9th MEETING OF THE DOE METEOROLOGICAL COORDINATING COUNCIL (DMCC)

OCTOBER 2000 MEETING

University of Nevada at Las Vegas
Las Vegas, NV
October 17-18, 2000

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0.0 EXECUTIVE SUMMARY

The Department of Energy (DOE) Meteorological Coordinating Council (DMCC), the Council, convened a Meeting in Ham Hall at the University of Nevada at Las Vegas (UNLV), Las Vegas, Nevada, on October 17-18, 2000. This meeting was held in conjunction with meetings held by the Subcommittee on Consequence Assessment and Protective Actions (SCAPA) and the Nuclear Utility Meteorological data User Group (NUMUG). This was the ninth meeting of the Council since its inception in December 1994. A total of 34 individuals, from the public and private sectors, attended and participated in the meeting.

This meeting served several purposes: The primary purpose of the meeting was to provide a forum for DMCC members and DMCC associates to review its accomplishments, products, and projects, and to discuss its mission and implementation. A brief roundtable discussion for DOE meteorological program managers was convened to identify issues and seek remedies. The meeting also informed the DMCC membership about recent technical advances in the atmospheric sciences to assist them in the execution of their duties. Several technical reports of interest to the membership were also presented.

There was a discussion on the FY00 accomplishments and work of the DOE Meteorological Topical Committee (MTC) that is associated with DOE/EH-53, the DOE office that administers the Technical Standards Program (TSP). The MTC is closely associated with the DMCC and is chartered with the Technical Standards Program Office (TSPO). A briefing on the progress of DOE sites adopting ANSI/ANS-3.11 as a voluntary consensus standard was provided.

Briefings on the activities of the Office of the Federal Coordinator for Meteorological Programs and Supporting Research (OFCM) and the DOE Office of Science were given.

There was a series of technical presentations in several aspects of the atmospheric sciences. These presentations addressed heavy (dense) gas transport and dispersion, a new meteorological data processing and display software developed at Hanford, the National Lightning Protection Network (NLPN) and the DOE focus area of lightning safety. In addition, there were excellent discussions concerning planetary boundary layer research and development studies, and upper air data acquisition and forecasting support to the managers responsible for mitigating the effects of the Cerro Grande forest fire.

Additional presentations focused on the National Center for Environmental Prediction (NCEP) program, the emergency response capabilities of the Air Resources Laboratory (ARL), an update of the National Atmospheric Release Advisory Capability (NARAC) system, and micro- and mesoscale modeling capabilities of the Army Research Laboratory (ARL).

Three action items resulted from the meeting which will be addressed by the DMCC Steering Committee.

The early planning for the 10th DMCC Meeting was briefly discussed. This meeting will be held in Reno, Nevada in conjunction with the Winter Meeting of the American Nuclear Society (ANS) in November 2001. The ANSI/ANS-3.11 Working Group will also reconvene at this meeting. It will be its first meeting since the publication of ANSI/ANS-3.11 on February 16, 2000.

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1.0 OVERVIEW

The DOE Meteorological Coordinating Council (DMCC) convened at Ham Hall in the University of Nevada at Las Vegas (UNLV), Las Vegas, Nevada during October 17-18, 2000. This was the ninth meeting that the DMCC has sponsored since its inception in December 1994. The meeting was called to order by the DMCC Chairman, Dr. Darryl Randerson, who is also the Director, National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory (ARL)/Special Operations & Research Division (SORD). This meeting was held to present new DMCC initiatives to its membership and associates, to share the many FY00 DMCC accomplishments, and to provide discussions on recent advancements in the atmospheric sciences to the DMCC membership. A roundtable discussion involving several DOE meteorological program managers also took place. In addition, several technical presentations of interest to DMCC members and associates were included. The agenda of this meeting is documented in Appendix A. The 34 individuals that attended the meeting and their respective affiliations are listed on the following page.

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LIST OF ATTENDEES

Individual	Affiliation
Rob Addis	Westinghouse Savannah River Company (WSRC) - SRS
Denny Armstrong	Los Alamos National Laboratory (LANL)
Ron Baskett	Lawrence Livermore National Laboratory (LLNL)
Tom Bellinger	Illinois Department of Nuclear Safety (IDNS)
Shawn Bond	BHI
Larry Campbell	Fluor
David Carrington	University of Nevada at Las Vegas (UNLV)
Yitung Chen	UNLV
Ron Cionco	Army Research Laboratory (ARL)
Ray Dennis	National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory Special Operations and Research Division (ARL/SORD)
Gina Deola	Sandia National Laboratory (SNL)
Jeff Feit	Department of Energy (DOE)/EH-53
Paul Fransioli	Science Applications International Corporation (SAIC)
Cliff Glantz	Pacific Northwest National Laboratory (PNNL)
Jerry Havens	University of Arkansas
Juan Heinrich	UNLV
Ron Kithil	National Lightning Safety Institute (NSLI)
Marty Leach	LLNL
Joseph Lombardo	UNLV
Carl Mazzola	Stone & Webster Incorporated (SW)
John Nasstrom	LLNL
Darrell Pepper	UNLV
Ricky Petty	DOE/Office of Science (OS)
Barbara Pierce	NOAA ARL/SORD
Doyle Pittman	Tennessee Valley Authority (TVA)
Darryl Randerson	NOAA ARL/SORD
Glen Rolph	NOAA ARL/HQ
Jim Sanders	NOAA ARL/SORD
Walter Schalk	NOAA ARL/SORD
Roland Stull	University of British Columbia (UBC)
Gayle Sugiyama	LLNL
Naomi Surgi	NOAA National Center for Environmental Predictions (NCEP)
Tom Tuccinardi	DOE/SO-41
Gary Worley	BWXT-Y12-Oak Ridge

2.0 OPENING EVENTS AND DISCUSSIONS

Dr. Darryl Randerson, Chairman of the DMCC, welcomed the DMCC members and associates to Las Vegas, Nevada, and convened the ninth DMCC Meeting. Darryl briefly described the mission and the objectives of the DMCC, and presented a brief history of the many accomplishments of the Council over its six-year history.

Each of the attendees introduced themselves and identified their affiliation and their function within the DMCC.

3.0 DMCC AND DOE/HQ PROGRAM INITIATIVES

3.1 FY00 DMCC Activities and Accomplishments (Darryl Randerson)

Dr. Darryl Randerson presented the FY00 accomplishments of the Council. The FY00 DMCC accomplishments are presented in Appendix B.

Dr. Randerson reported that the DMCC had performed a successful follow up assist visit at the Waste Isolation Pilot Plant (WIPP) and noted large improvements in the WIPP contractor's meteorological program. The DMCC was also heavily involved in the production and approvals associated with a new national standard on meteorological programs, ANSI/ANS-3.11, "Determining Meteorological Information at Nuclear Facilities." DMCC is overseeing the efforts of the Meteorology Topical Committee (MTC), which is interfacing in many ways with the DOE Technical Standards Program (TSP) under DOE/EH-53. DMCC has begun and will continue to work with the MTC to coordinate the efforts of the DOE meteorological program managers to adopt ANSI/ANS-3.11 as a Voluntary Consensus Standard (VCS). DMCC issued a memorandum to its membership in June 2000 that provided information on how DOE sites can adopt ANSI/ANS-3.11 as a VCS.

DMCC intends to coordinate the DOE Meteorological Programs section of the Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM) FY02 Federal Plan for Meteorological Services. In addition, DMCC has submitted proposals to update the DOE technical document EH-0173T and Atmospheric Sciences and Power Production-1984. Both of these efforts should begin in 2001.

DMCC held a meeting in Santa Fe, New Mexico, in September 1999, attended by 11 individuals. A report on this meeting was issued in early 2000, and can be downloaded from the DMCC web page.

3.2 DOE/EH-53 Technical Standards Program (Jeff Feit)

Jeff Feit, DOE/EH-53, presented an overview of the DOE/EH-53 TSP Topical Committees for Rick Serbu, who was unable to attend the meeting. Jeff explained the functions of the TSP within the tiered structured system for the definition of requirements that are applicable to DOE. The topmost tier of this structure is the DOE policymaking authority, followed by the requirements (e.g., Federal and State enabling regulations, DOE Orders, DOE Notices, DOE Manuals), then followed by guidance through safety and implementation guides, and lastly followed by technical standards and specifications. TSP has responsibility for implementing the lattermost function.

Jeff described the functions of the Topical Committees. He indicated that within the DOE TSP are 24 Topical Committees, inclusive of the MTC. These Topical Committees support DOE missions and functions and are populated by both Federal employees and contractor Subject Matter Experts (SMEs). The purpose of the Topical Committees is to represent DOE's interests to national and international Standards Development Organizations (SDOs), to support DOE missions and functions, and to serve as a technical standards reviewer, coordinator, and developer for areas of interest. SDOs that commonly interface with the Topical Committees include the American Society for Testing and Materials (ASTM), the American Society of Mechanical Engineering (ASME) and the American Nuclear Society (ANS).

Jeff provided the Universal Resource Locator (URL) of the very impressive DOE TSP Home Page, which is http://tis.eh.doe.gov/techstds/doe. DOE O 252.1 and DOE Guide 252.1-1, which describe the TSP, as well as all of the DOE standards, can be accessed on this web page.

The DOE/EH-53 discussion is presented in Appendix C.

3.3 ANS-3.11 and the Meteorology Topical Committee (Carl Mazzola)

Carl Mazzola presented the status of the new national standard for meteorological data, ANSI/ANS-3.11, as well as an overview of the MTC. The ANSI/ANS-3.11 project, undertaken jointly by NUMUG and DMCC, began in June 1996 and culminated with the publication of a national standard of meteorological information at nuclear facilities on February 16, 2000.

Carl identified the present membership of the MTC and presented both the FY00 activities and proposed FY01 activities for the following MTC objectives:

- Developing and implementing meteorological standards for the TSP Office;
- Coordinating newly published standards for DOE;
- Forming an advisory group for development/review of atmospheric sciences, standards, directives, guides, and handbooks for national or international use;
- Interfacing with non DOE SDO's and developing technical positions on meteorology standards for adoption by non-DOE technical standards entities; and,
- Developing liaisons with other DOE topical committees having mutual interests through the TSP Office.

Carl then led a brief discussion with the DMCC membership to identify any other projects that could be undertaken by the MTC. No suggestions were offered. Carl concluded his discussion by indicating that the DMCC would determine the FY01 agenda since there were no specific suggestions offered to the MTC.

Carl Mazzola's detailed presentation is presented in Appendix D.

3.4 Office of Federal Coordinator (Ricky Petty)

Sam Williamson, the OFCM Federal Coordinator, was unable to attend. Ricky Petty presented the activities of the OFCM. In addition to his daily duties with the DOE Office of Science, Ricky is also the DOE representative on the OFCM Interdepartmental Committee for Meteorological Services and Supporting Research (ICMSSR).

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Ricky first discussed the origin of the OFCM. In 1964, OFCM was established by the Congress to coordinate meteorological activities that existed in 15 separate Federal agencies. Accordingly, the OFCM is focused on cross cutting agency issues, needs, and capabilities. In response to its mission, the OFCM has developed nine key focus areas to define agency priorities. Of particular interest to the DMCC and the DOE meteorological program managers are the focus areas of modeling and prediction, environmental information, information technology and communications, and cooperative research.

The OFCM also sponsors annual conferences on hurricanes and atmospheric transport and diffusion. For the National Hurricane Conference, OFCM is the co-sponsor, and at the April 17-21, 2000 meeting in New Orleans, Louisiana, it hosted a session on improving public response to hurricane warnings.

The Joint Action Group (JAG) for Atmospheric Transport and Diffusion (ATD), chaired by Darryl Randerson, focuses on portions of the atmospheric sciences that are of significant interest to the DMCC membership. The ATD JAG oversaw the effort that culminated in the March 1999 publication, "Directory of Atmospheric Transport and Diffusion Consequence Assessment Models." The ATD JAG also sponsored a Workshop on ATD Modeling on June 6-8, 2000, in Silver Spring, Maryland. Areas that were addressed were model proliferation, Verification and Validation (V & V), identification of new requirements and unmet needs and leverage opportunities, and finding solutions to agency-identified technical barriers.

Ricky discussed some of the upcoming events for OFCM. In particular, on December 4-6, 2000, OFCM will sponsor the second symposium on Weather Information for Surface Transportation. It is also planning workshops on Severe Local Storms, Risk Assessment and Cost/Benefit Analysis, and on atmospheric transport and diffusion, with an emphasis on Weapons of Mass Destruction (WMD). The 55th Interdepartmental Hurricane Conference is scheduled for March 5-9, 2001.

Ricky Petty's discussion on the DOE Office of Science is presented in Appendix E.

3.5 Office of Science (Ricky Petty)

Ricky Petty presented the work that's being undertaken by the DOE Office of Science. The DOE Office of Science (OS):

- Provides significant growth for DOE science programs in areas of strength and excellence;

- Emphasizes new opportunities in the physical and life sciences and the interdependence between them;

- Emphasizes new approaches in advanced scientific computing; and,

- Delivers new capabilities and increased utilization for Office of Science scientific user facilities.

Ricky showed a graphic that shows which Federal agencies support areas of science, or related engineering and mathematics. DOE leads in spending for the physical sciences with an FY99 expenditure that exceeded $2B. DOE also leads in Research & Development (R & D) facilities, but is only fifth with respect to environmental sciences. The FY01 Budget request exceeds $3B, inclusive of $123M for global climate research, and $36M for carbon management science.

Ricky shifted his focus to the Office of Biological and Environmental Research (OBER) and its Life Sciences, Medical Applications, and Environmental Sciences Divisions. He emphasized that DOE needs to establish a DOE Meteorological Office with requisite funding for DOE meteorological programs. He discussed the U.S. Global Climate Research Program (GCRP) that is focusing energies to develop better models to establish whether global warming from anthropomorphic sources is actually occurring. More accurate models that address all CO_2 fluxes and the interdependence of climate and the carbon cycle and the impacts on carbon sequestration are needed before global warming can be scientifically verified.

Ricky provided URL's for the Atmospheric Chemistry, Vertical Transport & Mixing, and Gulfstream Aircraft programs and urged DMCC members to look at the network on these very informative web pages.

The adequacy of Lightning Detection Systems (LDS) at DOE sites has recently become a focus area. The types of LDS at each of the DOE sites vary significantly. Ricky asked the DMCC to assist him in compiling information on the LDS systems and output at each DOE site.

ACTION 00-01: Assist Office of Science in compiling LDS system information at each DOE site (Randerson).

Ricky closed his discussion with some items associated with the DOE-OFCM interfaces. He was particularly interested in the effort to put together a distribution list of DOE personnel consisting of DOE managers, assistant managers, and staff.

ACTION 00-02: Assist Office of Science in compiling list of DOE personnel at each DOE site (Randerson).

Ricky Petty's discussion on the Office of the Federal Coordinator is presented in Appendix F.

4.0 DISCUSSION OF DOE FIELD OFFICE METEOROLOGICAL PROGRAMS

Darryl Randerson led a roundtable discussion with the representatives of the DOE sites. The following summary captures the salient points of discussion.

Nevada Test Site (NTS): Darryl discussed the recent replacement and upgrade of the Lightning Detection System (LDS) at the NTS. This more comprehensive system, manufactured by Global Atmospherics, Tucson, Arizona, should be operational in the January-March 2001 timeframe.

Savannah River Site (SRS): Rob Addis discussed the installation of a lightning protection system to the meteorological towers at SRS. These towers are 11 to 12 years old and needed an upgrade to their lightning protection systems. Rob is even considering the replacement of the meteorological towers due to their age. The TV tower, which provided meteorological data at many different heights at a location near the SRS, is no longer instrumented. Rob will be replacing this tower. It will be instrumented with sonic anemometers.

Hanford: Cliff Glantz discussed the lightning protection system at Hanford. Due to a 1999 worker injury, Hanford is considering the possibility of upgrading its lightning protection system.

Sandia National Laboratory (SNL): Gina Deola mentioned that SNL is interested in whether DOE has any plans for integrating its lightning protection network.

Oak Ridge Reservation Y-12 Plant: Gary Worley shared information about the National Lightning Detection Network (NLDN). In addition, a vendor, GAI, has a home page, which includes cost information. Y-12 is undergoing a modernization plan that will include an upgrade to the meteorological monitoring system. A new location for the primary meteorological tower is needed.

Tennessee Valley Authority (TVA): Doyle Pittman shared that TVA has replaced its wind vanes and anemometers with sonic anemometers at its Browns Ferry, Watts Bar, and Sequoyah Nuclear Power Generating Facilities. There was an overlap with the existing wind sensors and Doyle plans to do a comparison of the sigma-theta data to see if the sonic anemometer provides better theta-distributions at very low wind speeds.

Yucca Mountain Project Office (YMPO): Paul Fransioli sadly reported on the recent stroke and ill health of Dr. Tom Lockhart. Paul is also involved in the development of an ISO sonic anemometer standard and will be involving the MTC. Paul has an action to involve the MTC in the peer review of an ISO sonic anemometer standard.

ACTION ITEM 00-03: Provide MTC an opportunity to peer review the ISO sonic anemometer standard (Fransioli).

5.0 TECHNICAL PRESENTATIONS

5.1 Heavy Gas Transport and Dispersion

Dr. Havens presented his work on field experiments and dispersion modeling as it pertains to the transport and dispersion of dense or heavier-than-air gases. Since the early 1980's, Dr. Havens has performed field studies and wind tunnel studies to extend classical atmospheric transport and dispersion models to address the effects of heavier-than-air gases. The University of Arkansas' wind tunnel has been used in much of this research.

Dr. Havens described the dispersion model that he developed for dense gas applications, Dense Gas DISpersion (DEGADIS), which provides for both gravity spreading and decreased vertical mixing. These physical effects are present only when chemicals that are both more dense than air or colder than air are introduced to the local ambient atmosphere. He provided excellent graphics of wind tunnel tests and field tests that showed dense gas dispersion phenomena for a variety of atmospheric conditions that were categorized by Richardson numbers. He reviewed the Department of Transportation (DOT) enabling regulation 49 CFR 193, which references the incorporation of National Fire Protection Association (NFPA) standard 59A and requires dispersion distances to be determined using the DEGADIS code. These regulations also provide another option, which is to use a more research-oriented model, FEM3A CFD.

Much of Dr. Havens' research was driven by the unfortunate disaster in Bhopal, India in 1984, where over 3,000 people lost their lives due to a release of heavier-than-air methyl isocyanate under stable low wind conditions.

Dr. Havens reviewed his results from a study in which he verified the FEM3A model predictions against wind tunnel and field tracer data. The study concluded that the FEM3A simulations were in good agreement with these experiments and that there was a substantial reduction in downwind flammability hazard extent if tank and dike impoundment structures were included in the engineering design. These engineered features reduce the surface area of the chemical that subsequently reduces the evaporation rate. The FEM3A predictions are also useful for optimizing the dike design for controlling dispersion distance. The validation experiments are expected to be complete prior to the end of Year 2000. Further evaluations will focus on applications associated with low wind speed and stable conditions.

Dr. Havens' discussion is presented in Appendix G.

5.2 MetView and APGEMS

Cliff Glantz demonstrated a new product that was developed at the Hanford Reservation which is designed to assist meteorologists, consequence assessors, and emergency management personnel with quick and easy interpretation of plume transport and consequence assessment results.

This new software was recently developed since most of the earlier tools at Hanford were DOS-based, non-Y2K compliant, and generally out of date. In addition, most of the available software at DOE sites were either hard to acquire, expensive to maintain, difficult to adapt, or it took too long to execute. Adoption of the software in the National Atmospheric Release and Advisory Capability (NARAC) was considered, but the time delay in acquiring consequence assessment information created an emergency management issue that was not easily resolvable. Therefore, a management decision was made to develop new software to assist Hanford in its emergency management needs. These software include two components, MetView and Dispersion model code used at Hanford:

- MetView: Meteorological data display software; and,
- APGEMS: A three-dimensional, mass-consistent, transport and dispersion model.

Cliff Glantz demonstrated both of these PC-based tools. MetView provides the ability of taking real-time or historical meteorological data (i.e., wind speed and direction, temperature, precipitation, and actual pressure) and overlaying it on a Hanford site map. One of the more useful screens shows the wind vectors and thus the non-linearities in the complex terrain flows that are common to Hanford. MetView can display meteorological data from the 32 meteorological towers as well as from several SODAR. The MetView software also has a zoom-in, zoom-out feature that provides deep insight into the determination of the spatial extent of the meteorological flows, allowing better interpretation of the results.

Cliff Glantz then demonstrated the companion APGEMS model and the screens that can be developed for the emergency management organization. These screens include source term definition, wind field streamlines, and dose contours. The zoom-in feature nicely shows the non-linearlities in the dose calculation results. A simpler version of APGEMS is generally used by first

responders at Hanford, and was very successfully applied to assist the firefighters during the recent summer forest fire. Generally, you choose a site, run the simulation, and APGEMS yields a plume footprint and identifies the affected area.
The three-dimensional diagnostic version is now available that yields more comprehensive information on the plume dimensions and the affected area.

Cliff Glantz' discussion is presented in Appendix H.

5.3 National Lightning Protection Network (NLPN)

Richard Kithil, President of the National Lightning Safety Institute (NLSI) discussed the NLPN.

Richard Kithil discussed various types of lightning detection mechanisms that are available on the market, which include radio frequency detectors. The radio frequency detectors are extremely useful and effective for identifying distance and direction. He indicated that there are a large number of vendors that manufacture surge protection devices that meet the IEEE 1100, "Protection of Low Voltage Systems" standard. Other important codes and standards that are met by these systems include Federal Aviation Administration (FAA) Standard 019c, MIL HDBK 419A, NAV OPSEA 5, KSC Standard 012B/013D, and AFI 32-1065.

Lightning protection designs include the following subsystems:

- Air terminals;
- Downconductors;
- Bonding;
- Grounding;
- Corrosion and cathodic protection;
- Transients and surges;
- Detection; and,
- Testing and maintenance.

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Richard Kithil emphasized that lightning safety is an extremely important component of an Environmental Safety & Health (ES & H) program, as lightning kills hundreds of people each year in the U.S. Since lightning protection is so highly site-specific, he recommended that each DOE site perform its own lightning safety evaluation. He identified Richard Stark, DOE/EH (richard.stark@eh.doe.gov) as a key point of contact to discuss requirements for lightning safety.

Richard Kithil then moved his discussion to the physics of lightning. Lightning's characteristics include current levels approaching 400 kA with the average being about 25 kA. The temperatures generated by lightning strokes are as high as 15,000 ^{o}C, and voltages measure in the hundreds of millions of volts. On a global scale 50-100 lightning strikes on earth occur every second. He presented some very interesting photographs of leader strokes of potential lightning strikes as it seeks the path of least resistance through the atmosphere to the ground. These leaders pulse every 50 meters of travel. The ground objects become ionized in the thunderstorm environment and emit streamers. When the streamer and leader meet, a lightning stroke results.

Dr. Kithil's slides are presented in Appendix I.

5.4 Planetary Boundary Layer and Ensemble Prediction of Pollutants

Dr. Roland Stull presented his extensive work on the planetary boundary layer and ensemble prediction of pollutants. The ensembles of many runs of a numerical forecast model provide much better meteorological information than a categorical forecast of a single run, since the ensemble average gives a more accurate plume track and wind speed.

Dr. Stull presented his work associated with ensemble prediction of atmospheric pollutant transport using the numerical models MC2 (i.e., a Canadian Mesoscale Compressible Community Model) and UW-NMS (i.e., the University of Wisconsin Non-hydrostatic Modeling System). From each initial condition, numerical forecasts were made using each model, periodically saving the full three-dimensional forecast fields of winds, temperature, humidity, and pressure. The final results of the study are still in progress, but early conclusions show that many plume centerline locations are possible for many different weather outcomes. Use of chaotic theory mathematical techniques is now being employed in meteorological models due to the randomness of turbulence motions in the atmosphere.

Dr. Stull also discussed his work associated with mixed-layer top levelness over irregular topography. It has been shown by observations that the top of the mixed layer does not always follow the topography, as had previously been thought to be true. Four archetypal levelness situations were presented ranging from the mixed layer following the topography to the mixed layer varying opposite to the topography. In order to determine why observations do not always reflect surface layer and planetary boundary layer theory, several dimensionless variables were established to develop empirical relationships from various databases. The dimensionless variables that affected levelness include the following variables:

- Time;
- Flatness;
- Drag coefficient;
- Advection;
- Divergence;
- Entrainment;
- Scale ratio; and,
- Cap strength.

When the mass conservation equation was applied to a mixing length over heterogeneous terrain, the levelness tendency was found to be a function of terrain-following terms and leveling terms. Equilibrium solutions using the empirical variables were then developed.

Lastly, Dr. Stull presented some of his recent work on wind and temperature profiles in the radix layer. The radix layer is the lowermost layer of the convective boundary layer, lying beneath the uniform layer and the entrainment zones within the mixed layer. Above the mixed layer is the free atmosphere. The surface layer, where the stress tensor is essentially uniform, lies at the surface as the radix layer does, but its vertical extent is less than the radix layer.

Field tracer data from a Minnesota field program and the Koorin experiment in Australia were used as the database for the empirical fitting of variables to describe the radix layer. From these data and the use of similarity theory, profile equations for wind and temperature in the radix layer was developed. These were tested by the 1996 Boundary Layer Experiment database. The study concluded that for mechanical turbulence dominated flow, similarity theory works reasonably well. However, for convection-dominated cases, where the atmospheric feedback mechanism is interrupted, similarity theory has much more limited applications. This work yielded significant insights into the radix layer and can be ultimately applied to transport and dispersion models once parameterization of the key variables is available. In addition to improving dispersion models, this research can be applied to cumulus cloud formation, turbulence scaling and similarity, research flight planning and interpretation, fog and frost formation, and global climate and forecast modeling.

Dr. Stull's discussion is presented in Appendix J.

5.5 ARL/SORD Support of Cerro Grande Fire

Ray Dennis presented the significant role that ARL/SORD contributed to the efforts associated with the response to the May 2000 Grand Cerro wildfire nearby LANL. ARL/SORD has more than 40 years of experience in providing atmospheric monitoring support to DOE/NV operations, the Nuclear Emergency Search Team (NEST), the Accident Response Group (ARG), and the Federal Radiological Management and Assessment Program (FRMAP). This experience translated into a unique capability to assist firefighters in mitigating the devastating effects of this fire.

Ray Dennis discussed the instrumentation that was used to provide upper air data and forecasted wind information that was vital to the fire fighting planning and execution efforts. Once it was quality-assured, the data was dispatched to the ARL/SORD home page for easy access through the Internet. It took only seven minutes after the data acquisition for its qualification and delivery to the end user community. The field ARL/SORD staff was located about 20 miles from the fire and used a Global Positioning System (GPS) and laptop to assist their efforts. Rawinsondes were periodically launched and tracked to provide vital upper air data to the fire fighting managers. Over a four-day period, 19 upper air data runs were provided.

Ray Dennis' slides are presented in Appendix K.

5.6 National Center for Environmental Predictions

Dr. Naomi Surgi discussed the National Center for Environmental Predictions (NCEP) program. Dr. Surgi first presented the NCEP organization chart to show the depth of the entire NCEP program. NCEP is the custodian of the Eta and RUC prediction models.

Dr. Surgi presented recent improvements in the MRF/AVN systems. There is now resolution to 75 km and the model has 42 levels thanks to the new supercomputer that is available for weather predictions. five-day forecasts have now been extended to ten-day forecasts due to the better calculation times and storage capacity of the new supercomputer. There has been a change to meso-Eta model involving better horizontal and vertical resolution and increased domain size.

With respect to climate modeling, NCEP is preparing for an exponential increase in available data over the next decade as a result of polar orbiters, Geostationary Orbiting Earth Satellite (GOES) platform, TRIMM satellite, scatterometer, and GPS meteorology technology. NCEP's philosophy is that underutilized data is a waste of money wasted.

Starting in 2001, hurricane intensity predictions will be enhanced and from 2002-2006, there will be an assimilation of a vast amount of both coastal and ocean data to improve hurricane predictions. Several other upgrades of NCEP models were discussed, each pointing to more rapid and comprehensive predictions in the years to come.

Dr. Surgi's slides are presented in Appendix L.

5.7 NOAA ARL Emergency Response Applications

Glenn Rolph discussed the emergency response activities of ARL, which are threefold:

- Internal to NOAA;
- Limited Access; and,
- Open Access.

With respect to the emergency response capabilities that are internal to NOAA, Dr. Rolph presented an overview on the Regional Specialized Meteorological Center (RSMC) located in Washington, DC. The RSMC program was organized by the World Meteorology Organization (WMO) of the United Nations (UN) per request of the International Atomic Energy Agency (IAEA) after the 1986 Chernobyl nuclear accident in the Ukraine. RSMC provides meteorological support and atmospheric transport and dispersion products to a WMO Region III or IV country in the event of a nuclear accident. The information products are placed on the Internet through the RSMC common dynamic web page access. Products include plume trajectories and integrated exposures and cloud deposition for 24-, 48- and 72-hour time periods after the event.

Dr. Rolph then described the infrastructure associated with the system. There is a Senior Duty Meteorologist (SDM) stationed at NCEP at any time (i.e., 24/7) as the initial point of contact. The SDM will then initate the HYSPLIT model for the consequence assessment and protective response of nuclear incidents or the VAFTAD model for the protective response to volcanic eruptions.

Dr. Rolph continued his discussion as they applied to the Limited Access Applications. These applications require a password or an approval. The products that can be obtained from this application in the chemistry and graphics modules from HYSPLIT, including special HYSPLIT runs (e.g., TOPOFF, LANL fires), and special high-resolution RAMS forecasts. Dr. Rolph demonstrated a run that produced a graphical representation of the TOMS aerosol index versus the HYSPLIT smoke particle forecast. NOAA/ARL limited access applications can also be accessed by meteorologists and emergency management personnel at nuclear facilities. Dr. Rolph also showed some graphics on the application of this system as it was used to assist in the mitigation of the Cerro Grande fire at Los Alamos, New Mexico.

Lastly, Dr. Rolph discussed the open access applications through Real-time Applications and Display sYstem (READY). READY provides a web-based access to dispersion models, air quality forecasts, and meteorological data, atmospheric stability forecasts, and an ability to execute the HYSPLIT and VAFTAD models. Several high-powered graphics were shown using READY inclusive of vertical velocity cross-section along trajectory, stability time-series using the Eta application, and a forecast sounding using RUC.

Dr. Rolph's discussion is presented in Appendix M. A brochure containing information absent the READY system is also included in Appendix N.

5.8 NARAC Update

John Nasstrom presented an update on the most recent version of the National Atmospheric Release Advisory Center (NARAC) system. The NARAC system was originally developed in the 1970's and is located at LLNL. NARAC, and its program, is one of the seven DOE Assets. The objective of the NARAC modeling system is to develop a modernized, verified, multi-scale flow and dispersion modeling system for real-time operational use in the DOE NARAC emergency response system. NARAC uses several different sources of meteorological information to drive a Lagrangian particle-in-cell (PIC) dispersion model (i.e., LODI) to produce consequence plots for releases of chemical, nuclear, and biological materials to the atmosphere.

John Nasstrom discussed ADAPT, a sub model that assimilates the meteorological data and produces data sets that are useful to the transport and dispersion modeling sub-models. Meteorological variables include a nondivergent wind field, scalar fields of temperature, pressure, humidity, and other meteorological variables, and turbulence scaling parameters. He then described the physics associated with the NARAC weather forecast model (i.e., NRL COAMPS), and reviewed the basic partial derivative differential equations associated with the parameterization of mean wind advection, turbulent diffusion, gravitational settling, precipitation scavenging, and radioactive decay.

The NARAC model has undergone significant V & V testing to ensure confidence in its results over a full spectrum of atmospheric conditions. Some of the field tracer data that was used in the verification was from Project Prairie Grass; the Mesoscale Atmospheric Tracer Studies (MATS) conducted at SRS, the Diablo Canyon Tracer Study and the European Tracer Experiment (ETEX). The Diablo Canyon data set was specifically applied to verify the model's treatment of complex flows resulting from seabreezes.

Recently, NARAC has added modules to address the street-canyon flows in an urban setting and has been used in modeling flows at Salt Lake City, UT, where the 2002 Winter Olympics will be held. Other recent applications include the Tokaimura criticality accident and the Cerro Grande fire at Los Alamos.

NARAC has supported several DOE programs inclusive of the ARG, NEST, and the Radiological Assistance Program (RAP). It provides advisory services to the Federal Avaiation Administration (FAA), the Federal Emergency Management Agency (FEMA), the Environmental Protection Agency (EPA), the Nuclear Regulatory Commission (NRC), and to various States.

See Appendix O for this portion of John Nasstrom's NARAC presentation.

John Nasstrom also presented the recently developed NARAC Internet and web technology that provides the capability to distribute NARAC predictions to multiple users from a web site using a standard web browser. John demonstrated how the system could be applied by first identifying the user interface information and then showing the graphical displays resulting from the model application. He then described the NARAC Client-Server architecture using either Internet or an Intranet communications link. Ongoing work on this new system includes solving issues of computer security, the ability to acquire site-specific meteorological data, and the integration of a rapid, local dispersion-modeling tool for the end-user's computer. The present schedule calls for the delivery of a beta version to DOE/HQ by September 2000, DOE site integration later in 2000 and integration with DOE assets by 2001. A demonstration is planned in Salt Lake City at the February 2002 Winter Olympic Games.

The sides from the NARAC Internet and web technology presentation are presented in Appendix P.

5.9 Army Research Laboratory Meteorological Modeling

Dr. Ron Cionco presented the work that he has been performing for the Army Research Laboratory (ARL) over the past 30 years. Dr. Cionco's main focus throughout much of his career is on the characterization of mesoscale and micro scale motions that are important to the atmospheric dispersion models used to determine concentrations of materials in an army battlefield environment. This scale is equivalent to the "neighborhood scale" for the EPA.

Dr. Cionco presented his work on microscale wind field simulations for terrain-only scenarios, for terrain plus morphology (e.g., trees) scenarios, for the army/neighborhood scale, and for unstable and stable conditions. His division supports four specific programs:

- Environmental Data;
- Propagation and Aerosols;
- Meteorological Modeling; and,
- Tactical Weather Technology & Impacts.

Dr. Cionco described the mesoscale and diffusion components of some of the models that ARL had developed. These include BFM, a high-resolution wind field model, NBFM, a canopy wind profile model, and an urban wind profile canopy model. These models have application to field operations concerned with smoke, obscurants, and releases of chemical and bidgical agents, hazardous materials emergency response, air quality in urban areas, agricultural meteorology, and forest meteorology (e.g., fire applications).

Dr. Cionco spent the balance of his presentation describing the physical applications of these models and the efforts associated with their verification.

Dr. Cionco's slides are presented as Appendix Q.

6.0 NOVEMBER 2001 MEETING

Darryl Randerson presented his thoughts on the early planning for the next DMCC meeting that is to be held in conjunction with the Annual Meeting of the ANS in Reno, Nevada. This will be a two-day business meeting tentatively scheduled for November 14-15, 2001. It will be coordinated with a meeting of the ANSI/ANS-3.11 Working Group that will examine the early changes needed to the new national standard on meteorological data.

Darryl Randerson indicated that he also plans to hold a technical DMCC meeting at a time to be determined in 2002, possibly in conjunction with the next NUMUG meeting, which is to be held in either April or May, 2002.

7.0 ACRONYMS

A

ANS	American Nuclear Society
ANSI	American National Standards Institute
APGEMS	Dispersion model code used at Hanford
ARG	Accident Response Group
ARL	Air Resources Laboratory
ARL	Army Research Laboratory
ASME	American Society for Mechanical Engineering
ASTM	American Society for Testing & Materials
ATD	Atmospheric Transport and Diffusion
AZ	Arizona

B

B	Billion

C

C	Centigrade
CFR	Code of Federal Regulations

D

DEGADIS	Dense Gas DISpersion
DMCC	DOE Meteorological Coordinating Council
DOE	Department of Energy
DOS	Disk Operating System
DOT	Department of Transportation

E

EH	Environmental Health
EPA	Environmental Protection Agency
ES & H	Environmental Safety & Health
ETEX	European Tracer EXperiment

7.0 ACRONYMS

F

FAA Federal Aviation Administration
FEMA Federal Emergency Management Agency
FRMAP Federal Radiological Monitoring and Assessment Program
FY Fiscal Year

G

GA Georgia
GCRP Global Climate Research Program
GOES Geostationary Orbiting Earth Satellite
GPS Global Positioning System

H

HDBK Handbook
HQ Headquarters

I

IAEA International Atomic Energy Agency
ICMSSR Interdepartmental Committee for Meteorological Services and Supporting Research
IDNS Illinois Department of Nuclear Safety
IEEE International Electrical and Electronics Engineers
ISO International Standards Organization

J

JAG Joint Action Group

K

kA Kiloampere
KSC Kennedy Space Center

7.0 ACRONYMS

L

LA	Louisiana
LANL	Los Alamos National Laboratory
LDS	Lightning Detection System
LLNL	Lawrence Livermore National Laboratory

M

M	Million
MATS	Mesoscale Atmospheric Tracer Studies
MD	Maryland
MTC	Meteorology Topical Committee

N

NARAC	National Atmospheric Release Advisory Capability
NAV	Naval
NCEP	National Center for Environmental Predictions
NEST	Nuclear Emergency Search Team
NFPA	National Fire Protection Association
NLDN	National Lightning Detection Network
NLPN	National Lightning Protection Network
NLSI	National Lightning Safety Institute
NM	New Mexico
NOAA	National Oceanic and Atmospheric Administration
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
NUMUG	Nuclear Utility Meteorological data User Group
NV	Nevada

O

O	Order
OBER	Office of Biological and Environmental Research
OFCM	Office of the Federal Coordinator for Meteorology
OS	Office of Science

7.0 ACRONYMS

P

PC	Personal Computer
PIC	Particle-in-cell
PNNL	Pacific Northwest National Laboratory

Q

R

R & D	Research & Development
RAP	Radiological Assistance Program
READY	Real-time Applications and Display sYstem
RSMC	Regional Specialized Meteorological Center

S

SAIC	Science Applications International Corporation
SCAPA	Subcommittee on Consequence Assessment and Protective Actions
SDM	Senior Duty Meteorologist
SDO	Standards Development Organization
SME	Subject Matter Expert
SNL	Sandia National Laboratory
SODAR	Sonic Doppler Acoustic Radar
SORD	Special Operations & Research Division
SRS	Savannah River Site
SW	Stone & Webster Incorporated

T

TSP	Technical Standards Program
TV	Television
TVA	Tennessee Valley Authority

7.0 ACRONYMS

U

UBC	University of British Columbia
UN	United Nations
UNLV	University of Nevada at Las Vegas
URL	Universal Resource Locator
US	United States
UT	Utah
UW-NMS	University of Wisconsin Non-hydrostatic Modeling System

V

V & V	Verification and Validation
VCS	Voluntary Consensus Standard

W

WIPP	Waste Isolation Pilot Plant
WMD	Weapons of Mass Destruction
WMO	World Meteorology Organization
WSRC	Westinghouse Savannah River Company

X

Y

YMPO	Yucca Mountain Project Office

Z

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8.0 APPENDICES

Since a Proceeding of the meeting presentations was not developed prior to the meeting, this section is reserved to document the presentations and other relevant documentation that were made at this meeting. The following presents a listing of these presentations.

Appendix	Description
A	Agenda
B	FY00 DMCC Accomplishments
C	DOE Topical Committees
D	Meteorology Topical Committee
E	Office of the Federal Coordinator for Meteorology Activities
F	Office of Science
G	Heavy Gas Transport and Dispersion Modeling Issues
H	MetView and APGEMS
I	Contemporary Lightning Safety for Environments Containing Sensitive Electronics, Explosives and Volatile Substances
J	The Planetary Boundary Layer and Ensemble Prediction of Pollutants
K	ARL/SORD Support to Cerro Grande Fire
L	NCEP
M	NOAA ARL Emergency Response Applications
N	READY System Brochure
O	NARAC Update

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Appendix	**Description**
P	NARAC Internet and Web Capabilities
Q	Army Research Laboratory Meteorological Modeling

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Appendix A

Agenda

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Appendix B

FY00 DMCC Accomplishments

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Appendix C

DOE Topical Committees

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Appendix D

Meteorology Topical Committee

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Appendix E

Office of the Federal Coordinator for Meteorology Activities
(Electronic Copy Not Available)

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Appendix F

Office of Science
(Electronic Copy Not Available)

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Appendix G

Heavy Gas Transport and Dispersion Modeling Issues
(Electronic Copy Not Available)

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Appendix H

MetView and APGEMS
(Electronic Copy Not Available)

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Appendix I

Contemporary Lightning Safety for Environments Containing
Sensitive Electronics, Explosives and Volatile Substances
(Electronic Copy Not Available)

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Appendix J

The Planetary Boundary Layer and Ensemble Prediction of Pollutants
(Electronic Copy Not Available)

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Appendix K

ARL/SORD Support to Cerro Grande Fire

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Appendix L

National Center for Environmental Predictions
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Appendix M

NOAA ARL Emergency Response Applications
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Appendix N

READY System Brochure
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NARAC Internet and Web Capabilities

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Appendix Q

Army Research Laboratory Meteorological Modeling
(Electronic Copy Not Available)