent experiences at the Sandia and Los Alamos National Labs to accomplish just that objective. Of interest was the experience gained when the TA-18, Critical Experiment Facility was closed at LANL and when the Manzano Nuclear Facility and the Hazard Category 3 Transportation organizations were re-categorized at Sandia.

During the first half of CY 2014, Sandia National Laboratory (SNL) embarked on an effort to downgrade two nuclear facilities to radiological operations; The Manzano Nuclear Facilities (MNF) and the Hazard Category 3 Transportation (HC3T) organization. The effort was part of an ongoing mission completion, safety and security initiative to reduce the footprint of all nuclear facilities at SNL in alignment with mission needs. That effort was successfully completed

and reported to the Sandia Field Office (SFO) as such, on April 9, 2014. This dual facility 'downgrade' marked a milestone for the Laboratory. Many old, and some new, techniques were invoked to see the project through to successful completion. Included in that kit bag of techniques were;

- Nuclear Material Inventory Control policies and procedures
- Mission management and strategic forecasting techniques
- Project Management tenets
- Organizational collaboration and interdependency requirements, and
- Readiness Review Imperatives to name a few.

This paper discusses the key elements of the campaign and takes a candid look at the successes and challenges in getting to a reduced nuclear facility footprint at SNL.

In the Spring of 2007, the University of California (UC), then the Management and Operations (M&O) contractor for the Los Alamos National Laboratory (LANL), completed the hazard re-categorization of Technical Area 18 (TA-18), downgrading numerous Hazard Category 2 (HC-2) nuclear facilities to industrial/radiological (i.e., <HC-3) facility status. The project included a vast effort to remove the special nuclear material (SNM) clean and secure the Technical Area. Simultaneously, safety infrastructure had to transition from nuclear safety basis requirements to those of an industrial/radiological facility. The mission to remove the SNM and re-categorize the facilities spanned several years and included a wide array of challenges:

- Develop a graded approach for implementation of Conduct of Operations (ConOps);
- Relocate critical experimental machines to the Nevada Test Site (NTS);
- Categorize, package, and ship SNM to various sites around the world;
- Quantify the SNM that remained at TA-18;
- Thoroughly identify, define and categorize the remaining hazards at TA-18;
- Decommission, decontaminate, and perform limited demolition (DD&D) of facilities;
- Develop Safety Basis controls for the impending Industrial/radiological Facility;
- Retire the HC-2 nuclear operation Safety Basis; and
- Negotiate readiness agreements with the Department of Energy/National

Nuclear Security Administration and the Los Alamos Site Office (DOE/NNSA/LASO).

Also included in this paper is a recount of the project experiences of this final TA-18 mission in an effort to collect pertinent lessons for similar current and future NNSA projects.

Ultimately, this paper will compare and contrast these recent LANL and SNL experiences as a mechanism for dialogue about future, similar, endeavors. As the nuclear weapons mission is recast and old facilities, as needed, are replaced by new operations, this topic of how to effectively retire the 'nukes' of old should certainly prove insightful.

Relationship of the Work to Safety Basis Analysis

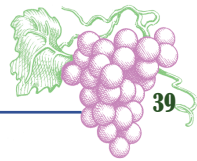
The task of downgrading nuclear facilities at both LANL and SNL required significant Safety Basis elements that warrant discussion:

- Development of an Industrial/radiological Facility Safety Plan.
- Retirement of the existing DSAs and associated Technical Safety Requirements (TSRs).
- Inventory of diverse SNM and NM constituents to develop, publish and defend, a Sum of the Fractions value (DOE-STD-1027-92).
- Development a graded approach for implementation of a ConOps framework for safe operations.
- Appropriate definition and application of Readiness Review precepts for facilities no longer subject to DOE O 425.1D but expected, nonetheless, to demonstrate readiness to perform a revised mission within a revised operational framework.

Because all of these SB elements are pertinent to current nuclear and non-nuclear operations complex-wide, there are lessons that can, and should, be chronicled from the LANL and SNL facility downgrade experience.

Results of the Work

At both LANL and SNL, certain select facilities and operations were downgraded from HC- 2 or 3 status to a non-nuclear, radiological facility status without undue complexity or heartburn. Those experiences should be captured and shared, within the SAWG community, as a way to continue to accomplish similar projects in an ever improving manner.-Tom Beckman, 9 July 2014.



Hazard Categorization Modern Dosimetry Threshold Quantities

Mr. William C. Walker
Nuclear & Radiological Protection Division, Oak Ridge National Laboratory
walkerwc@ornl.gov

Hazard Category-3 (HC-3) Threshold Quantities (TQs) published in DOE-STD-1027, CN-1 were derived from Environmental Protection Agency (EPA) pathway dose exposure data. The EPA methodology for deriving pathway dose exposure data relied upon International Commission on Radiological Protection (ICRP) publication ICRP-30 for inhalation and ingestion dose coefficients and the respiratory tract / clearance model. Also, the EPA methodology used nuclear transformation data from obtained from the National Nuclear Data Center (subsequently published as ICRP 38).

The HC-2 TQs published in DOE-STD-1027 were derived from internal dose conversion factors published report DOE/EH-0071 (1988), which similarly utilized inhalation dosimetry data from ICRP-30.

Since the publication of ICRP-30 and ICRP-38 (circa 1980's), the ICRP has superseded the respiratory tract / clearance model with the publication of ICRP-66 (1994) and has revised inhalation / ingestion dose coefficients for workers in ICRP-68 (1994) and for the public in ICRP-72 (1995). Additionally, the ICRP has published revised nuclear transformation data in ICRP-107 (2008), which supersedes ICRP-38.

Collectively, the revised ICRP dosimetry data are informally referred to as "modern dosimetry data". The modern dosimetry data from these publications can be used to derive updated HC-2 and HC-3 TQs. In 2011, the National Nuclear Security Administration (NNSA) published supplemental guidance outlining the usage of modern dosimetry HC-2 TQs and HC-3 TQs.

This paper provides an overview of the derivation of modern dosimetry TQs (including key inputs and critical assumptions). Additionally, this paper documents a comparative analysis of the hazard categorization assessment of selected inventories that would be typical for various Department of Energy (DOE) facilities.

An Industrial Facilities Perspective of the Nuclear Facility Downgrade Process

Lead Author: Kelsey L. F. Curran, CIH
Co-Authors: Michael R. Greutman and Timothy S. Stirrup
Sandia National Laboratories, New Mexico/Clover Leaf Solutions Inc.
klfcurr@sandia.gov

Many variables must be taken into account and analyzed when downgrading a facility from one type to another—in this case, from a nuclear facility to an industrial facility. One variable that may be overlooked is the process required to integrate the safety basis of the former nuclear facility into an industrial facility safety basis, which does not have a Documented Safety Analysis, while still maintaining the rigor and integrity of an adapted Hazard Analysis. That is, hazards not previously carried forward for analysis as a nuclear facility may be identified and require further analysis as hazards pertinent to an industrial facility. These hazards may have been previously screened out based on the receptor, material quantity, or the potential hazards' inability to impact the operator. The Process Safety Management element may also be a new concept, one that new industrial facilities will need to incorporate into their facility documentation.

This presentation will highlight the lessons learned during the downgrade process from the Industrial Facilities Safety Basis standpoint, that is, during the downgrade from a nuclear facility to an industrial facility. We will focus on the struggles encountered, as well as the improvements made to the downgrade process/protocol at Sandia National Laboratories, and will identify the areas found to be most problematic when bridging the gap between the nuclear facilities safety basis and the industrial facilities safety basis process.

Approaches to Clarify Margin of Safety

Phillip B. Montgomery
James E. O'Neil
Gregory L. Jones
CNS Y-12
montgomerypb@y12.doe.gov

The Nuclear Safety Management final rule, 10 CFR 830, provides an undefined term, margin of safety (MOS). However, 10 CFR 830.203 requires the USQ Process to include MOS within its evaluations. DOE Guide 424.1-1B, Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements, does not define MOS either; however, it discusses MOS in conflicting terms that make it exceedingly difficult to efficiently and correctly answer USQD question number 7 (i.e. reduction in the MOS). Continuing questions and issues regarding MOS are causing inefficient use of large amounts of contractor and DOE resources.

This effort will provide an insight to current contractor and DOE approaches to more clearly define a MOS that can be efficiently implemented.

WIPP – A USQ Perspective Before and After Radiological Release Event

Patty Hollen, Senior Nuclear Safety Analyst
Nuclear Waste Partnership, LLC
P. O. BOX 2078 Carlsbad, NM 88221
Patty.Hollen@wipp.ws

Objective: The objective is to provide a perspective of the USQ process both before and after the Waste Isolation Pilot Plant radiological release event. Prior to the event the USQ process was considered sufficient to ensure proper

authorization of proposed changes to the facility and its operations. After the event, the process was critically reviewed by multiple outside organizations, including not only the local DOE field office, but also other field office and headquarter personnel and contractors supporting DOE operations. The reviews concluded the USQ procedure, training and implementation were less than adequate and required strengthening and better integration with the work control process. In April 2014, NWP placed compensatory measures in place to ensure all USQ "Determinations" be independently reviewed by NWP Nuclear Safety. In addition to being reviewed by NWP Nuclear Safety, URS Senior Corporate Professionals independently assessed the USQ Determinations prior to final approval. The URS Corporate team checked all the USQ documents, i.e., screens, determinations, and PISA determinations prepared by NWP. The use of Categorical Exclusions was halted until the WIPP USQ procedure could be updated as suggested by the Accident Investigation Board.

Relationship to the Workshop: The WIPP is critical to the continued mission of environmental cleanup and storage of non-high level waste. Due to the radiological release event and uncertainties in the initial conditions leading to the release a Potential Inadequacy in the Safety Analysis (PISA) was declared. Since the PISA was not going to be resolved near term, the facility was placed in a safe configuration (i.e., no underground waste handling and a suspension of waste receipt from other DOE sites). However, in order to determine the conditions leading to the release, investigation activities were required to be authorized in the underground facilities. A number of Evaluations of the Safety of the Situation (ESS) were prepared and approved by DOE on case-by-case basis. To support the recovery operations, accident investigations and modifications to the ventilation system for the underground, hundreds of work control documents have been evaluated by the USQ process. The paper will provide the perspective of how an unplanned event can cause significant process changes and lead to a better understanding of uncertainties in the safety basis.

Results of the Work: Due to the uncertainties in the safety basis, a number of ESS documents, and oversight perspectives, USQ compensatory measures required a significant expenditure of resources to perform required USQDs. Based on the review of prior USQ documents, the ability to authorize activities based on categorical exclusions, and to a certain extent screenings, was halted until the USQ process was re-vamped and the safety basis inadequacies could be resolved. This required a tremendous effort by NWP, with the support of URS, to evaluate all changes using only USQDs with only limited exceptions.

NWP with URS support revised the USQ procedure with input from a number of USQ experts and oversight personnel to better ensure integration with the work control process. The process to identify PISAs and take appropriate actions received particular attention.

Methodology for Developing a USQ Workbook to Assist Entry Level and Under-performing USQ Analysts

S. Elizabeth Gilbertson

Background is presented on the typical learning styles of Safety Analysts. This background is used to establish target educational tools to most effectively reach this audience. A Workbook is developed to expose the learner to successful writing and analysis techniques when performing USQs and lessons learned from audits and assessments are incorporated into the learning schema to ensure improvement of the process. The workbook presents open-ended performance tasks with suggested answers to allow the learner to "check" his or her work and learn from mistakes prior to performing analysis on proposed changes to documents or the facility. It also aids the learner in understanding when and where it is appropriate to screen and how to avoid common errors in wording by providing suggestions of boiler plate terminology. The learner's work is evaluated based off of rubric style criteria which can be administrated by management or senior analysts. The same tool can be used for entry level analysts needing to establish a knowledge base, or it can be used in segments as remediation for under-performing analysts needing to improve in targeted areas. The workbook's effectiveness is evaluated in a pilot study and initial performance is tracked using control and test groups of entry level analysts and under-performing analysts. Results are discussed in the conclusions section.

Application of Risk Matrices in Hazard Analysis

John A. Farquharson, P.E.
ABS Consulting
jfarquharson@absconsulting.com

Hazard analysis teams are using risk matrices as a tool to help promote more consistent qualitative risk decision making and to help document the results. While quantitative analysis may provide additional insight that may not be apparent in a purely qualitative analysis, a quantitative risk analysis (QRA) may not be warranted for some studies. The typical next step toward quantification of risk is an approach termed semi-quantitative in that numerical definitions are provided for the consequence and frequency gradations. However, it remains only semi-quantitative because consequence and/or frequency modeling is not necessarily used in estimating consequence and frequency. Nevertheless, many find that this approach is of greater value to an experienced hazard analysis team since, based upon its collective experience, the team has at least a historical sense of how frequently an event might occur or how great the consequences might be.

This paper examines the trend in the Department of Energy (DOE) nonreactor nuclear facilities towards this risk matrix approach in categorizing the risk associated with key accident scenarios. In the chemical industry, this trend is labelled a layer of protection analysis (LOPA) approach. This paper will discuss risk matrices that are used in both the chemical and nuclear industries. Additionally, the paper will examine basic concepts and potential pitfalls in the risk matrix approach. Hopefully, this paper will stimulate discussion on how the DOE operators can use the risk matrix approach in defining the risk and as a tool to selecting the appropriate credited controls.

Determination of the Flammable Content of Positively-Buoyant Plumes of Fuel Gas

John Hargreaves
Los Alamos National Laboratory
jhrgrvs@lanl.gov

This paper applies recent theoretical developments allowing determination of the total flammable content of positively-buoyant plumes of fuel gas.

The relationship of the work to the overall interests of DOE Safety Analysis: Determination of the total flammable content of a plume of fuel gas provides a conclusive basis for estimating the total energy released by ignition of the plume. This provides a basis for safely locating gas lines with respect to DOE nuclear facilities.

Recent work of Epstein and Fauske provides a basis for determining the boundaries of the lower and upper flammable limits of a plume of fuel gas in air. This work currently applies to vertical plumes of circular origin and is applicable throughout the momentum- and buoyancy-driven regimes of flow. Gaussian and Top-Hat profiles of gas and entrainment of air are examined. Solution of the resulting closed-form equations is accomplished using Mathematica. The results of this application of theory are shown for a recent analysis of a gas line adjacent to the LANL CMR facility. Flow in the gas line is treated as adiabatic, compressible, and friction-limited. The final results for total flammable mass of gas in air are shown relative to the entrapment of the plume in a recirculation cavity.

Combustible Material Loading to Limit the Designed Fire Size

Ron Beaulieu

Design Verification Methodology for Safety Instrumented Systems Used in DOE Nonreactor Nuclear Facilities

Pranab Guha
U.S. Department of Energy, Office of Health, Safety & Security
Office of Nuclear Safety Basis & Facility Design, Office of Nuclear Safety
Pranab.guha@hq.doe.gov

Abstract — DOE-STD-1195, Design of Safety Significant Safety Instrumented Systems used at DOE Nonreactor Nuclear Facilities, was issued in 2011. This standard focuses on safety instrumented systems (SISs) used in safety significant (SS) applications and illustrates how a widely-used process industry standard, American National Standards Institute/International Systems and Automation Society (ANSI/ISA), 84.00.01-2004, Functional Safety: Safety Instrumented Systems for the Process Industry Sector (ISA84), can be used to support reliable designs. The standard provides requirements and guidance for the design, procurement, installation, testing, maintenance, operation, and quality assurance of SISs that may be used at Department of Energy (DOE) nonreactor nuclear facilities for SS functions. The standard also provides guidance on verification methodology for the SS SIS design that is validated through the life-cycle to ensure that the SIS is maintained as designed to fulfill its safety functions. This paper gives an introduction to the verification methodology for the SS SIS designs.

Thursday, October 16

Effect of Deposition Models on Plume Depletion

Akshay Gowardhan[a], Dave Thoman[b], Nick Schira[b], And Elizabeth Henley[b]
[a]Lawrence Livermore National Laboratory / [b]URS Professional Solutions
gowardhan1@llnl.gov

Deposition Removes materials from plumes and deposits it on the ground. The Gaussian Plume models implemented in the DOE toolbox dispersion codes for radiological consequence analysis use the deposition velocity and the source depletion model (Van der Hoven, 1968) to determine the rate of removal. A higher removal rate results in lower (less conservative) relative air concentrations (χ/Q values) at downwind distaeces. MACCS2, GENII, and HotSpot sse the same source depletion model, but implement the governing equation in different ways. This leads to different removal rate predictions even when the same deposition velocity is used.

In This paper, the various implementations of the source depletion model are presented and discussed. A Parametric study shows the sensitivity of the removal rate to various deposition velocities across the full range of atmospheric stability classes. Results from MACCS2, GENII, and HotSpot are compared against one another and against hand calculations. The effect of the deposition process on calculating the 95th percentile χ/Q will also be discussed.

Evaluation of Near Field Atmospheric Dispersion around Nuclear Facilities Using a Lorentzian Distribution Methodology

Gavin Hawkley
Idaho National Laboratory
Gavin.Hawkley@inl.gov

Atmospheric dispersion modeling within the near field of a nuclear facility typically applies a building wake correction to the Gaussian plume model, whereby a point source is modeled as a plane source. The plane source results in greater near field dilution and reduces the far field effluent concentration. However, the correction does not account for the concentration profile within the near field. Receptors of interest, such as the maximally exposed individual may exist within the near field and thus the realm of building wake effects. Furthermore, release parameters and displacement characteristics may be unknown, particularly during upset conditions. Therefore, emphasis is placed upon the need to analyze and estimate an enveloping concentration profile within the near field of a release. This investigation included the analysis of 64 air samples collected over 128 weeks. Variables of importance were then derived from the measurement data, and a methodology was developed which allowed for: the estimation of Lorentzian based dispersion coefficients along the lateral axis of the near field recirculation cavity; the development of recirculation cavity boundaries; and conservative evaluation of the associated concentration profile. The results evaluated the effectiveness of the Lorentzian distribution methodology for estimating near field releases, and emphasized the need to appropriately place air monitoring stations for complete concentration characterization. Additionally, the importance of the sampling period and operational conditions were discussed to balance operational feedback and the reporting of public dose.

Sludge Treatment Project – Spray Leak Methodology

Nuclear Safety Analyst - Ralph D. Crowe
CH2M Hill Plateau Remediation Company
Ralph_Crowe@rl.gov

One of the accident scenarios identified for the CH2M Hill Plateau Remediation Company Sludge Treatment Project (STP) is a spray leak resulting from a failure of piping, hoses or connectors during sludge transfer from a K West Basin engineered container to a sludge transport and storage container. This postulated pressurized release could result in the spray of sludge with a potential radiological exposure to onsite and offsite individuals.

Some of the current concerns regarding spray leak analysis methodologies include:

- Uncertainty in slurry rheology, including properties such as viscosity and the effect of these properties on the formation of droplets in the spray
- Applicability of spray correlations for multiphase flows with suspended particulate including the effect of entrained solids particulate on droplet formation
- Applicability of commonly used droplet distributions and droplet characteristics such as the Sauter Mean diameter (SMD) and droplet aerodynamic shape
- Selection of appropriately conservative crack configurations

To include all these phenomena in the spray calculations is difficult. For the STP spray release analyses, a method independent of any spray correlation is used. The basic premise for the correlation-independent method ("fog model") was to select a conservative aerosol concentration 100m from the point of the spray release and use this concentration in conjunction with the appropriate dispersion factors to estimate the radiological dose consequences for the receptors.

The paper demonstrates that the dose consequences calculated using 12.5 mg/m3 are larger than those estimated using other correlations and remain reasonably conservative for the STP sludge transfer conditions (i.e. pressure and sludge characteristics).

Insights from a Detailed Analysis of a Potential Criticality Accident

Nathan G. Cathey
Bruce S. Carlisle, Andrew W. Prichard, Robert A. Jones
Nuclear Safety and Facility Authorization
Nathan.Cathey@pnnl.gov

In support of enhancing the Pacific Northwest National Laboratory's Nuclear Criticality Safety Program implementation of ANSI 8.23, Nuclear Criticality Accident Emergency Planning and Response, a detailed analysis of a simulated criticality accident was performed. The criticality accident evaluated involves a small magnitude event at a HC-2 nuclear facility.

The results of this evaluation provide:

- Prompt dose estimates for personnel within the immediate area as well as those collocated within the facility
- An estimate of the number of personnel impacted and to what level
- Dose estimates due to rescue and recovery operations
- Potential impact of Cl-38 on Quick Sort results immediately following the event
- Consolidated information associated with the sheltering, transport, and monitoring of affected personnel

The magnitude of the criticality accident modeled (initial pulse ~ 7 x 1016 fissions) is representative of potential solution criticality accidents across the complex. The results of this analysis may be used directly in some cases, used to gain insights into existing programs and/or used to identify potential enhancements to planned responses.

Pseudo-Evaporation of High Specific Activity Alpha-Emitting Materials

Ralph H. Condit, Leonard W. Gray, Mark A. Mitchell
Lawrence Livermore National Laboratory
e-mail: condit2@llnl.gov

The purpose of this paper is to document a little known physical phenomenon that is unique and particular to high specific-activity actinides. It is part of the folklore among those who work with high alpha-emitting materials that they can self-levitate and migrate as a sort of aerosol, what we call pseudo-evaporation. This is an inquiry into the possible mechanisms of such migration of alpha-emitting species. High specific-activity alpha emitting isotopes that are solids but are somehow, due to the emission of high energy alpha particles, given a recoil kick that can lift them away from a surface into a moving air stream, which would then carry them away.

This paper presents a way to estimate the magnitude of such migration and, perhaps, to achieve enough understanding to allow improving safety procedures when working with high specific-activity actinides such as plutonium-238, polonium-210, and curium-244. An equation is derived giving the rate of pseudo-evaporation of 238PuO2. It is concluded to be a function of the material's specific activity to the power of 2. Assuming a cluster of plutonium oxide molecules, the rate of pseudo-evaporation for an isotopically pure 238PuO2 cluster would be 1E+03 psuedo-evaporations per second per cm2, greater than for pure 239PuO2 by a factor of about 105.

The same phenomena that cause pseudo-evaporation may contribute to the enhanced chemical reactivity of plutonium-238 metal.

Risk and Reliability Data for Nonreactor Facility Applications: Current Status and Proposed Improvement Options

Kevin R. O'Kula, C. Ray Lux
URS Professional Solutions LLC
2131 South Centennial Avenue, Aiken, SC 29803; kevin.okula@urs-ps.com

With the issuance of Draft Depart of Energy (DOE) Standard ("Draft Standard"), "Development and Use of Probabilistic Risk Assessments in Department of Energy Nuclear Safety Applications" (December 2010), DOE states that nuclear safety decision-making processes can be supplemented and strengthened through application of quantitative and probabilistic risk assessment methodologies. Furthermore, the National Defense Authorization Action for 2013 states, "The Administrator and the Secretary of Energy shall ensure that the methods for assessing, certifying, and overseeing nuclear safety… use national and international standards and nuclear industry best practices, including probabilistic or quantitative risk assessment if sufficient data exist." Although many risk-informing approaches are potentially applicable to supplement DOE facility safety analysis, those that are quantitative in nature (e.g., quantitative or probabilistic risk assessments, FMECAs, fault tree and event tree logic models) require applicable data for achieving reasonably conservative estimates of equipment (i.e., systems, structures, and component), system and facility risks.

Risk-based analyses conducted in the DOE Complex in the 1970s through the mid-1990s often utilized site-specific databases, maintained and applied to similar facility processing and operational environments. However, many if not all of these sources of data are no longer available, or if still accessible, are in varying states of maintenance and quality assurance pedigree. Instead, initial risk applications, including quantitative risk analysis (QRA) and similar projects since the publication of the Draft Standard have relied on single-site data, or commercial industry sources such as NUREG/CR-6928 and IEEE 493. However, these sources are not always directly transferable due to the type of equipment and the anticipated operating environments.

We outline several improvement opportunities for current and future uses of risk and reliability data in support of design and safety applications by DOE

contractors. In the short-term, the EFCOG SAWG Hydrogen Safety Interest Group is cataloging sources of data that are currently available from nuclear safety and commercial industry. In the long-term, an electronic database is proposed that could be maintained for DOE, and accessible to safety contractors. These and other options will be summarized, and collectively suggest that improved and technically more defensible risk and reliability assessments would result.

The DOE Criticality Safety Support Group – A Retrospective Perspective

Fitz Trumble*, Chair DOE CSSG
David Erickson, Deputy Chair DOE CSSG
*URS Professional Solutions
fitz.trumble@urs-ps.com

The Department of Energy (DOE) Nuclear Criticality Safety Support Group (CSSG) came into being as a response to the DNFSB recommendation 1997-2 "Criticality Safety" which dealt with the continuation of criticality safety at defense nuclear facilities in the Department of Energy complex. The DNFSB was concerned over the lack of capability management of practical experience pertinent to avoiding a criticality accident in non-reactor environments. One of the specific recommendations of 1997-2 was to "Identify a core group of criticality experts experienced in the theoretical and experimental aspects of neutron chain reactions to advise on the above steps and assist in resolving future technical issues". The CSSG, a group of 10 recognized experts in criticality safety, was chartered in late 1997to address the recommendation. Members of the CSSG are drawn from DOE employees and contractor staff to provide advice and technical support to help meet the criticality safety needs of DOE missions, including stockpile stewardship, materials stabilization, transportation, storage, facilities decommissioning, and waste disposal.

The CSSG is an integral part of the DOE Nuclear Criticality Safety Program (NCSP) developed to maintain and enhance the criticality operational and technical expertise and capability within the Department of Energy enterprise. This paper outlines the history, purpose and continuing contribution of the

CSSG as well as providing an understanding of the interfaces between the DOE CSSG, the DOE Criticality Safety Coordinating Team (CSCT), the ANS Nuclear Criticality Safety Division and the EFCOG Criticality Safety Subgroup.

Expanding Nuclear Safety R&D through Existing Facilities, a Possibilities Study of Sandia National Laboratories

Peter V Subaiya
Nuclear Safety Basis Engineer, Sandia National Laboratories (NM)
Pvsubai@sandia.gov

The need for nuclear safety R&D facilities and experiments is becoming a big issue in our community. Following Fukushima, there were numerous questions left unanswered about reactor safety and accident analysis/progression. The end result of these questions being a need for more robust analyses, and more robust computer models to not only predict accidents but to understand how failures progress. This report uses Sandia National Laboratories to describe how safety basis engineers can better utilize the programs, facilities and expertise available to them at various sites to support nuclear safety R&D. There will also be a discussion as to the capabilities available at Sandia National Laboratories (NM) and some of the support programs that could be used to facilitate future work in nuclear safety R&D. Finally, projects will be proposed that could utilize the programs available at Sandia National Laboratories in both the short and long term, and paint a picture about the research that is available to not only at these facilities but other sites as well. The results and goals of this report are to inform the nuclear safety community about opportunities here at Sandia, and also to present a process for repurposing existing facilities to support nuclear safety R&D and the greater community.

Implementation Lessons Learned with DOE-STD-1189, Integration of Safety into the Design Process

Kevin Kimball
Consolidated Nuclear Security, LLC
P.O. Box 2009, Oak Ridge, TN 37831-8010
kimballkd@y12.doe.gov

Several major key projects have implemented DOE-STD-1189-2008, Integration of Safety Into the Design Process. Two projects in particular, the Uranium Processing Facility (UPF) and the U-233 Disposition Project implemented the Department of Energy (DOE) standard mid-way into the design efforts. The UPF project is a major design build project, and the U-233 Disposition Project was a major modification that involved a design of a new facility. These projects have major similarities that created challenges for implementing the DOE standard, including:

- A major design build on an existing DOE site with other hazardous facilities,
- Extensive design re-direction in the middle of the preliminary design phase,
- A modified critical decision strategy that differs from the classical approach described in DOE Order 413.3C,
- Major radiological, criticality safety, and toxicological hazards, and
- The use of multiple design agencies to perform the design.

DOE-STD-1180-2008 provides good direction regarding the expectations of implementing safety into the design, and has improved the visibility of the nuclear safety requirements in the design evolution and approval processes. This paper identifies the challenges experienced with implementing the standard, and provides recommendations for clarifications and improvements for the next revision.

The following elements of the standard are addressed in the paper:

- The importance and implications of early design decisions and key project risks;
- The roles and responsibilities of the Safety Design Integration Team;
- The importance of the Safety Design Strategy and the interface it provides to design criteria and configuration management;
- The role of the safety basis documents in controlling design criteria and configuration control;
- The review and approval expectations by external oversight agencies; and
- The application of criteria contained in the appendices of the standard

The Challenges of Achieving Consistency of the Safety Basis Programs of Y-12 and Pantex

Bruce A. Wilson
Chief Engineer, Nuclear Facility Safety, B&W Y-12 Technical Services, LLC
Wilsonba2@y12.doe.gov

Objective: In 2012, the Department of Energy combined their site offices at Y-12 and Pantex into one organization, NNSA Production Office (NPO). They also re-bid the contracts for management and operation of the two production facilities. As of the end of December, DOE had not yet released the name of the team that will be awarded the contract to operate both sites. But activities had already begun to analyze the differences and similarities in the Safety Basis programs for each of the sites and to start the process of achieving consistency, where possible, between the two programs. The objective of this paper is to describe these efforts and the lessons learned from a management point of view in achieving this goal.

This paper will be of interest across the spectrum of DOE sites. One of the overall goals of EFCOG is to achieve uniformity in the interpretation and implementation of DOE rules and guidance. Yet, these efforts are mostly voluntary since approvals and guidance is primarily a local DOE function. Combining the work at Pantex and Y-12 under one contract makes this effort more in the realm of mandatory, rather than voluntary.

Results: Since the contract has not yet been awarded, there are no significant results to report at this time. The results will be reported in the technical paper.

Alternate Safety Basis Methodology for DOE Research Reactors

Charles Carathers

Panels

DOE Directives Status
Chair: Mike Gruetman
Tuesday, 11:00am – 12:00pm, Ballroom

This panel will discuss the status of DOE Directives (e.g., DOE-STD-3009, DOE-STD-1104, DOE-STD-3007, DOE-STD-1189, Accident Analysis (AA) Handbook, Natural Phenomena Hazard (NPH) Handbook, DOE TSR Guide, and DOE USQ Guide), including perspectives from AU-31.

DOE Directives Issues and Impacts
Chair: Mike Gruetman
Tuesday, 3:15pm – 4:00pm, Ballroom

This panel will discuss potential issues and impacts of DOE Directives.

DNFSB Topics
Chair: Matt Moury
Wednesday, 8:00am – 9:00pm, Ballroom

This panel will discuss topics of interest to DOE and DNFSB.

DOE 0 420.1C
Chair: Pranab Guha
Wednesday, 1:30pm – 2:30pm, Ballroom

DOE Office of Nuclear Safety Basis & Facility Design (AU-31) will discuss proposed changes to the DOE Order 420.1C, Change 1, Facility Safety, such as, invocation of revised DOE Standard (STD) 1104-2014, Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents, and DOE-STD-3009-2014, Preparation of Nonreactor Nuclear Facility Documented Safety Analysis, as well as

other administrative changes required by DOE O 251.1C, Departmental Directives Program. The session will provide observations and insights, and stimulate discussions on the following:

- O 420.1C, Change 1, which has been through RevCom review, is in comment resolution, and will be issued along with issuance of DOE-STD-1104 and 3009;
- Applicability of the DOE-STD-3009-2014 and STD-1104;
- Impact on new and major-mod facilities; and
- Impact on existing facilities.

Panel 3 continued (Discuss implementation issues related to DOE-STD-1020 and DOE-STD-1066)
Chair: Pranab Guha
Wednesday, 3:00pm – 3:30pm, Ballroom

Fukushima: The Event and the Aftermath
Chair: Rob McKeehan
Thursday, 8:00am – 9:00am, Ballroom

This panel will discuss Fukushima, the event itself. A subsequent panel will discuss the DOE HSS Operating Experience Level 1: 2013-01, and path forward.

OE-1 Post Fukushima
Chair: Rob McKeehan
Thursday, 9:00am – 9:45am, Ballroom

DOE HSS Operating Experience Level 1: 2013-01 specified enhanced evaluation of Beyond Design Basis Events (BDBEs) as part of annual updates of the documented safety analysis (DSA) for nuclear Hazard Category 1 and 2 facilities having the potential to exceed 25 rem

unmitigated offsite. This panel will examine the efforts taken by DOE to assist in that task and some of the actions and results by the contractors to date. Particular items for discussion are experiences and lessons learned from DOE site assist visits, development of a protocol document, incorporation of the evaluation results with revision of the DSAs, and results and feedback thus far from contractor experience with the initiative.

WIPP Events and Current Status
Chair: Greg Stephens
Thursday, 1:45pm – 2:45pm, Ballroom

This panel will discuss what happened leading up to the events (fire and radiological release), WIPP response to the events, and WIPP recovery actions to achieve full operations and the timing for those actions. DOE perspective on the events and recovery actions.

Deposition Velocity
Chair: David Pinkston
Thursday, 3:50pm – 4:30pm, Ballroom

This panel will discuss the history and current status of issues involving deposition velocity, including the paper, Deposition Methods for DOE Site Safety Analysis. The project was sponsored by the National Nuclear Security Administration (NNSA) Nuclear Safety Research and Development Program and monitored by the Chief of Nuclear Safety (CNS) from the Office of the Under Secretary for Management and Performance. This panel will explore potential issues and impacts of deposition velocity. Panel members include: David Pinkston (panel lead), Gayle Sugiyama (paper author), DOE EHSS AU-30 staff, as well as contractors from other sites.

SAWG Steering Committee, Subgroup Chairs, DOE Sponsors

SC - Steering Committee
CR - Company Representative

Anderson, Amanda
Amanda.Anderson@hq.doe.gov
DOE/HSS
DOE SME

Balo, Karen
karen.balo@ettp.doe.gov
UCOR
Safety Basis Subgroup Vice-Chair

Beaulieu, Ron
BeauliR1@nv.doe.gov
Nevada National Security Site
SC

Blackburn, Mark
mark.blackburn@hq.doe.gov
DOE HQ EHSS/AU-32
DOE Sponsor

Brock, R. T.
rtbrock@bechtel.com
Bechtel National Inc
CR

Burns, Tom
Tom.Burns@parsons.com
Parsons
CR

Carothers, Charles
cdcarat@sandia.gov
Sandia National Labs
SAWG Secretary

Carroll, Kevin
carroll26@llnl.gov
Livermore National Security, LLC
SC

Cathey, Nathan
Nathan.Cathey@pnnl.gov
PNNL
Safety Basis Supgroup Chair

Cato, Diane
Diane_M_Cato@RL.gov
Washington River Protection Solutions
CR

Clark, Doug K.
clarkdk@y12.doe.gov
Y-12 National Security Complex
CR

Contardi, John
John.Contardi@srs.gov
Savannah River Remediation
CR

DiNunno, Brian
bdinunno@pec1.net
DOE HQ
DOE SME

Evans, Brad
Brad.Evans@pnl.gov
Pacific Northwest National Laboratory
SC

Farquharson, John
jfarquharson@absconsulting.com
ABS Consulting
SC

Goss, James
James.Goss@npo.doe.gov
DOE Y-12
DOE Field Sponsor

Greutman, Michael
mrgreut@sandia.gov
Sandia National Laboratories
SAWG Vice-Chair

Guha, Pranab
Pranab.Guha@hq.doe.gov
DOE HQ
DOE SME

Gupta, Mukesh
mukesh.gupta@wsms.com
URS Professional Solutions
NSRD Subgroup Chair

Hale, Roger
roger@spectratechinc.com
Spectra Tech Inc.
CR

Harvey, Jeff
jeffrey.harvey@ettp.doe.gov
UCOR
CR

Hillman, Mike
Michael.Hillman@hq.doe.gov
DOE, AU-31
DOE

Hitchler, Mike
Mike.Hitchler@ettp.doe.gov
UCOR
CR

Hukari, Ken
ken@hukari.com
Hukari Technical Services, Inc.
CR

Johnson, Larry
Lawrence.Johnson@srs.gov
Savannah River Nuclear Solutions
CR

Johnston, Julie
jajohnston@energysolutions.com
EnergySolutions
Training Liaison

Jones, Greg
Gregory.L.Jones@rl.doe.gov
RL Nuclear Safety Division
DOE Field Sponsor

Joseph, Mark
mjoseph@anl.gov
Argonne National Laboratory
CR

Kimball, Kevin
kimballkd@y12.doe.gov
Consolidated Nuclear Security
SC

Kuropatwinski, James
wujek@lanl.gov
Los Alamos National Laboratory
Criticality SG Vice-Chair

Lanning, Roger
rdlannin@bechtel.com
URS - WTP
Accident Analysis SG Chair

Lavender, Jay
John_C_Lavender@rl.gov
CHRPC
CR

Lehto, Michael
michael.lehto@inl.gov
Idaho National Laboratory
CR

Low, James (Jim)
james.low@hq.doe.gov
DOE/HQ AU-45
DOE

Lowrie, Bob
Bob.Lowrie@urs-ps.com
URS Professional Solutions
CR

MacDougall, Al
amacdougall@ntc.doe.gov
Senior Safety Advisor, NTC
DOE

Mauney, Carl (Van)
mauneycv@y12.doe.gov
VP, Program Management, Y-12 National Security Complex
EFCOG Sponsor

McAllister, John
john.mcallister@urs-ps.com
URS/PS
AA Subgroup Vice-Chair

McCormick, James
james.mccormick@wipp.ws
URS/WIPP
SC

McEahern, Patrice
Patrice.mceahern@cbifederalservices.com
CB&I Federal Services
CR

McKeehan, Rob
mckeehanrs@ornl.gov
Oak Ridge National Laboratory
SC

Mitchell, Mark
Mitchell36@llnl.gov
Lawrence Livermore National Lab
SAWG Chair

Montgomery, Phil
montgomerypb@y12.doe.gov
Y-12 National Security Complex
USQ SG Chair

Munoz, Jose
Jose.munoz@nnsa.doe.gov
NNSA Sandia Field Office
DOE Field Sponsor

Nelson, Bob
Robert_C_Nelson@rl.gov
DOE HQ/EM
DOE EM Sponsor

Niemi, Belinda
bjniemi@rl.com
WRPS
CR

O'Brien, James
james.o'brien@hq.doe.gov
DOE HQ/EHSS/AU-30
DOE EHSS Sponsor

O'Kula, Kevin
Kevin.OKula@wsms.com
URS Professional Solutions
Hydrogen Safety Lead

O'Neil, Jim
James.oneil@nnsa.doe.gov
DOE
DOE Field Sponsor

Ostby, Paula
paulaostby@gmail.com
B&W Technical Services
CR

Paik, Ingle
ingle_k_paik@rl.gov
Washington River Protection Solutions
CR

Peatross, Rod
Rodney.Peatross@icp.doe.gov
CWI/Idaho
SG

Peters, George
glpeters@lanl.gov
Los Alamos National Laboratory
CR

Prichard, Andy
Andrew.Prichard@pnnl.gov
PNNL
Criticality Safety SG Chair

Renfro, David
renfrodg@ornl.gov
Oak Ridge National Laboratory
CR

Restrepo, Louis
Louis.Restrepo@nuclearassociates.com
Nuclear Safety Associates
CR

Rice, John
jrice@epsilonsystems.com or
jwrice46@gmail.com
Epsilon Systems Solutions
CR

Schofield, Wayne
wayne.schofield@moellerinc.com
Dade Moeller & Associates
CR

Scruggs, Alan
CSCRUGGS@pantex.com
Pantex Plant
CR

Selvage, Ron
rselvage@lanl.gov
LANL
USQ SG Vice-Chair

Smith, Garrett
Garrett.Smith@hq.doe.gov
DOE AU-31
DOE

Tran, Tinh
Tinh.Tran@urs-ps.com
URS Professional Solutions
CR

Trujillo, Ivan
Ivan.Trujillo@nnsa.doe.gov
NNSA NA-SH-80
DOE

Vincent, Andrew
Andrew.vincent@srs.gov
Savannah River Nuclear Solutions
SC

General Transportation Information Guide

Car Rental: We have plenty of free parking at the hotel should people choose to rent a car.
Enterprise
925-609-6900

Hertz
925-227-8800

Avis
925-460-0960

Budget
925-460-5230

Car/Van/Bus Service with driver:
Creatours, Nino
925-497-2376
www.creatours.com

Local Shuttle: the hotel shuttle van accommodates up to 7 people and transports within a 7 mile radius of the hotel.

Shuttle Services:
Oakland: the closest airport is Oakland Int'l. Shuttle transportation is $39 each way for one person and it goes down depending on how many share i.e. 2 ppl - $54, 3 ppl - $70, 4 ppl - $80. The company used is called East Bay Connection.
800-675-3278
www.eastbayconnection.net

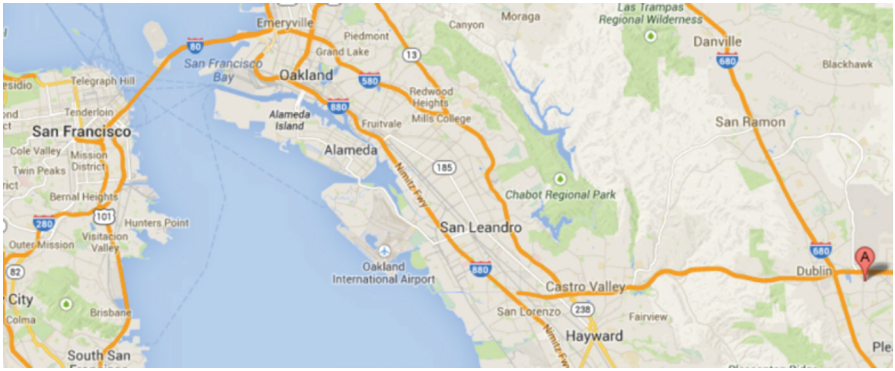
San Francisco: San Francisco Int'l Shuttle transportation is $48 each way for 1 person, 2 ppl - $71, 3pp - $77, 4 ppl - $88. The company used is called East Bay Connection.
800-675-3278
www.eastbayconnection.net

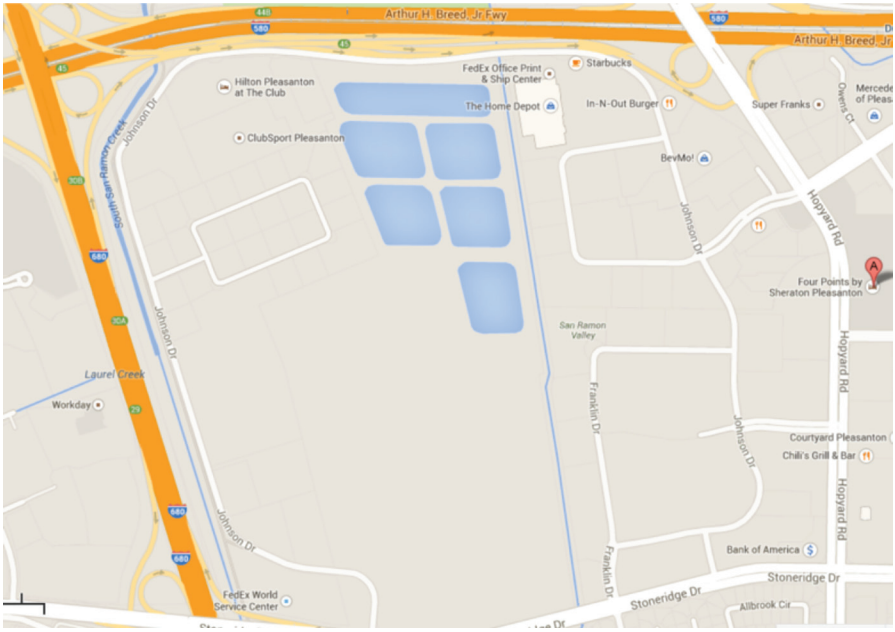
San Jose: SJC Int'l shuttle transportation @ $65 for 1 person and $10 for each additional guest up to 9 in a Shared Ride Van. The company used is called Super Shuttle
1-800-258-3826
www.supershuttle.com

Public Transportation:
Go to *www.bart.gov* for quick guide schedules. BART station is two blocks from the hotel.

From Oakland Int'l it is $3.60 to get the BART train which stops just two blocks from the hotel. There is a shuttle from the Airport terminal to the Bart station, $3.00, total cost to hotel $6.90. Walking is possible we also have a shuttle that can pick people up from BART.

Conference Location





From San Francisco Int'l BART leaves from the International Terminal and is $10.70 per person each way.

Bart to downtown San Francisco – approximately 35-45 minutes.

Taxi Cabs
From Oakland it is approximately $75 for a cab

From San Francisco it is approximately $180 for a cab without a reservation (can go to $129 if reserved in advance).

From San Jose it is approximately $105 for a cab, vans are available.

Distance to Airports:

Oakland – 19 miles; San Francisco – 34 miles; San Jose – 29 miles

BART map

Pleasanton Area Restaurants

Mediterranean Cuisine

$$ FAZ Restaurant (located in Four Points hotel) 460-0444

American and Continental Cuisine

$$ Black Angus 4814 Dublin Blvd, Dublin 556-9800
$ Cheese Steak Shop 4825 Hopyard Rd 734-0293
$$ The Cheesecake Factory 1350 Stoneridge Mall Rd 463-1311
$$ Chili's 4801 Hopyard Rd 734-0911
$$ Copper Skillet Restaurant 7265 Amador Valley Blvd 828-4731
$$ Eddie Papa's American Hangout 4889 Hopyard Rd 461-2333
$$$ Hap's 122 W Neal St 600-9200
$ Kinder's Meats Deli and BBQ 4825 Hopyard Rd 461-2333
$$$ McNamara's Steakhouse 7400 San Ramon Rd, Dublin 833-0995
$$ Mimi's Café 4775 Hacienda Rd 833-2521
$$ Outback Steakhouse 6505 Regional Dr, Dublin 833-9335
$$ Red Robin 4503 Rosewood Dr 225-1755
$$ Red Smoke Grill 4501 Hopyard Rd 734-0307
$$ Stacey's Café 310 Main St Ste A 461-3113
$ Souplantation & Sweet Tomatoes 4501 Hopyard Rd 463-9285
$ Extreme Pita 4555 Hopyard Rd C-7 462-7848

Breakfast

$ Denica's, 6058 Dougherty Road , Dublin, 829-6200
$$ Dean's Café 620 Main St 846-4222
$ Denny's (open 24hr) 6455 Owens Dr 463-0720
$ IHOP 6397 Dublin Blvd 828-7934
$ Peets Specialty's, 5050 Hopyard Rd, 877-502-2837
$ Starbucks, 4555 Hopyard Rd, 468-0138
$$ Vic's All Star Kitchen 201 Main St. 484-0789

Burgers and Sandwiches

$ Arby's Restaurant 5900 Owens Dr 467-1912
$ Burger King 5315 Hopyard Rd 463-9394
$ In & Out Burger 6015 Johnson Dr 800-786-1000
$ McDonald's 6800 Santa Rita Rd 463-1955
$ Nations 5321 Hopyard Rd 463-2388
$ Subway 4555 Hopyard Rd 460-0707
$ Togo's 3120 Santa Rita Rd 846-8646

Chinese

$ China Village 7200 Regional St, Dublin 829-5292
$ Chinese Szechuan 3059 Hopyard Rd 846-5251
$$ Koi Palace (dim sum) 4288 Dublin Blvd, Dublin 833-9090
$$ PF Chang's China Bistro 1330 Stoneridge Mall Rd 224-9916
$$ Pleasant Asian Cuisine 5901 Owens Dr 847-6081

Deli's & Café's
- $ Café Joy 5321 Hopyard Rd 225-0150
- $ Eric's Deli 4247 Rosewood Dr 847-9755
- $ Jamba Juice 4555 Hopyard Rd 847-8525
- $ Starbucks 4555 Hopyard Rd 468-0138

Japanese
- $$ Sendo Sushi 4555 Hopyard Rd 227-9000
- $$ Senro Sushi 30 W Neal St 600-8040
- $$ Ume Sushi 4855 Hopyard Rd #7 734-0996
- $$ Yanagi Sushi and Grill, 6599 Dublin Blvd, Dublin 556-9575

Mexican
- $$ Alberto's Cantina 435 Main St 462-2316
- $ Baja Fresh Mexican Grill 2457 Stoneridge Mall Rd 251-1500
- $$ Blue Agave 625 Main St 417-1224
- $$ Casa Orozco 7995 Amador Valley Blvd 828-5464
- $ El Molino 5321 Hopyard Rd 463-0428
- $ Rancho Grande Taqueria 2707 Hopyard Rd 600-8620

Indian
- $$ Abhiruchi Indian Cuisine 5100 Hopyard Rd 463-8773
- $$ Ashoka, 3550 Stanley Blvd Pleasanton 846-1185
- $$ Blue Fox Indian Cuisine, 5681 Gilbralter Dr Pleasanton 225-9999
- $$ India Garden 210 Rose Ave 485-4800

Italian
- $$ Campo di Bocce, 175 E Vineyard Ave, Livermore, 24909800
- $$$ Barone's Restaurant 475 Saint John St 426-0987
- $$ De La Torre's Trattoria 6025 W Las Positas Blvd 484-3878
- $$ Fontina Restaurante 349 Main St Ste 150 462-9399
- $$ Strizzi's 649 Main St 484-9600
- $$ La Vite Ristorante 3037-G, Hopyard Road, 94588 485-4800

Pizza
- $$ Amici's East Coast Pizzeria 4640 Tassajara Rd 875-1600
- $$ California Pizza Kitchen 2245 Stoneridge Mall Rd 251-9770
- $ Extreme Pizza 6599 Dublin Blvd Ste G 833-2400
- $ Garlex Pizza and Ribs 4301 Valley Ave 484-4540
- $$ Gay Nineties Pizza 288 Main St 846-2520
- $ Little Caesars Pizza 2889 Hopyard Rd 417-8880
- $ Mountain Mike's 3120 Santa Rita Rd 485-4242
- $ New York Pizza @ 5321 Hopyard Rd Ste D 847-1700
- $ Pizza Guys 4000 Pimlico Dr Ste 110 227-1111
- $ Round Table Pizza @ 4855 Hopyard Rd 847-0752
- $ Straw Hat Pizza 2953 Hopyard Rd 462-1222

Sports Bar & Grill

$ Beeb's Sports Bar and Grill, Las Positas Golf Course, 455-7070
$$ Handles Gastropub, 855 Main St Pleasanton 399-6690
$$ The Hop Yard Alehouse & Grill 3015 Hopyard Rd 462-9600
$$ Sunshine Saloon 1807 Santa Rita Rd 846-6108
$$ Main Street Brewery 830 Main St 462-8218

Thai

$$ Little Home Thai Cuisine 4000 Pimlico Dr 251-9877
$$ Pleasanton House Thai Cuisine 929 Main St 846-1091
$$ ThaiSky 4301 Valley Ave Pleasanton 462-3550

Things To Do in and Around Pleasanton

(Information courtesy of Four Points Sheraton)

Historic Downtown Pleasanton; *www.pleasantondowntown.net*
Charming, historic Downtown Pleasanton is an enjoyable place to shop, dine and meet friends in a quaint, Old California setting. The pedestrian friendly, tree-lined streets offer a vibrant blend of parks and historic buildings, specialty shops and services, fine dining and coffee shops

Alameda County Fairgrounds; 925-426-7600**;** *www.alamedacountyfair.com*
The Alameda County Fair originated in 1859 as a Floral Fair. Its racetrack is the oldest one-mile horse racing track in America, and the fairgrounds host hundreds of events annually. It is also home to Pleasanton Off Track Betting.

Rock'n Jump; 925-828-7676 ext 4; *www.rockinjump.com*
A jumpsafe, clean, fun trampoline experience for every customer. The focus is on continued innovation and safety to ensure a memorable experience for all ages. Corporate, social, youngers and oldsters alike. Great food service is available on-site. 5875 Arnold Road, #100, Dublin, CA .

Earl Anthony's Dublin Bowl; 925-828-7550; *www.earlanthonysdublinbowl.com*
6750 Regional St., Dublin, CA 94568

Livermore Valley Wine Country; *www.livermorewine.com*
Home to over 50 wineries, ranging from handcrafted startups to historic leaders of the California wine industry. Attracting well over 500,000 visitors per year, the Livermore Valley has an east-west orientation, making it unique among Northern California wine growing regions.

Campo di Bocci; 925-249-9800; *www.campodibocce.com*
Campo di Bocce of Livermore is a family-owned Italian restaurant and United States Bocce Federation affiliated Bocce Club located in the beautiful Livermore Valley Wine Country. Please call ahead to reserve a bocci ball court.

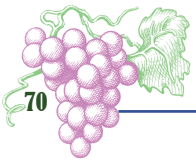
Underdog Wine Bar, Concannon Vineyard; 925-583-1581; *www.underdogwinemerchants.com*
With a host of local wines as well as many others from around the world, Underdog Wine Bar has more than 50 wines available by the glass. The menu at Underdog Wine Bar is carefully designed to complement the wines. Hours: Thursday-Saturday Noon–10pm Sunday-Wednesday Noon–8pm

Blackhawk Museum; 925-736-2277; *www.blackhawkmuseum.org*
Museum Hours Wednesday through Sunday 10:00AM until 5:00PM
The Blackhawk's Museum's automotive exhibition of International Automotive treasures presents and displays historically significant and artistically inspired automobiles.

Stoneridge Mall; 925-463-2770; *www.shopstoneridge.com*
Truly a one-stop shopping destination anchored by Nordstrom, Macy's, Macy's Home, Sears and JCPenney, there are over 165 specialty stores and services with everything you need in one convenient location.

Hacienda Crossings; *www.hacienda-crossings.com*
Located just one mile east off Interstate 580, Hacienda Crossings is home to Best Buy, Old Navy, Pier One and over 20 other fine stores and more than 20 restaurants and the Regal/Imax theater.

Livermore Performing Arts Center; 925-373-6100; *www.livermoreperformingarts.org*
Home to the TriValley Repertory Theater, The Livermore/Amador Symphony and the Livermore



Valley Opera, the Performing Arts Center also hosts many other touring and seasonal concerts and plays throughout the year.

Livermore Premium Outlets; 925-292-2668; *www.premiumoutlets.com/livermore/*
130 outlet stores. Find impressive savings at Armani, Barneys New York, Bloomingdale's Outlet, Burberry, Cole Haan, DKNY, Elie Tahari, Kate Spade...

Pleasanton Sports Fields; *www.ci.pleasanton.ca.us/services/recreation/sports-and-sport-fields.html*
Home of regional soccer, baseball, softball and numerous other sports tournaments

Shadow Cliffs Regional Recreation Area; 925-846-2988; *www.ebparks.org/parks/shadow_cliffs*
Picnic areas, hiking, fishing, swimming, and fun for the whole family

Mount Diablo State Park; 925.838.9225; *www.parks.ca.gov/?page_id=517*
for weather conditions. This park is one of the ecological treasures of the San Francisco Bay Area. Every season in the park has its own special qualities. Discover the mountain's beautiful wildflowers, extensive trail system, fascinating wildlife, and distinctive rock formations. View the stars from its lofty heights, bike ride to the 3,849 foot summit or explore the more remote trails on horseback.

Boomer's; 925-447-7275; *www.boomersparks.com/site/livermore*
Family fun with go-kart tracks, bumper boats, miniature golf, video arcade and café.

Tommy T's Comedy Steak House; 925-227-1800; *www.tommyts.com/pleasanton/index.htm*
As the name implies, Tommy T's Comedy and Steakhouse is a great place to sink your teeth into a steak, and catch a big name comedian tear into an unforgettable set.

The Tri-Valley Area is home to many great golf courses – here's a sampling of some of our favorites:
CityGolf; 925-484-4653; *www.citygolfca.com*
6 high definition golf simulators; 30 min. or 3 hours, rain or shine, day or night, play/practice

The Bridges Golf Course; 925.735.4253; *www.thebridgesgolf.com*
18 hole, par 72. Driving range, lessons, full services available

Callippe Preserve Golf Course; 925.426.6666; *www.playcallippe.com*
18 hole, par 72. Driving range, lessons, full services available

Las Positas Golf Course; 925.443.3122; *www.laspositasgolfcourse.com*
18 hole, par 72. Driving range, full services available

Poppyridge Golf Course; 925.455.2035; *www.poppyridgegolf.com*
18 hole, par 72. Driving range, lessons, full services available

Sunol Valley Golf Course; 925.862.0414; *www.sunolvalley.com*
Two 18 hole, par 72 courses. Driving range, lessons, full services available

Wente Golf Course; 925.456.2475; *www.wentevineyards.com/golf*
18 hole, par 72. Driving range, lessons, full services available

Pleasanton Fairways Golf Course; 925.462.4653; *www.pleasantongolfcenter.com*
9-hole, par 30 Executive Course. Home of the First Tee of the TriValley. Driving range, lessons, full services available

Notes

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