Subcommittee on Consequence Assessment and Protective Actions (SCAPA)

2011 ANNUAL MEETING

Charleston, SC
May 2, 2011

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Executive Summary

The DOE Subcommittee on Consequence Assessment and Protective Actions (SCAPA) convened its annual meeting at the Marriott Hotel in Charleston, S.C., on May 2, 2011, in conjunction with the 25th Meeting of the Emergency Management Issues Special Interest Group (EMI SIG) meeting (see agenda). More than 50 individuals from the public and private sectors participated in this year's SCAPA meeting.

The primary purpose of the annual SCAPA meeting is to provide a forum for SCAPA participants to review its accomplishments, products, and projects and to discuss its present and future missions. Eighteen technical presentations of interest to the membership, including those from the five active SCAPA Working Groups and the National Atmospheric Release Advisory Capability (NARAC) User Group, were delivered. Each of the working group (WGs) continues their work in the coming year and will report on their activities at the next SCAPA meeting. That meeting is scheduled for May 7–10, 2012, in conjunction with the next EMI SIG meeting in Seattle, WA.

The meeting had three distinct parts:

1. Joint session of SCAPA/DMCC and HASC, which dealt with dispersion modeling
2. Lunch and learn workshop, in which a panel addressed direction-specific initial protective actions
3. SCAPA meeting

The agenda for the meeting is presented below.

Meeting Agenda

	Time (EDT)
JOINT SESSION: SCAPA/DMCC/HASC	
Dispersion Modeling	
INL HYSPLIT (Kirk Clawson, AFLFRD/INL)	1030–1055
LANL CAPARS (John Ciolek, AlphaTRAC	1055–1120
Turbulence and Concentration Averaging Times in Plume Models (John Nasstrom, LLNL)	1120–1145
LUNCH & LEARN WORKSHOP	
Direction-Specific Initial Protective Actions: Forum Discussion of Technical, Policy, Health Risk and Other Considerations (Jeremy Rishel, PNNL)	1215–1300
SCAPA MEETING	
Welcome, Introductions, and General Topics	
Welcome and Review of Meeting Agenda (Cliff Glantz, PNNL)	1315–1320
Introduction of SCAPA Members (Carl Mazzola, Shaw Environmental)	1320–1335
Welcome and Brief Update on DOE/NA-41 Activities (Dave Freshwater, DOE)	1335–1340
SCAPA Year in Review (Carl Mazzola, Shaw Environmental)	1340–1350
What's New with the SCAPA Website (Cliff Glantz, PNNL)	1350–1355
Consequence Assessment Modeling	
New DOE/HS-23 Software Quality Assurance Order and Guide (Cliff Glantz)	1355–1410
SCAPA Consequence Assessment Modeling Toolbox (Jeremy Rishel)	1410–1435
Software Quality Assurance Lessons: CAPARS Experience (John Ciolek, AlphaTRAC)	1435–1455
Biosafety Working Group	
Biosafety Working Group Accomplishments (Dina Siegel, LANL)	1455–1505
Source Term Working Group	
Source Term Working Group Accomplishments (Michele Wolfgram, ORNL)	1505–1515

1.0 Reports on SCAPA Program Initiatives/Other Matters of Interest

1.1 INL HYSPLIT

Rick Eckman presented a status briefing on the HYSPLIT code that Idaho National Laboratory (INL) is developing for emergency response to replace the 30-year old MDIFF code.

Rick discussed the MDIFF Modeling System, the rationale for NOAA HYSPLIT model adoption, and the requirements and drivers for the new INL HYSPLIT system. The talk then focused on the current modeling applications of HYSPLIT; the HYSPLIT model evaluation; HYSPLIT training, popularity, and its relevancy; and finally the adaptation of HYSPLIT for use at the INL.

Rick briefly discussed the attributes of the older MDIFF model which is an in-house system that has been largely unchanged since the 1990's. This code is DOS/Windows 3.1-based, a puff model with a two-dimensional wind field. The main reasons why this code is being replaced by HYSPLIT is that there is no effective outside support for MDIFF and resources are insufficient to continue operating this model in isolation. Moreover, it lacks important features such as deposition, dose computations, and forecast capability.

Rick moved on to discuss the NOAA HYbrid, Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model, which was first developed in the 1980's, is continuously updated and widely used within and outside NOAA for assessment of emergency response, radiological plumes, chemical plumes, volcanic ash, air quality, wildfire smoke, dust, dioxin, and mercury impact assessment.

HYSPLIT uses NOAA forecast models; is a three-dimensional wind field model; and includes deposition, decay, doses, and multiple radionuclides. It follows particle motion; is run off-line (which makes it easy to re-run); requires meteorological fields; and provides particle or puff solutions on UNIX, PC, Mac, and Web architectures.

He briefly discussed future directions for the INL HYSPLIT code. This includes in-line and multi-CPU architectures and shared memory optimization.

Rick reviewed some requirements for a new INL HYSPLIT System. It must retain the popular features from MDIFF system, have the appropriate client/server configuration, be able to run pre-configured INL release scenarios, and execute rapidly.

INL HYSPLIT has a high-quality background map with terrain, cities, and other important features and provides the user with an easy manipulation of output plots. HYSPLIT provides "now-casts" or forecasts, addresses multiple radionuclides with dose computations, and provides meaningful contours for emergency managers. INL desires that HYSPLIT use existing NOAA modeling capability as much as possible.

Rick then reviewed the national drivers associated with NOAA HYSPLIT which includes the National Response Framework (NRF) as approved by the President. An interesting aspect of this modeling effort is the collaboration with NOAA to include the Areal Locations of Hazardous

Atmospheres (ALOHA) source model, which provides a link to the Computer-Aided Management of Emergency Operations (CAMEO) chemicals data.

Rick reviewed the HYSPLIT model annual training which involves 3-day training workshops—14 have been held since 2004.

HYSPLIT is a popular and relevant code that has been used to perform consequence assessments on the Deep Water Horizon oil spill, the Iceland volcano, and the Japanese Fukushima Dai-ichi nuclear reactors.

Rick outlined future work that ARL FRD hopes to accomplish:

- Add new INL-specific features
- Address radiological releases from arbitrary location (e.g., transportation event)
- Improve its execution speed
- Use the emerging technology of Graphics Processing Units (GPUs)
- Employ multi-core processing, improve the mesonet pre-processor with an improved diagnostic model
- Develop a scenario management program

Integrate with other NOAA dispersion codes (e.g., ALOHA)

1.2 LANL CAPARS

John Ciolek discussed the new CAPARS code that is being installed at Los Alamos National Laboratory (LANL).

John reviewed the CAPARS requirements, which are to automate as much as possible, reduce input error and provide decision-critical information. Other desirable attributes are to address client-specific requirements, ensure timeliness for emergency response requirements, rapid simulation completion, contingency modeling, redundancy, and the ability to rapidly incorporate new meteorological data sources.

John reviewed the CAPARS basics. CAPARS, developed for real-time analyses, is a localized modeling system customized for individual sites, is a diagnostic code which can utilize prognostic model output and has automated meteorological data collection and time time-varying 3-dimensional meteorological fields. CAPARS simulations involve the emission of ellipsoidal puffs and the model tracks dispersion using similarity theory, plume characteristics, wet and dry deposition, plume rise, and radiological in-growth and decay. Impacts are presented using nested receptors, time-varying dose, concentration, and deposition.

John then presented some CAPARS wind field images at LANL which he characterized as a domain that poses interesting challenges. These include very complex terrain, steep canyons and finger mesas, a location on an extinct volcano caldera, and drainage into the Rio Grande rift valley.

John mentioned that in each nested domain, the following data sets are presented:

1. Terrain elevation
2. Land use/land cover
3. Terrain variability
4. GIS map features
5. Meteorological data from 25 to 50 surface stations
6. Meteorological data from 5 LANL towers
7. Input from the LANL Sonic Detection and Ranging (SODAR)
8. 13 MAPS profiles.

Although this data set is comprehensive and rather large, LANL is still investigating the availability of additional data sources.

One unique feature is the use of embedded meteorological data profiles since the terrain is so rugged and complex. This technique determines regional meteorological fields and extracts profiles along the middle-domain lateral boundaries, while inserting profiles into middle-domain meteorology input data set. Thus it is built on middle-domain meteorological fields, which is then repeated for the inner-domain.

John showed CAPARS outputs of a canyon flow with a reversal and a detailed view of the canyon.

1.3 Turbulence and Concentration Averaging Times

John Nasstrom discussed the effect of averaging times on plume concentrations using Gaussian models and the sensitivity of the results to the selected averaging time.

1.4 Welcome and Brief Update on DOE/NA-41 Activities

Dave Freshwater, NA-41 SCAPA Lead, welcomed all who were in attendance and gave a brief update on NA-41 activities associated with the SCAPA program.

1.5 SCAPA Year in Review

Carl Mazzola provided a brief overview of SCAPA accomplishments from May 2010-April 2011, inclusive of the work performed by each of the five SCAPA Working Groups.

Carl briefly discussed the last annual SCAPA meeting, held on May 3, 2010, in Las Vegas, Nev., which had more that 60 attendees, and 19 technical presentations. The report is posted on the SCAPA web page. Since that meeting, six full-SCAPA bimonthly teleconferences were conducted which provided continuity between annual meetings. The attendance ranged between 17–25 attendees, with an average of 22.

Carl reviewed the significant actions of the five active SCAPA Working Groups, as follows:

- The Chemical Exposures Working Group (CEWG) updated the Protective Action Criterion-Temporary Emergency Exposure Limit (PAC/TEEL) data set and the associated

Workbook and database. Published in September 2010, Revision 26 provides PAC/TEEL values for 3,383 chemicals. The CEWG is in the process of developing PAC/TEEL Revision 27 which incorporates an updated TEEL development methodology. The publication date for Rev 27 is undetermined.

- The Chemical Mixtures Working Group (CMWG) continues to enhance the Chemical Mixture Methodology/Health Code Number (CMM/HCN) and develop supporting products (which include the CMM Online Wizard). CMM Rev 26 includes updated HCNs for about a thousand chemicals and incorporates the latest PAC/TEEL data. The CWMG is in the process of developing CMM Revision 27, which will be published nearly simultaneously with PAC-TEEL Revision 27. Carl also discussed the status of the HCN toxicology publications. The first article was published in the Journal of Applied Toxicology. The second article is drafted for a different technical journal, and the third article is in early draft stage.
- The Consequence Assessment Modeling Working Group (CAMWG) supported the work that enables the consequence assessment code HOTSPOT 2.07 to be included in DOE Central Registry Toolbox for Safety Software. The CAMWG also developed its own Consequence Assessment Self-Assessment Tool and the SCAPA Toolbox for Safety-Related Software. Work is underway to populate the SCAPA Toolbox. Consequence models are being evaluated against the guidance provided in SCAPA's *Software Quality Assurance (SQA) Guidance for Consequence Assessment Software Designed for Safety-Related and Other Non-Safety Applications.* The SQA assessment for CAPARS is complete and APGEMS and NARAC are the next modeling systems to be reviewed for admission to the Toolbox.
- The Biosafety Working Group (BWG) continues its association with the American Biological Safety Association (ABSA) and several BWG members attended the ABSA Annual Meeting that was held in Denver, Colo., in September 2010. BWG members published a technical article in the Journal of Applied Biosafety, entitled, "Incident Response Planning for Biocontainment Facilities in the DOE National Laboratory Complex." BWG also reviewed Draft DOE O 456.1, "Safe Handling of Nanoparticles," and shared news of key technical and regulatory publications affecting biosafety-related issues.
- The Source Term Working Group (STWG) developed several technical products which included a Frequently Asked Questions associated with the DOE Transuranic waste standard and its application to Emergency Preparedness Hazards Assessments, development of a criticality source term, and examination of available Leak Protection Factors. Additionally, ball-milled plutonium-238 source terms were examined and non-respirable source terms were reviewed to ensure appropriate assessment of non-respirable dose impacts (e.g., gamma cloud ground shine). Lastly, the STWG studied Dose-Equivalent curies to support emergency planning and plume modeling during real events.

1.6 What's New with the SCAPA Website?

Cliff Glantz provided an update of the structure and contents of the SCAPA website and briefly described the contents for each WG webpage.

1.7 New DOE/HS-23 Software Quality Assurance Order and Guide

Cliff Glantz discussed the activities associated with software quality assurance. In 2005 DOE issued an Order and Guide establishing SQA requirements for safety software (i.e., DOE O 414.1C and DOE G 414.1-4, respectively). Recently, a revision to the order, DOE O 414.1D, was issued.

Cliff mentioned that this Quality Assurance (QA) Order applies to all work conducted by, or for the DOE. DOE programs must still meet all other QA regulatory requirements of the Nuclear Regulatory Commission and Environmental Protection Agency. In DOE O 414.1D, the definition of safety software remains essentially unchanged—all software, not just safety software, must meet ten basic QA criteria, as follows:

1. Have a framework for your SQA Program. Establish responsibilities for managing, performing, and assessing work. Establish processes for funding, planning and scheduling work.
2. Train project personnel. Train and certify personnel to do their assigned work. Provide continuing training.
3. Conduct quality improvement activities. Implement processes to detect, prevent and correct problems. Identify the causes of problems and prevent recurrence. Identify items needing improvement.
4. Prepare and maintain records. Prepare and maintain QA-related documents and records.
5. Follow Regulations and Contracts. Perform work according to regulatory and contract requirements.
6. Design and test software before implementation. Perform design work according to sound engineering and scientific principles and requirements. Verify and validate work before implementation. Do not have people verify and validate their own design work.
7. Define and implement procurement requirements. Implement procurement requirements. Use criteria to evaluate and select prospective suppliers.
8. Conduct acceptance testing. Test software using established acceptance and performance criteria.
9. Identify and fix QA problems. Management works to identify and correct organizational SQA problems.
10. Conduct independent assessments. Plan and conduct independent assessments. Ensure that persons who perform independent assessments are technically qualified. Ensure assessors are not subject to conflicts of interest.

Cliff then presented an excerpt from DOE G 414.1-2B, which states: "Risk is a fundamental consideration in determining the extent to which controls should be applied at the facility level. The type and amount QA controls should be dependent upon function, complexity, consequence of failure, reliability, repeatability of results, and economic considerations."

The graded approach to QA in DOE Order 414.1D should be commensurate with:

1. The relative importance to safety, safeguards, and security
2. The magnitude of any hazard involved
3. The life-cycle stage of a facility or item
4. The programmatic mission of a facility
5. The particular characteristics of a facility or item
6. The relative importance to radiological and non-radiological hazards
7. Any other relevant factors

Cliff reported that DOE/HS-33 has not provided any indication when work will begin to update the DOE SQA guide for safety software. The Guide is where “the rubber meets the road” and the real implications occur for consequence assessment models.

1.8 SCAPA Consequence Assessment Modeling Toolbox

Jeremy Rishel reported that for the development of new or the upgrading of existing safety-related and other non-safety consequence assessment software, the SCAPA SQA Guidance document recommends minimum compliance levels for each of the ten SQA work activities described in DOE G 414.1-4. The SCAPA Consequence Assessment Modeling (CAM) Toolbox website will provide a repository for consequence assessment models that adhere to the SCAPA SQA guidance.

Key areas of importance for SQA are as follow:

1. Technical and user documentation
2. Configuration management
3. Verification & validation testing
4. Problem reporting and sharing

Jeremy indicated that there are many benefits of the SCAPA CAM Toolbox. One benefit is to provide a “one-stop-shopping” website with introductory material on the models and links to more detailed information on the model’s individual websites. Additional benefits are to support the continued use of the “tried-and-true” legacy codes, and to spearhead the drive toward the adoption of consistent, reasonable SQA practices.

Jeremy then moved on to efforts associated with populating the CAM Toolbox. The first step is to select models for conditional acceptance into the toolbox. The starting set will focus on the

most widely-used models for safety-related consequence assessment applications. These include:

1. CAPARS (effort complete);
2. APGEMS (effort underway);
3. NARAC (perform self-assessment gap analysis); and,
4. RASCAL, HYSPLIT, RAMS/LPDM, and Puff-Plume.

Jeremy indicated that a second set of models will be considered later.

CAMWG members will be selected to review and evaluate the SQA gap analyses prepared by the model developers and then work with the model development team to formulate a plan to prioritize and close any SQA gaps.

Jeremy then reviewed the toolbox-related work activities during the past year.

The CAPARS review team included Michelle Wolfgram, Hoyt Walker, Erik Kabela, Cliff Glantz, and Jeremy Rishel. The CAPARS gap analysis and model documentation was provided by John Ciolek, and the gap analysis covered each of the ten SQA work activities. Over a period of a few weeks, the team reviewed the documentation and provided feedback and scores on each work activity.

In general, the best scores were for the high priority SQA work activities. Each work activity either met or partially met its objectives.

Cliff Glantz then discussed development of the SCAPA CAM Toolbox website. The site, along with the first tier model SQA reviews, will be completed by the end of FY11. The CAM Toolbox Homepage provides an introduction to the toolbox, and offers four other web pages:

1. Link to SCAPA SQA guidance
2. Current toolbox models
3. Future toolbox models
4. Problem reporting and questions

The web page also provides a status report on the current set of Toolbox models, and offers left navigation page links to information and SQA gap analysis reviews for the models. It also has clickable links in the status table and provides information on the future set of candidate models. Each model has its own webpage information.

1.9 Software Quality Assurance Lessons: CAPARS Experience

John Ciolek discussed the lessons learned as CAPARS was the first model to undergo the SCAPA SQA process. John emphasized that this presentation is not about the SCAPA SQA process or the SCAPA toolbox CAPARS SQA. Instead, this presentation is about what AlphaTRAC did for the SCAPA SQA review and the problems encountered in the process.

John stated that the purpose of this presentation is to help other model developers going through the SCAPA SQA process to learn from mistakes and successes, to reduce effort and cost, and to initiate a common framework for SQA review. John noted that SQA is largely a documentation effort.

John stated that CAPARS is a legacy real-time, emergency response atmospheric dispersion modeling system developed at Rocky Flats. Through a technology transfer to AlphaTRAC, the TRAC code was continuously improved to its present form. It was implemented at several DOE facilities and used by various state and county departments of health. CAPARS received formal acceptance of its extensive validation program in the 1990s and was developed before DOE SQA guidelines and requirements even existed. The previous SQA effort applied internally-developed QA programs based on ASME/NQA-1 adapted for software systems. These QA programs were updated several times—each time driven by project needs.

John discussed various problems encountered with the previous SQA. Five different SQA programs, various inconsistencies, differences, ownership changes, and funding changes were compounded by records retention issues. This resulted in a challenge for the CAPARS SCAPA SQA effort. However, lessons learned and information from the reviewers provide a framework for any other future SQA effort.

John stated that organization was the greatest challenge faced in the SQA process. Questions associated with how to present, store, and maintain information were encountered as there were no widely used systems in industry. AlphaTRAC spent about 150 hours solving these obstacles. The solution was to develop an MS SharePoint site for SQA Centralized repository for information. The easy navigation and search capabilities allows for many contributors.

The CAPARS SCAPA SQA had 10 SCAPA-defined work-activity components and 39 sub-components, some of which were not part of the SCAPA SQA. An example involved the design elements which are common for all following the SCAPA SQA process.

With respect to the code element evaluation, the modeler needs to define everything that makes up a system and the code element structure should be identical for all modeling systems.

CAPARS version 5.11 has 21 releases identified in its sub-system. These are discrete elements that usually function independently, and include:

1. Meteorological data
2. User interface
3. Model
4. Task manager
5. Mapping server
6. Utilities
7. Product display and access component

Conceptual portions of sub-systems (e.g., health, depositions components of model sub-system) involve 26 CAPARS components. There are 122 CAPARS programs module software elements that make up a program and in total, about 600 CAPARS modules.

CAPARS version 5.11 installation at LANL was performed during SCAPA SQA benchmark evaluation. AlphaTRAC decided to use the SCAPA SQA process which required four system modification projects. Two types of SQA documentation were identified.

John stated that after the SQA benchmark, AlphaTRAC will document all SQA work in electronic logbooks and use MS Word documents. The installation SQA requires multiple logbooks depending on the activity. John stated that the development project SQA requires two logbooks:

1. Administration Log Project Log
2. Installation Logs.

John reviewed the lessons learned. The primary lesson is that SQA organization is difficult. It is important that to use existing tools, templates as much as possible to minimize the amount of documentation that is required. The SQA SharePoint design that AlphaTRAC uses saves much effort. Another challenge is that benchmarking work performed more than 5 years ago is challenging and following the SCAPA SQA process adds cost to projects. This additional cost needs to be quantified in project estimates. However, continually following a well-designed SQA system should minimize this cost.

1.10 Biosafety Working Group Accomplishments

Dina Siegel presented the 2010–2011 accomplishments of the BWG. The BWG is continuing its alliance with American Biological Safety Association (ABSA) and will be attending the ABSA annual meeting in October 2011.

Dina emphasized that the BWG had active participation in the Federal Experts Security Advisory Panel (FESAP) working group for National Institutes for Health (NIH) and the United States Department of Agriculture (USDA).

Dina mentioned that the BWG published an article in the ABSA Journal of Applied Biosafety which was authored by Roberto, Sentieri, Horton, and Powers, and entitled, “Incident Response Planning for Biocontainment Facilities in the Department of Energy National Laboratory Complex.”

Lastly, Dina reviewed topics that the BWG will address in 2012. These include the development of TEELs for biological toxins, membership coordination with the DOE Executive Biosurety Working Group, involvement with several additional technical publications, and tasks associated with the implementation of Executive Order (EO) 13546, “Optimizing the Security of Biological Select Agents and Toxins in the United States."

1.11 Source Term Working Group Accomplishments

Michele Wolfgram presented the seven (7) 2010–2011 accomplishments of the STWG, reviewing the various activities, as follows:

- STWG AI 08-01: The DOE Transuranic (TRU) waste standard (DOE-STD-5506-2007) paper regarding applicability of TRU Standard for Emergency Planning Hazards Assessments was issued. This successful activity is closed.
- STWG AI 08-02: The non-radiological vs. radiological health effects was determined to be a facility-specific issue with no reasonable general approach to be pursued any further. This activity is closed.
- STWG AI 09-01: Criticality source terms were studied and reviewed and an information paper was posted on the Source Term Information web page. This successful activity is closed.
- STWG AI 09-02: Studies on ball-milled Pu-238 were reviewed and an information paper was issued on the Source Term Information web page. This successful activity is closed.
- STWG AI 09-03: A respirable versus non-respirable source term comparison study is ongoing. Wayne Davis presented the concern that gamma-emitting radionuclides, if a major part of the source term mix, would make the inhalation pathway evaluation non-conservative. Wayne presented his findings at the STWG Meeting and is developing a paper to be sent for STWG review.
- STWG AI 09-04: A summary of Leak Protection Factors (LPFs) continues. A panel discussion on LPFs was conducted at the last annual meeting. This successful activity is closed.
- STWG AI 09-05: A paper was drafted on Dose Equivalent (DE) Curies by Dan Conners. Since Dan has been reassigned, the STWG is looking for a new point of contact to move the work forward.

1.12 PAC/TEEL Development Team Accomplishments

Jayne-Anne Bond discussed the accomplishments with respect to PAC/TEEL development since the last annual SCAPA meeting.

Jayne-Anne defined TEELs and mentioned the individuals involved in the development process since Doug Craig created the first TEELs in the early 1990's. In 1991, the Revision 1 TEEL data set consisted of 86 chemicals, while 19 years later, the 2010 Revision 26 PAC/TEEL data set is up to 3,388 chemicals. The work of the NA-41 TEEL development team is documented in DOE HDBK-1046-2008.

Jayne-Anne reported on how the TEELs Advisory Group (TAG) enables NA-41 to appropriately oversee the fidelity of the TEEL development process and TEEL values. She then discussed the difference between a PAC and a TEEL.

She identified two web pages that DOE sites should use to request the development of PAC/TEEL values:

- https://orise.orau.gov/emi/forms/TEELRequestForm.html
- https://orise.orau.gov/emi/forms/TEEL-RequestforReview-Form.html

1.13 Enhancing and Updating the TEEL Development Methodology

Doug Craig discussed the TEEL development methodology. Until recently, this methodology remained fundamentally unchanged since the 1990s. This methodology has been applied in accordance with DOE O 151.1C and the DOE G 151.1-series Emergency Management Guide. An Outside Review Group, appointed by NA-41, provided several recommendations for improving this methodology. Accordingly, it is time to update the methodology based on those recommendations.

Doug discussed the PAC data set definitions, the searchable data base, the presentation of PAC values in Excel and PDF formats.

Every year, the PAC/TEEL database collects information on the chemical of most interest and who is using the database. In 2010, the top 10 States using the PAC database were California, Colorado, Tennessee, District of Columbia, Washington, Massachusetts, New Jersey, Idaho, Virginia, and New York. The top 10 countries were the United States, Canada, Germany, France, Spain, Israel, Australia, Japan, China, and Belgium.

Doug next talked about the report of the Outside Review Group, which focused on the development of more robust and updated adjustment and multiplication factors and the need to develop a process or criterion to identify materials in the PAC data set that are not likely to cause an operational emergency.

Doug discussed various aspects of PAC/TEEL adjustment factors and statistics associated with them. The TEEL development team plans to identify chemicals that are candidates for removal from the PAC/TEEL data set, including those that will not cause an operational emergency, cannot attain toxic concentrations in the air nor have the inability to generate high airborne levels. A list of identified chemicals will be given to NA-41 for consideration.

Doug indicated that a TEEL Review Panel was established by NA-41 to resolve technical conflicts regarding the implementation of the enhanced methodology.

1.14 Changes to the TEEL Database during 2010 and 2011

Doug Craig discussed the changes to the TEEL data base since the last SCAPA annual meeting. The PAC/TEELs Revision 26 was completed and published on September 30, 2010.

Doug mentioned that the Outside Review Group recommendations were submitted to NA-41, who promptly issued 18-point update instructions. The PAC/TEELs Revision 27 will reflect the methodology changes and will include a revised workbook.

The major changes from PAC/TEELs Revision 25 to Revision 26 were the next topic of discussion. The toxicity data was updated for 785 chemicals, most of which were on the

PAC/TEEL list before September 30, 1997. Rigid rules for data selection followed. In addition, columns of dates were added and populated in the data set—including the dates the TEELs were first derived, last reviewed, and last changed. Additional details were also added to Source-of-PACs column. The concentration dependence of toxicity (Y or N) was reevaluated for many chemicals. Columns added included:

1. PAC-TEEL values changed from PACs Rev 25 (this information was previously placed in the "Comments" column)
2. National Fire Protection Association (NFPA) Health Hazard Rating

A few new chemicals were added, which were mainly chemicals for which new Acute Exposure Guideline Limits (AEGLs) or Emergency Response Protection Guidelines (ERPGs) were published in 2010.

Doug then focused his talk on the effort associated with PAC/TEELs Revision 27:

1. All TEELs to be based on 60 minute exposure
2. All time scaling to use ten Berge equation (C^n x t = K) where n = 1 when extrapolating to longer times and n = 3 when extrapolating to shorter times
3. Eliminate the AEGLs Adjustment Ratio for human-equivalent concentrations that were used in the past to compare animal toxicity data to ERPG-2 or ERPG-3
4. New ratios of toxicity data to AEGLs are to be computed
5. Reference hierarchy order for consulting primary references are to be changed
6. Species hierarchy to be changed to human, monkey, dog, rat, mouse, rabbit, guinea pig, cat, and pig
7. Routes of Exposure used for toxicity data limited to, in order, inhalation , oral (os), dermal (sk), intraperitoneal (ip), and intravenous (iv). This is a significant change from the past
8. Default exposure times are to be used when not specified for acute exposures. For intermittent exposures all species = 360 minutes for least number of days. For continuous exposures, all species = 1440 minutes for least number of days
9. Rearranged exposure limit priorities

Doug concluded his talk with the discussion of the final step in the TEEL derivation. A review panel will be convened to apply a "laugh test" to all TEEL values (i.e., does application of the default methodology yield TEEL values that are reasonable, and are consistent with the definitions at each level?).

1.15 Chemical Mixture Methodology – 2010 Overview

Rocky Petrocchi presented the CMM improvements since the last SCAPA annual meeting.

Rocky indicated that with respect to CMM Revision 25, approximately 1000 chemicals (no HCNs) were developed by a PNNL Intern. CMM Revision 26 had approximately 1000 older chemicals HCNs updated by another PNNL intern with QA performed on two-thirds of the HCN updated data base. These will be posted on the SCAPA website soon.

Rocky provided a preview to the plans for CMM Revision 27. Approximately 1000 older chemicals HCNs were updated by a third PNNL Intern in 2010 with 15% QA yet to be performed. Nearly the whole HCN data base will be updated. These will also be posted to the SCAPA website around Christmas 2011.

Rocky then presented further improvements that will be undertaken in Revision 27. Chemicals with extremely conservative HCNs [i.e., HCN 4.00 (General acute effects) + HCN 3.00 (General chronic effects)] reserved for chemicals with no useful toxicological data, were added to every target-organ exposure bin. This assumption produces very conservative results. About 10% of the HCN data base, approximately 370 chemicals, will be evaluated to find more specific-toxicity HCNs. Accomplishment of this task will make results more realistic.

Rocky stated that an effort to make the CMM-HCN/PAC coordination more efficient will decrease manual effort and time for CMM revisions.

There are currently 10 biotoxins in the HCN data base with no HCNs assigned. An open TAG question—"Should biotoxin HCN development be more in-depth?— is currently under discussion.

Rocky next mentioned the CMM Publication “The Development and Application of the Chemical Mixture Methodology in Analysis of Potential Health Impacts from Airborne Releases in Emergencies.” Xiao-Ying Yu was the lead author with 9 co-authors. This was published on 15 July 2010 in the Journal of Applied Toxicology. The publication describes improvements in the CMM since its original publication in 1999.

There will be two new PNNL interns this summer. One Intern will help with the CMM-HCN program and the other will help with further CMM Wizard development. The latter intern is being funded through the National Science Foundation (NSF)-STAR program at no cost to DOE.

1.16 Enhancing Emergency Preparedness Analysis: The CMM Wizard

Jeremy Rishel discussed the CMM Wizard. This is an online, user-friendly version of the CMM Excel Workbook. Four sequential steps guide the user through the process of calculating a mixture’s hazard indices (HIs). The Workbook’s chemical data are stored in an Access database and the web-forms update dynamically based on user input.

The CMM Wizard most noticeably enables access from any computer with internet access. There is no need to download anything and no need to enable macros. Chemical updates are immediately available to the end user. Some other benefits of the CMM Wizard Application are:

1. Four simple steps require very little learning curve
2. Unlimited chemicals can be added to a mixture

3. Chemical can be quickly queried based on compound name, Chemical Abstract Services Registry Number (CASRN) or Sax number, and then be added to a mixture
4. Integrity of the underlying chemical data can be better maintained because the data are stored in a database

Jeremy then presented a demonstration using the workbook through a sample problem.

- Step 1: Select method of adding chemical to mixture
- Step 2: Select the chemical compounds to add to the mixture
- Step 3: Input concentrations at the receptor point
- Step 4: Select protective action criteria as basis for calculating HIs
- Examine results (HI Summary)
- Examine results (HIs by Mode)
- Examine results (HIs by Target Organ)

Jeremy concluded his presentation by discussing the CMM Wizard future refinements. In the short term, there will be general interface improvements. These include:

1. Provide the ability to save and open previously defined mixtures
2. Provide the ability to add multiple receptor distances for calculating His
3. Provide ability for additional entry of assumptions used in analysis (e.g., wind speed, stability class)

In the longer term, there are plans to directly link the Wizard to an atmospheric dispersion model (e.g., EPICODE) to automatically calculate concentrations at defined receptor locations.

1.17 EMI SIG Meeting Schedule and Working Group Schedule

Cliff Glantz reviewed the remaining schedule of SCAPA events.

The schedule for Tuesday activities:

- 7:00 AM– 8:00 AM: Source Term Working Group (Crystal Ballroom D)
- 11:30 AM – 1 PM: NARAC/HOTSPOT User's Group (Crystal Ballroom D)
- 5:00 PM – 6:00 PM: Consequence Assessment WG (Crystal Ballroom D)
- 6:30 PM – 8:30 PM: SCAPA Dinner.

The schedule for Wednesday activities:

- 7:00 AM – 8:00 AM: Biosafety Working Group (Crystal Ballroom EF)
- 11:30 AM – 1:00 PM: TEEL Advisory Group (TAG) (Crystal Ballroom D)

The schedule for Thursday activities:

- 8:00 AM – Noon: Tour of Port of Charleston Emergency Management
- 8:00 AM – 5:00 PM: EOTA Exercise Design/Exercise Builder Course

Cliff mentioned that the all-day HotSpot workshop and computer practicum was postponed and will likely be conducted in conjunction with the NARAC September 12–14, 2011, training class at Lawrence Livermore National Laboratory.

1.18 Closing NA-41 Remarks

Dave Freshwater closed the meeting indicating that the SCAPA program remains successful.

2.0 Meeting Attendees

The following identifies individuals who signed the attendance roster for the meeting and their respective company affiliations. Additional EMI SIG members were in attendance for portions of the meeting but did not sign the roster. Each individual was given a brief opportunity to introduce themselves, discuss their background, and relate what role they played in the SCAPA program.

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3.0 Acronyms and Initializations

A

ABSA	American Biological Safety Association
AEGL	Acute Exposure Guideline Limit
AIHA	American Industrial Hygienist Association
ALOHA	Areal Locations of Hazardous Atmospheres
APGEMS	An atmospheric transport and dispersion model
ARL FRD	Air Resources Laboratory Field Research Division
ARL SORD	Air Resources Laboratory Special Operations and Research Division
ASME	American Society of Mechanical Engineers
ATL	Advanced Technology Laboratories

B

BNL	Brookhaven National Laboratory
BSL	Bio Security Level
BWG	Biosafety Working Group

C

CA	Consequence Assessment
CAM	Consequence Assessment Modeling
CAMEO	Computer-Aided Management of Emergency Operations
CAMWG	Consequence Assessment Modeling Working Group
CAPARS	Computer-Assisted Protective Action Recommendation System
CASRN	Chemical Abstract Services Registry Number
CEWG	Chemical Exposure Working Group
CMM	Chemical Mixture Methodology
CMWG	Chemical Mixtures Working Group
CO	Colorado
CPU	Central Processing Unit

D

DE	Dose Equivalent
DMCC	DOE Meteorological Coordinating Council
DOE	Department of Energy
DOS	Disk Operating System
DOT	Department of Transportation

E

EMG	Emergency Management Guide
EMI	Emergency Management Issues
EO	Executive Order
EOC	Emergency Operations Center
EOTA	Emergency Operations Training Academy
EPA	Environmental Protection Agency
EPHA	Emergency Preparedness Hazard Assessment
EPICODE	An atmospheric transport and dispersion model
ERP	Emergency Response Planning
ERPG	Emergency Response Planning Guideline

F

FAQ	Frequently Asked Question
FESAP	Federal Experts Security Advisory Panel
FY	Fiscal Year

G

GIS	Graphical Information System
GPU	Graphics Processing Unit

H

HASC	Hazards Assessment Subcommittee
HCN	Health Code Number
HDBK	Handbook
HHR	Health Hazard Rating
HI	Hazard Index
HOTSPOT	An atmospheric transport and dispersion model
HS	Health and Safety
HYSPLIT	HYbrid Single-Particle Lagrangian Integrated Trajectory

I

IL	Illinois
INL	Idaho National Laboratory
IRT	Independent Review Team

J-L

LANL	Los Alamos National Laboratory
LBNL	Lawrence Berkeley National Laboratory
LC_{50}	Lethal Concentration 50%
LC_{lo}	Lethal Concentration low
LD_{50}	Lethal Dose 50%
LD_{lo}	Lethal Dose low
LFL	Lower Flammability Limit
LLNL	Lawrence Livermore National Laboratory
LPF	Leak Protection Factor

M

MAR	Materials At Risk
MDIFF	Mesoscale DIFFusion atmospheric dispersion code
MS	Microsoft

N

NA-41	DOE Office of Emergency Management
NARAC	National Atmospheric Release Advisory Capability
NFPA	National Fire Protection Association
NNSA	National Nuclear Security Administration
NOAA	National Oceanic and Atmospheric Administration
NQA	Nuclear Quality Assurance
NRC	Nuclear Regulatory Commission
NRF	National Response Framework
NSF	National Science Foundation

O

ORISE	Oak Ridge Institute for Science and Education
ORNL	Oak Ridge National Laboratory

P

PAC	Protective Action Criteria
PAR	Protective Action Recommendation
PC	Personal Computer
PDF	Portable Document File
PNNL	Pacific National Northwest Laboratory

Q-R

QA	Quality Assurance
RAMS/LPDM	An atmospheric transport and dispersion model
RASCAL	An atmospheric transport and dispersion model

S

SAIC	Science Applications International Incorporated
SCAPA	Subcommittee on Consequence Assessment and Protective Actions
SEI	Shaw Environmental Incorporated
SIG	Special Interest Group
SMS	Safety Management Systems
SNL-NM	Sandia National Laboratory/New Mexico
SODAR	Sonic Detection and Ranging
SQA	Software Quality Assurance
SRNL	Savannah River National Laboratory
SRS	Savannah River Site
STAR	Science and Mathematics Teacher and Researcher
STD	Standard
STWG	Source Term Working Group

T

TAG	TEELs Advisory Group
TEEL	Temporary Emergency Exposure Level
TRU	Transuranic

U-V

USDA	United States Department of Agriculture

W-Z

WG	Working Group