Argonne NATIONAL LABORATORY

ANL/EVS/R-07/6

Summary of PERF Air Program Review August 22–23, 2007, Annapolis, Maryland

Environmental Science Division

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Summary of PERF Air Program Review August 22–23, 2007, Annapolis, Maryland

by
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Introduction

For many years, the U.S. Department of Energy (DOE) has supported and sponsored various types of environmental research related to the oil and gas industry through its Office of Fossil Energy and its National Energy Technology Laboratory (NETL). In November 2005, Argonne National Laboratory (Argonne) organized and coordinated a review of DOE's water research program in conjunction with the fall 2005 meeting of the Petroleum Environmental Research Forum (PERF). PERF is a nonprofit organization created in 1986 to provide a stimulus and forum for collecting, exchanging, and analyzing research information related to the development of technology for the petroleum industry and also to provide a mechanism for establishing joint research projects in that field. Additional information on PERF can be accessed at http://www.perf.org.

The water program review was so successful that both DOE and PERF agreed that a second program review would be useful — this time on air research and issues. Argonne coordinated the air program review, which was held in Annapolis, Maryland, on August 22 and 23, 2007. This report summarizes the presentations and related discussions that were part of the air program review. The full agenda for the program review is included as Appendix A.

Participants

Twenty-eight persons attended one or more of the days of the program review. A list of all participants, including their contact information, is included in Appendix B. Table 1 shows the breakout of participants by type of organization.

Table 1 – Participants in PERF Air Program Review

Participant's Organization	*Number of Participants*
DOE	4
Other federal agency	2
National laboratory	6
University	2
Oil and gas company	9
Other	5

What Did We Learn and Where Do We Go from Here?

Feedback from the participants indicated that they found the program review to be valuable. This was an unusual opportunity for major oil and gas companies to meet with several federal agencies and researchers from universities, national laboratories, and other contractors.

The participants agreed that air research was valuable to the industry. At the discussion sessions at the end of each day, some of the research gaps and needs were pointed out. Although no commitments were made to immediately pursue solutions to the research gaps, the discussions

were useful in educating the participants about a wider range of issues and ideas and stimulating future planning processes.

One fundamental issue concerns the source of future funding for air research. DOE's Office of Fossil Energy has funded millions of dollars of oil- and gas-related air research, but its research budget has diminished in recent years, and the future of its research program is unknown. Major oil and gas companies used to fund significant in-house research efforts; however, many such programs have shrunk or disappeared. PERF can play a role in facilitating communication between the large oil and gas companies and other interested researchers, although the results of some privately funded PERF projects are kept proprietary for several years after the projects have been completed. No clear solution to the future funding issue was identified. The participants encouraged greater communication and collaboration among researchers and users of the research. Other future gatherings like this program review may be helpful in benchmarking progress and enhancing communication.

Acknowledgments

Argonne's coordination and management efforts for critical review of DOE's environmental program are part of DOE Contract DE-AC02-06CH11357. Dave Fashimpaur of BP was the PERF chairperson during the program review. He strongly encouraged and supported the program review.

John Veil of Argonne was the meeting organizer and coordinator. Patria Leath of Argonne provided assistance in planning and carrying out the meeting arrangements and logistics. Argonne's David Schmalzer and Patria Leath served as note takers throughout the meeting and contributed to the content of this summary. The summary was prepared by John Veil.

Summary of Day One – Wednesday, August 22, 2007

Day-One Overview

The primary focus of day one was to review the suite of research projects currently being funded by DOE related to oil and natural gas air issues as well as several air projects that had been completed in recent years. Nine different researchers gave summaries of their projects, providing details on the following:

- Project title, contractor name, and contact information;
- Partners/subcontractors;
- Project goal;
- Scope and approach;
- Current status;
- Schedule;
- Benefit to oil and gas industry;
- Transfer of knowledge, including any reports, publications, or significant presentations resulting from the project;
- Relationship to other DOE or non-DOE research; and
- Funding levels.

Summary of Presentations

Adel Hanna of the Institute for the Environment at the University of North Carolina at Chapel Hill described his team's efforts to develop and refine an advanced variable-grid-resolution (VGR) air quality modeling tool to provide detailed, accurate representation of the dynamical and chemical processes governing the fate of anthropogenic emissions in coastal environments. The VGR model can provide more accurate assessments of the impact of emissions related to oil and gas activities on local and regional air quality than can conventional modeling tools. The VGR modeling tool can help in designing field measurements and monitoring networks and could be used in examining potential impacts of future exploration and production (E&P) activities. Current practice is to make successive runs at 36-, 12-, and 4-km grid sizes to develop localized air quality estimates. This approach is cumbersome and computer-resource-intensive, and it can introduce artifacts when the discrete solutions at the larger grid scales are used as boundary conditions in the succeeding model runs. The new approach uses automated grid scaling within model runs to improve speed and accuracy. He showed two case studies: for North Carolina and for the Gulf of Mexico region.

Edan Prabhu of FlexEnergy reported on a project called OFFGASES. The project involved several partners. The OFFGASES program was designed to study ways of capturing stranded gas from oil wells and landfills in California. Stranded gas is produced in relatively small quantities at locations that have no gas collection and distribution network. Historically, most stranded gas has been flared to the atmosphere. The program attempted to convert four streams of stranded gas (low-Btu gas, medium-Btu gas, high-Btu gas, and harsh gas) into electricity by using several

types of turbine technologies, particularly microturbines. OFFGASES evaluated the energy savings from power generation. In addition, OFFGASES evaluated the resulting increase in oil production for each of its clients. The project showed positive results with four types of benefits:

- Enhanced oil production,
- Lower energy costs,
- Increased natural gas available, and
- Reduced emissions and greenhouse gases.

The results appeared marginal when the feed gas contained considerable H_2S. The results were encouraging for the low Btu site, but the technology needs further developement.

Sarah Nuss-Warren of the National Gas Machinery Laboratory at Kansas State University reported on a project to study reciprocating internal combustion engines used in oil and gas field applications. The project is being conducted in two phases. Thus far, the researchers have identified the types of engines currently in use. They assessed commercially available and emerging emission control and monitoring technologies and then determined technology and market gaps. They concluded that lean-burn technology is robust down to below 2 g/bhp-hr, while rich-burn technology has a gap in continuous control at low levels and low hp. Continuous emission monitoring systems remain too expensive for these engines. The major objective of the program is to reduce the cost of emission control systems, with the target being $50/hp. There are 15 million hp currently used in upstream operations. If the new technology was used on just 15% of the hp, the total savings would be $112 million. In addition, the better-performing engines could reduce the time needed to obtain permits, production limits resulting from caps on annual emissions, and the emission profiles of current engine technologies. Continued testing is ongoing, and the project completion date is January 2009.

Nancy Brown of Lawrence Berkeley National Laboratory (LBNL) presented extensive information on her work developing and modifying a seasonal air quality model for the central California region. The proposed new ozone standard could roughly triple the number of annual exceedance days for air quality. The researchers first validated the emission inventory for oil and gas production in the state. They found that in Kern County, a large oil- and gas-producing region, the oil and gas industry is responsible for one-third of the nitrogen oxides (NO_x) and the anthropogenic volatile organic compounds (VOCs) emitted and is affected by emission controls. The topography and meteorology in central California give rise to large pollutant loadings. San Francisco Bay forms a gap in the coastal range that allows wind to blow pollutants into the valley from other regions. The researchers added some new capabilities to the existing U.S. Environmental Protection Agency (EPA) CMAQ modeling system and conducted a 15-day simulation of air quality in the central California region for the summer of 2000. The additions included improving (a) ozone deposition; (b) boundary conditions for all species and their vertical dependence and the characterization of their inflow/outflow; (c) nudged, un-nudged, and averaged wind fields; (d) photochemistry (satellite products for albedo, total column ozone, and clouds); (e) vertical mixing; (f) forest fire emissions; (g) sensitivity studies of emission type, location, and timing; and (h) process analysis of the weekend effect. The additions yielded improved model performance, especially for San Joaquin Valley. The current modeling system tends to under-predict peak ozone concentrations. The project led to development of a formal

sensitivity analysis approach that is useful for characterizing the change of limiting reagents for ozone production in time and space, intra- and inter-basin transport, and the way that sensitivities change as a result of uncertainties in important parameters. The modeling showed that control strategies might need to be region-specific, some areas would benefit from VOC reductions, other areas might need NO_x reductions, and some areas might need both. Ozone production chemistry is highly nonlinear; new areas that are out of compliance with the current standard often have NO_x as their limiting reagent.

Gerry Baker of the Interstate Oil and Gas Compact Commission (IOGCC) reported on a project conducted in conjunction with ALL Consulting. The goal of the project is to define technically sound analytical methods for environmental impact assessments so that access to federal lands for oil and gas E&P can be simplified, particularly in Alaska and the Rocky Mountain region. A bottleneck exists in approving permit applications; the number of Bureau of Land Management (BLM) permit applications has tripled since 1999, straining the resources available for review and analysis. The project team completed an initial topical report on the guidance that has been provided for permitting accurate assessment of environmental impacts. The members are currently developing a series of issue-specific reports that discuss barriers to access, such as true impacts on sage grouse and increasingly urbanized locations. These additional reports are scheduled for completion by November 2007.

Melissa Lunden of LBNL reported on several projects related to air visibility. Implementation of the Regional Haze Rule in rural areas like the Central Rocky region can have an impact on oil and gas E&P. LBNL has investigated the interactions between aerosols and visibility by analyzing existing data sets, conducting experiments to understand important sources of natural aerosols, and modeling to better understand the controlling variables. The three projects she described in her presentation are:

- The effect of time averaging on the relationship between aerosol extinction and relative humidity;
- Aerosol growth in a Western mountain pine forest and its relationship to biogenic VOC emission and oxidation products and other organics of anthropogenic origin;
- The influence of forest fires in the Western United States on regional aerosol concentrations at a number of Interagency Monitoring of Protected Visual Environments (IMPROVE) sites in California.

Secondary organic aerosols (SOAs) can be a significant component of haze. Current data sets do not have adequate time or spatial resolution for validating model outputs. Some measured variables, particularly NO_x and sulfur oxides (SO_x) are highly correlated, which obscures details and determination of causality. Fire emissions were found to be an important source of particulates in the Western United States. Emissions from wildfires were demonstrated to have strong and sustained regional impacts on aerosol concentrations, air quality, and visibility.

Mike Lazaro of Argonne described several tasks undertaken for the Four Corners Air Quality Task Force, which is made up of representatives from industry and federal, state, and tribal agencies. These tasks focus on coal bed methane and natural gas production in the San Juan Basin. Under the air monitoring task, Argonne is compiling data from current and historical air

quality and visibility measurement sites within the Four Corners Region. The data are being made readily accessible through a geographic information system (GIS) Web-based aerometric monitor mapping system. It provides easy access to data for analysis and use in supplementing planned modeling for regional haze and visibility assessments. Under a second task, Argonne is developing innovative incentive-based mitigation options for oil and gas production engines. This is being done by:

- Compiling an inventory of reciprocating internal combustion engines and assessing current engine technologies;
- Working with the Task Force to identify innovative technologies and economic-incentive-based NO_x emission reduction measures;
- Establishing voluntary partnerships to encourage collaboration between engine manufacturers and gas producers; and
- Conducting laboratory emission testing to evaluate the performance of advanced engine retrofits.

Glenn England of GE Energy described his work related to improvements in measuring $PM_{2.5}$ (particulate matter that is 2.5 micrometers or smaller in size) and estimating new emission factors, and he reviewed some new technologies that can help in capturing and controlling PM. He and his colleagues developed a compact dilution sampler technology for $PM_{2.5}$ stationary source stack sampling that offers improved portability, accuracy, and sensitivity for stationary source $PM_{2.5}$ measurements. The preliminary validation results are promising, but some issues remain with regard to very clean sources. Currently, an ASTM standard is being developed. The researchers developed new speciated $PM_{2.5}$ and precursor emission factors for gas-fired sources on the basis of dilution sampling. Thus far, only a small number of sources of each type have been tested; more samples are needed to calculate more robust emission factors. The $PM_{2.5}$ mass emission from continuous gas combustion is much lower when measured by using dilution sampling than by the traditional hot filter/iced impinger methods. $PM_{2.5}$ mass and speciation vary with source type and fuel. Traditional PM control devices were found not to be effective for "condensable" PM or ultrafine particles. Improvements in rapping technology and electrode geometry can increase capture rates 35–50%. Baghouse filter performance can be enhanced by pleating filter media and developing improved membrane materials and construction.

Steve Bergin of Integrated Concepts and Research Corporation (ICRC) described his company's efforts to produced synthetic fuels from remote and stranded gas by using a Fischer-Tropsch (F-T) process. The project had a strong focus on both military applications and on cold-weather locations (i.e., Alaska). The goals of the project were to:

- Design and operate a small-footprint F-T fuels plant,
- Produce about 150,000 gal of F-T diesel fuel from natural gas,
- Run dynamometer tests on two engines for diesel fuel-system durability,
- Demonstrate how F-T fuels performed in Denali National Park snowplows all winter,
- Compare F-T and conventional diesel fuels under cold-start conditions,
- Provide the first 10,000 gallons of F-T jet-fuel to the U.S. Military, and
- Study the feasibility of small-footprint F-T plants for rural Alaska.

The results showed that diesel lubricity additive works fine in F-T fuel. Diesel particulates and NO_x emissions are less than those from conventional fuels. Some injector fouling was observed in diesel engines, but it is believed to be controllable with minor fuel additives. However, even in Alaska, which has the highest U.S. prices for diesel fuel, small-scale F-T fuel economics are still marginal.

Discussion following the Day One Presentations

Bill Hochheiser of DOE noted that DOE's oil and gas environmental program has diminished as overall oil and gas research and development appropriations have been reduced. Some work will continue, but the scale is uncertain. A new oil and gas research program was authorized by the Energy Policy Act of 2005, but rather than being funded through DOE's budget, the new program relies on an outside organization (the Research Partnership to Secure Energy for America — RPSEA) to administer the research program. RPSEA plans to issue solicitations for research proposal during September 2007. Some of the solicitation topics will include environmental elements.

Angela Zahnhiser of BLM stated that she was unable to attend the program review on day 2, but she offered to make herself available for discussions about the role of BLM in air quality issues. She noted that BLM performs two monitoring programs in Wyoming; one is called State of the Atmosphere, and the other is called Wyoming Air Resource Monitoring System, or WARMS. Each of these programs operates several monitoring stations. In addition, the BLM also operates three National Atmospheric Deposition Program monitoring stations in Wyoming. Bill Hochheiser mentioned that DOE has conducted about 25 cooperative projects with BLM. Although only a few of these focused on air issues, he indicated DOE's willingness to work with BLM on air projects.

Much of the discussion session focused on industry's ability and need to comply with existing and future air quality regulatory requirements. Several persons suggested that oil and gas producers have concerns about meeting tightening air standards and should develop a greater focus on their environmental needs. Nancy Brown noted that some proposed standards do not account for background levels that enter regions by transport, are not subject to control by the affected regions, and may place the region in a noncompliant position without significant in-region emission sources. She further noted that there needs to be balance between regulatory requirements and what can realistically be achieved. It is counterproductive to create a regulatory regime with which most localities will be unable to comply despite diligent efforts. Several examples were discussed.

Jeff Adams of BP offered his opinion that the ozone standards come with a huge economic impact that has not yet been broadly recognized. New science will need to be developed to ascertain the meaning of regional haze and other parameters. Doug Blewitt of BP indicated that the proposed ozone standards for the rural West will lead to 20–30 exceedance days/yr, making rural Wyoming and Colorado nonattainment areas. There are lots of measurement and control issues. In Wyoming, about one-half of ambient ozone comes from transport from outside the

state. Jeff Adams also noted that more study is needed on stationary engine environmental controls, particularly for small engines.

Melissa Lunden mentioned that much of the air quality modeling used to support regulatory decisions has focused on urban regions (e.g., the Los Angeles air basin). There has been little focus on applying these state-of-the-art air quality models to the rural areas where much of the oil and gas production is occurring, such as the Intermountain West. In the research community, this has not been perceived as a top research topic; however, to meet the future air quality requirements, these tools will be needed. In addition, there are few to no measurements of important pollutants in these rural areas, and they are necessary as inputs to models and as means to measure model performance and to monitor and assess compliance.

The discussion shifted to DOE's role in technology and regulations. Bill Hochheiser noted that DOE looks at the impacts of new regulations on energy supply and end-use and often works behind the scenes with the EPA as new regulations are being developed to ensure that energy impacts are properly considered and sound science is used as the basis for new requirements. DOE has tried to get regulations adopted that do not preclude new technologies. The regulatory discussion concluded with a recommendation that a group of experts from different sectors (industry, government, consultants, researchers) be convened to suggest workable ways to get to compliance. It may be necessary to "think outside the box" to find workable solutions.

Adel Hanna was asked about the reduction in cost when VGR modeling is used. He noted that variable gridding could reduce computational effort and expense by a factor of about three. Bill Hochheiser mentioned that getting acceptance to use new models or modeling methods is difficult because of the biases and comfort levels of the stakeholders involved. Often, regulators prefer staying with an accepted model rather than going through the effort of getting a new model accepted.

The group also discussed several other topics not directly related to the day's presentations. These included air issues related to biofuels production, the hydrogen economy, advanced reactors, and carbon capture and sequestration.

Summary of Day Two – Thursday, August 23, 2007

Day-Two Overview

Unlike Day One, which focused on DOE-funded research, Day Two looked at industry research and concerns. Day Two also included a presentation by the EPA. The presentations are summarized in the following section.

Summary of Presentations

Dave Fashimpaur of BP is the current chair of PERF. He gave a short overview of the PERF organization, its history, and its membership. He showed examples of some current and completed PERF projects. Thus far, 81 projects with a value of more than$63 million have been completed, and 13 projects with a value of more than $2.2 million are currently under way. He discussed how researchers can get involved with PERF projects. More information on PERF can be found at www.perf.org.

Bob Fegley of EPA's Office of Research and Development (ORD) described ORD's organization and research goals. EPA has both technology and regulatory arms that are separate but interrelated. He gave these examples of air research that relates to the oil and gas industry:

- Emissions characterization that uses advanced optical and other measurement techniques;
- Air emissions control and prevention options, including advanced membrane systems and solvent substitution;
- Atmospheric characterization through the development and evaluation of methods to measure atmospheric concentrations of pollutants, such as particulate matter (PM) and other organics;
- Research to identify and describe atmospheric processes that impact pollutant fate and transport, particularly secondarily formed pollutants, such as ozone and secondary organic aerosols (SOAs);
- Models to identify integrated approaches for cost-effective pollution reduction from the refinery sector; and
- Information on health effects of pollutants emitted from petroleum-related operations, such as data from the Integrated Risk Information System (IRIS).

Many EPA regulatory actions are schedule-driven either by statute or by court orders. An integrated science document on NO_x is due soon under court order. New source performance standards for refineries and for reciprocating internal combustion engines, primarily used in oil and gas fields, are scheduled to be promulgated around January 2008. A major analysis of the environmental consequences of bio-based fuels is expected by the December 2008 time-frame.

Jeff Siegell of ExxonMobil described monitoring techniques for identifying leaks of VOCs. It is important to identify leaks because VOCs react with NO_x to form ozone. The EPA has standards for ozone. Further, some of the VOCs may be toxic or carcinogenic chemicals, like benzene,

xylene, or butadiene. The EPA also has regulations for hazardous air pollutants. The current approved methods for leak detection and repair (LDAR) are very labor-intensive and costly. An American Petroleum Institute (API) study showed that 92% of the leakage mass flow comes from only 0.13% of components. Smart LDAR is a technology that can rapidly screen for significant leaks, avoiding the manual checking of thousands of components that have minimal leakage. The development of Smart LDAR for VOC control is an API project that is an outgrowth of earlier work funded by DOE at Sandia National Laboratories. The presentation reviewed the technology development history of several generations of optical screening devices. Over time, the size of the equipment was reduced from a van-mounted unit to a device the size of a camcorder. In 2006, the EPA proposed a rule that would allow use of Smart LDAR for regulatory compliance. The final rule is currently under review. At the end of his presentation, Mr. Siegell showed a video that gives a clear view of the leak image seen by the LDAR camera.

Doug Blewitt of BP described some of the air quality issues that are impacting oil and gas operations in the Rocky Mountain region. The forthcoming ozone and haze regulations could restrict growth in the region and lead to a cap-and-trade regime in which offsets would be required for any new source. Air quality modeling for environmental impact statements (EISs) and other analyses will be a continued requirement. Recent air modeling shows that ozone transport by advection into the region is a major source. However, the EPA's CALPUFF model is significantly overstating the actual impacts. At many sites, there has been very little change in measured visibility or NO_x impacts. He believes that better modeling tools and approaches are an absolute necessity. Industry needs to stay very involved and insist on "good science." Industry and government should set up science peer review panels. Although sensible regulations are needed, he acknowledges that oil and gas emissions and practices also must change.

Bob Hermanson of BP described ozone National Ambient Air Quality Standards (NAAQS) recently proposed by the EPA. The EPA proposed a health-based primary standard and a secondary standard for foliar and crop protection. Both proposed standards are lower than the currently promulgated values. Public hearings will be held in Philadelphia, Los Angeles, Atlanta, Chicago, and Houston. The EPA has proposed a new process for revising the NAAQS by using an Integrated Science Assessment instead of the currently used Criteria Document. The current process is elaborate and involves multiple reviews and revisions. Virtually all final rules are litigated, often by both industry and environmental stakeholders. Current health effect models do not recognize any threshold level of exposure, which has made it difficult to justify any detectable level as being "safe."

Bob Hermanson made a second presentation on behalf of Ted Steichen of API, who was unable to attend the program review. The API-managed NAAQS-related research effort was described. Industry needs to look ahead and develop science to impact the 2009 and 2010 EPA review cycles. It is too late to impact the current cycle. Standards will continue to trend down because of nonthreshold health effects models and improved analytical capabilities. The API strategy is to identify scientific gaps in PM and ozone. The majority of the API research funds will be leveraged with other partners, such as research institutes and industrial partners. Areas of activity will include the following:

- PM Exposure Characterization: For emission sources of concern, identify and quantify specific PM components.
- PM Health Effects: Of the identified PM components, determine which, if any, are associated with toxicity and adverse health impacts, and what is the shape of the exposure-response curve.
- Ozone Exposure Assessment: Perform air quality analysis to identify and support relevant background levels; confirm and address exposure misclassification; and identify trends in ambient air concentration levels.
- Ozone, Health Effects: Determine which supposed cause/effect relationships are genuine and what is the shape of the exposure-response curve.
- Communications of Research Results: Develop less technical descriptions of research results and develop messages about those results for key policy makers beyond EPA technical staff.

Discussion following the Day Two Presentations

The goal of the Day Two discussion was to identify gaps in research and technology and to have a conversation about how to meet those needs that covered funding sources. The discussion began with a review of a list of research needs suggested by Doug Blewitt. There is a need for:

- The development of more accurate approaches for estimating oil and gas growth that reflect a decline in production. Need to get actual emission inventories. There is a lot of uncertainty in the numbers. Uncertainty should be quantified and documented.
- A critical review of visibility impairment assumptions. Nancy Brown thinks that some of this may have been done already for the Western States Petroleum Association.
- Rethinking ozone compliance (national level).
- Photochemical modeling (dealing with the importance of boundary conditions, uncertainty in modeled effects of distance sources, compensating errors).
- Meteorological modeling (there is the potential for a large uncertainty in local and distant wind fields).
- An analysis of emission trends and monitoring trends.
- Advances in control technology (which may require draconian measures)

Nancy Brown suggested several other areas in which research is needed to add to Doug's list:

- Climate,
- Interaction of climate and air quality,
- Emissions from Asia,
- Interactions between PM and ozone,
- Secondary organic aerosols,
- Need to know the actual background levels,
- Multiple pollutant strategies,
- Instrumentation for continuous monitoring, and
- New fuels and their air quality and climate impacts.

The discussion shifted to how research could be used to answer regulatory questions and, in particular, ease unnecessarily stringent regulations. Doug Blewitt noted that in Colorado, regulators wanted to put VOC controls on natural-gas-fired engines, an action that does not accomplish much. Jeff Adams stated that sometimes, particularly with regard to air issues, underlying causality is murky enough that regulators may come to conclusions than are the opposite of what the research indicates. He added that the EPA is often driven by statutory or court-ordered schedules and is unable to take the time to carefully review and interpret research findings. Ideally, industry would like to get regulatory recognition that oil and gas activities are only small contributors to emissions in some areas.

Doug Blewitt stated that conducting cooperative studies with agencies can often yield results that have better credibility and gain more acceptance. John Veil gave a water-related example of how this principle can work. Each year, a large zone of low oxygen (the hypoxic zone) forms in the Gulf of Mexico. Although most scientists believe the cause is nutrients coming from the Mississippi and Atchafalaya Rivers, when EPA Region 6 was renewing the discharge permit for offshore oil and gas discharges in 2004, it asked for a study of the nutrient levels in discharges coming from the platforms. The results of a cooperative study involving DOE, EPA, Minerals Management Service (MMS), and industry showed that the total pound loading coming from platforms was less than 1 percent of the river loading into the Gulf of Mexico. The EPA reviewed the data and hired a contractor to model the data. The EPA ultimately agreed that no additional nutrient controls on platform discharges were warranted, thereby avoiding hundreds of millions of dollars of potential cost plus some lost oil and gas production and lost tax and royalty revenue.

Bill Hochheiser reported that DOE has frequently played the role of conducting research to justify more realistic regulatory requirements. The DOE staff and its technical support provided through national laboratories and other contractors is funded by the research and development budget. The loss of that budget means a loss of staff and contractors for involvement in studies. Unfortunately, there often is a political view that there is no need for government research support. The best evidence for getting future research funding is a quantitative benefit. Estimates of actual or potential savings are needed. It is much more difficult to show the value of a project that leads to avoided costs than one that develops a technology or “widget” that actually saves cost.

Nancy Brown noted that, in the regulatory community, there sometimes exists a mistrust of scientific contributions that result from projects supported by DOE or industrial partners. LBNL has observed this while attempting to contribute to the science being reviewed in support of the latest PM standard. Melissa Lunden commented on a perceived lack of interest in new voices in the review of current and future air quality standards. The EPA, in particular, often appeals to the same experts over time, which restricts new viewpoints on the science.

Melissa Lunden added that sometimes companies are unwilling to share emissions data with the public. Furthermore, the public is usually leery of “company” research. Jeff Adams replied that much of the industry reluctance is because of fear of stricter permit limits and potential compliance issues.

Discussion continued on the role of industry and government in funding research and the barriers that future funding would face. Jeff Adams noted that it is hard within industry to get a focus on longer-term regulatory actions; there is a strong tendency to focus on the near term, much of it driven by compliance needs. Vanessa Tassas added that it is difficult to get upper management interest in long-term research, since there is a strong short time horizon for expenditures and results. She added that many senior managers are approaching retirement so are not focused on longer term issues.

Jeff Adams mentioned that although cooperative projects are undertaken, most cooperative work is done on a subscription basis where information is shared among only the sponsoring or participating companies (e.g., Joint Industry Projects or PERF projects). There often is a disconnect between funding and benefits. He added that API is the only trade association he knows of that has a research budget, but API members are a minority producer in most U.S. fields. As an example, the Kansas State University engine program (Day One presentation by Sarah Nuss-Warren) was difficult to fund even though industry broadly understood its value. He added that industry is better at organizing and executing research than it is at getting broad acceptance of results in policy forums. DOE has always helped get the research accepted by the agencies by participating in the studies. Mr. Adams added that in many cases, industry (through API and individual companies) has funds set aside for research, but they do not have staff or member "sweat equity" available to manage the projects. He postulated that if DOE could provide manpower to help promote, organize, coordinate funding and manage the projects industry needs, more research might get accomplished and the research would retain DOE's credibility. The trade associations do a lot of good individually, but no one can do enough. Coordination of their efforts would be a step forward. It was recognized by the group that DOE did not have the funds for this type of effort, but Mr. Adams stated that this concept might be good for future budget discussions.

Melissa Lunden commented on a perceived disconnect between the different research communities tackling environmental issues. A majority of the academic work on air quality is supported by the EPA, National Science Foundation (NSF), National Oceanographic and Atmospheric Administration (NOAA), and other organizations that do not traditionally interact with the national laboratory and industrial research communities, and vice versa. There are numerous reasons: different research agendas, difficulty sharing resources between the different organizations, or just distrust. As a result, solutions to science questions that benefit all communities in the goal of cleaner air do not get addressed as such.

Bill Hochheiser noted that a traditional reason for government-funded research is the inability of private-sector funders to capture the benefits of the research.

Another area of discussion was international air quality and global transport. Jeff Adams noted that CO_2 is recognized to be a global issue having global sources, but there has been no real talk about global ozone transport. Nancy Brown added that the global ozone background concentration is 30–40 parts per billion, with higher levels at higher elevations. Daytime heating produces higher ozone levels at higher altitudes, which tends to mix with lower altitude air mass.

The remainder of the discussion covered how to develop a research needs list and to move forward. The current meeting was thought to be a good beginning, but the group expressed an interest in continued meetings with a larger number of participants representing different stakeholder groups. Bill Hochheiser noted that DOE is unlikely to have much budget but would be willing to orchestrate such a meeting. Industry would need to be willing to provide funding to support the research if much interest is to be developed. He expressed a willingness for DOE to work with PERF toward developing a needs document.

A National Petroleum Council (NPC) report on “Hard Truths” was mentioned as identifying research needs. The report could possibly serve as a starting point on research needs.

There was considerable discussion regarding how to initiate a program to address the identified air quality research needs. It was felt that a potential approach would be to convene a joint PERF meeting that would target developing a conceptual program to for the research needs.

Appendix A – Agenda for the Program Review

ARGONNE NATIONAL LABORATORY

AGENDA

Program for Wednesday, August 22 – AIR PROGRAM REVIEW – PRESENTATIONS OF AIR PROJECTS BY DOE-FUNDED CONTRACTORS

7:30 AM	Registration and Continental Breakfast	
8:00 AM	Welcome to Annapolis, Review of Logistics	John Veil, Argonne
8:10 AM	Introduction of Participants	All
8:20 AM	Introductory Remarks on Program Review	Bill Hochheiser, DOE
8:30 AM	Modeling the Transport and Chemical Evolution of Onshore/Offshore Emissions and Their Impact on Local and Regional Air Quality Using a Variable-Grid-Resolution Air Quality Model	Adel Hanna, Univ. of North Carolina
9:00 AM	Distributed Generation Power Units at Marginal Oil Well Sites	Edan Prabhu, FlexEnergy
9:30 AM	Cost-Effective Reciprocating Engine Control and Monitoring for E&P Field and Gathering Engines	Sarah Nuss-Warren, Kansas State University
10:00 AM	Break	
10:20 AM	Seasonal Modeling of Central Calif.	Nancy Brown, Lawrence Berkeley Laboratory
10:50 AM	Seasonal Modeling of Central Calif. – contd.	Nancy Brown, Lawrence Berkeley Laboratory
11:20 AM	Compilation and Presentation of Existing Data on Oil and Gas Leasing and Development in a Matter Useful to the NEPA Process	Gerry Baker, IOGCC
11:50 AM	Lunch	
12:45 PM	Characterizing the Formation of Secondary Organic Aerosols	Melissa Lunden, Lawrence Berkeley Laboratory
1:15 PM	Characterizing the Formation of Secondary Organic Aerosols – cont'd.	Melissa Lunden, Lawrence Berkeley Laboratory
1:45 PM	Four Corners Air Quality Science and Technology Initiatives for Sustainable Oil and Gas Development	Mike Lazaro, Argonne National Laboratory
2:15 PM	Break	
2:35 PM	PM2.5 Measurement Improvements, Emission Factors and Control Challenges	Glenn England, GE
3:05 PM	F-T Fuels Production and Demonstration	Steve Bergin, Integrated Concepts & Research
3:35 PM	Discussion of Contractor Presentations	All
4:15 PM	Adjourn	

Program for Thursday, August 23 – REVIEW OF AGENCY AND INDUSTRY AIR RESEARCH AND INDUSTRY AIR ISSUES

7:30 AM	Continental Breakfast	
8:30 AM	Announcements	John Veil, Argonne
8:40 AM	PERF Overview and Introduction of Day 2 Agenda	Dave Fashimpaur, BP
9:00 AM	EPA Activities Related to Petroleum/Air Pollution Issues	Bob Fegley, EPA
9:30 AM	Smart LDAR for VOC Control	Jeff Siegell, ExxonMobil
10:00 AM	Break	
10:30 AM	Western Air Quality Issues Faced by Oil and Gas – A Business Risk	Doug Blewitt, BP
11:00 AM	Current Status of Ozone NAAQS Review, and EPA's Plans to Streamline the NAAQS-Setting Process	Bob Hermanson, BP
11:30 AM	API's Ongoing Research Programs and Opportunities for Partnering and Augmentation	Ted Steichen, API (presentation made by Bob Hermanson, BP)
12:00 PM	Lunch	
1:00 PM	Facilitated Discussion of Air Research Gaps and Needs	John Veil, Argonne
2:30 PM	Adjourn	

Appendix B – List of Attendees

Name		Affiliation	Address	City	State	Zip	Phone	email
Adams	Jeff	BP America Production Company	501 Westlake Park Blvd.	Houston	TX	77079	281-366-3173	adamsja@bp.com
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