

Intermountain West Data Warehouse - Western Air Quality Study

Operation Plan: Process for Future Work Plans and Contingency Plans

1. Purpose of Operational Plan

This document outlines a process for streamlining the development of future Intermountain West Data Warehouse - Western Air Quality Study (IWDW-WAQS) work plans or contingency plans (hereafter referred to as “plans”) for the Cooperating Agencies and affiliated contractors by documenting the steps and basic elements needed for developing future plans. Previous work plans developed for the IWDW-WAQS have generally covered work activities on a 3-year cycle. In the case where all resources are allocated or depleted and the Cooperating Agencies cannot obtain additional funding to cover future IWDW-WAQS work activities, the Cooperating Agencies will need to develop a contingency plan.

The document is organized into the following sections:

- Section 2: Determination of the Development of a New Work Plan or Contingency Plan
- Section 3: Background of IWDW-WAQS
- Section 4: Benefits of the IWDW-WAQS
- Section 5: Sustainability and Funding Mechanisms of IWDW-WAQS
- Section 6: Administrative Items of IWDW-WAQS
- Section 7: Scope of Technical Work for New Work Plan
- Section 8: Scope of Expansion Criteria and Guidelines
- Section 9: Leveraging and Coordinating with other Air Quality Analysis, Management, and Planning Groups
- Section 10: Preparation and Approval Process and Timelines for Each New Work/Contingency Plan

2. Determination of the Development of a New Work Plan or Contingency Plan

Prior to the culmination of each current or effective work plan or when all resources are allocated to work activities, the Cooperating Agencies will need to decide on one, or a hybrid, of the three options outlined below. The selection of the option(s) will determine whether another 3-year work plan or a contingency plan will need to be developed for the study. The planning process should begin about twelve months prior to the end of funding. The options for consideration based on future resources and commitments include:

Option 1: Continue IWDW-WAQS efforts and develop another 3-year work plan. Assumes additional funding is available (or likely to be available) to sustain work efforts through federal and state agencies and other contributions, direct contributions by private sector contributions through BLM, or outside client contributions. This results in the continuation of IWDW operations and air quality monitoring and modeling work to support future air quality planning studies.

Option 2: End study at the culmination of the current work plan, and the Governing Board commits to obtaining funding to keep IWDW operational until other funding opportunities become available to support additional monitoring and modeling work. This results in supporting future air quality planning studies with the available work products, but this option will not support the acquisition of future monitoring data and updated air quality modeling products. Time provided by staff may also need to increase without sufficient funding to support contractors.

Option 3: End study at the culmination of the work plan, and develop a contingency plan that will shut-down all activities assuming the Cooperating Agencies cannot obtain funding to support IWDW-WAQS beyond the current work plan. This results in developing an approach for filling final data requests, housing data outside of CSU/CIRA, taking IWDW off-line, communicating situation to users, etc.

If the decision by the Cooperating Agencies is to develop a new work plan, the remaining sections of the document (section 3 to section 10) outline the components of the WASQ-IWDW that should be assessed for the potential revisions or updates and elements that should be addressed in the new plan.

If the decision by the Cooperating Agencies is to develop a contingency plan, the contingency plan should, at a minimum, address the following items:

- Approach for filling final data requests.
- Storage of data outside of CSU/CIRA.
- Procedures for taking IWDW off-line.
- Communication of situation to users.
- Future communication and coordination efforts among Cooperating Agencies to discuss potential re-activation of the IWDW-WAQS.

3. Background of IWDW-WAQS

The National Environmental Policy Act (NEPA) and federal Clean Air Act (CAA) require air quality planning studies and projects by federal, state, and local agencies. These detailed air quality assessments address actions that may significantly affect the environment or are needed to adopt emissions controls to achieve health and welfare air quality standards and rules. The air quality assessments may include a qualitative analysis that describes the air quality issues or impacts using available monitoring data and studies. The air quality assessments may also include a quantitative analysis that involves the use of air quality models to assess potential impacts to air quality and Air Quality-Related Values (AQRVs), such as visibility and atmospheric deposition.

A plume dispersion model (e.g., AERMOD) and a photochemical grid model (PGM) (e.g., CAMx and CMAQ) are typically used to quantitatively assess the potential air quality impacts associated with a proposed development or air quality improvements resulting from mitigation strategies. These models require emissions and meteorological information to estimate the concentration and dispersion of pollutants that are known to impact air quality. Considerable resources are needed to develop the model inputs and to conduct the air quality

modeling analyses. As a result, multiple federal and state agencies in the intermountain west identified the need to more efficiently and expeditiously collect air quality data and conduct air quality modeling. To address this need, the agencies entered into a Memorandum of Understanding (MOU) in 2011 to initiate a pilot project (Three State Air Quality Study (3SAQS))¹ that would add ambient air quality monitoring stations and develop an air quality modeling platform to assess the air quality in the intermountain west. The 3SAQS developed the Intermountain West Data Warehouse (IWDW) to maintain the ambient monitoring data, emission inventories, meteorology, and air quality modeling inputs and outputs. After the 3SAQS culminated in 2014, the Cooperating Agencies of the study decided to continue the efforts and refer to the study as the Western Air Quality Study (WAQS).²

The on-going goals of the IWDW-WAQS include:

- Maintaining the high-quality and sustaining the technical capacity that was developed in the 3SAQS pilot study.
- Operating and maintaining an ongoing data warehouse (i.e., the IWDW) with current, representative, and complete data, particularly every three years to coincide with the National Emissions Inventories (NEI).
- Ensuring the ability to characterize air quality in the region at a high level.
- Working under analysis protocols and data criteria that are commonly agreed to by the Cooperating Agencies.
- Effectively communicating project status and activities internal and external to the Cooperating Agencies.
- Establishing and maintaining a future funding mechanism to ensure sustainability of monitoring sites, air quality modeling platform, and the IWDW.

4. Benefits of the IWDW-WAQS

The IWDW-WAQS provides high quality tools for understanding and assessing the effects of current and future energy development on air quality in the intermountain west. It also provides a centralized and robust platform to store and share air quality monitoring and modeling data. The products provided by the IWDW-WAQS are reviewed and approved by multiple federal and state agencies as a measure of quality assurance and to ensure that the most state-of-the-science techniques are used to produce the products provided by the IWDW-WAQS for air quality analyses. These efforts also result in streamlining a process for air quality analyses and ensuring consistency among data formats, data quality, data updates,

¹ Memorandum of Understanding for the Three State Study Data Warehouse Pilot Among U.S. Environmental Protection Agency Region 8, Bureau of Land Management – Colorado, Utah, Wyoming State Offices, U.S. Forest Service Region 2 and 4, National Park Service Intermountain Region, Colorado Department of Public Health and Environment, Wyoming Department of Environmental Quality and Utah Department of Environmental Quality, January 2011. http://views.cira.colostate.edu/tsdw/Resources/project_documents/MOU3State.pdf

² Memorandum of Understanding for the Intermountain West Data Warehouse for Air Quality Among U.S. Environmental Protection Agency Region 8, Bureau of Land Management – Colorado, Utah, Wyoming and New Mexico State Offices, U.S. Forest Service Rocky Mountain Region, Intermountain Region and Southwestern Region (14-MU-11020000-042), National Park Service Intermountain Region, Fish and Wildlife Service, Mountain-Prairie Region 6, Colorado Department of Public Health and Environment, Wyoming Department of Environmental Quality, Utah Department of Environmental Quality, and New Mexico Environment Department, 2017. http://views.cira.colostate.edu/tsdw/Resources/project_documents/Intermountain%20West%20MOU.pdf

data collection, and analytical assumptions. Most importantly, the IWDW-WAQS reduces the redundancy and resources of starting an air quality analysis from scratch. In particular, analyses would not need to generate model input data for baseline periods, a no-action scenario for future model simulations, and model performance evaluations. It is predicted that future projects utilizing the IWDW-WAQS products could save up to two years and \$800K per project.

The products offered through the IWDW-WAQS can be used in conducting air quality assessments for NEPA, Regional Haze, State and Federal Implementation Plans, AQRVs, land management planning (e.g., forest planning), and other regulatory air quality analyses. Groups positively affected by the IWDW-WAQS includes oil and gas companies, scientists, land managers, outdoor recreation enthusiasts, ozone sensitive plants, air quality regulators, decision-makers, environmental groups, and tax payers.

5. Sustainability and Funding Mechanisms of IWDW-WAQS

The Cooperating Agencies have fully funded IWDW-WAQS activities and leveraged external data and studies since the creation of the study. While these are subject to change, the minimum estimated costs of sustaining the IWDW-WAQS for the current Cooperating Agencies and geographic domain using past budget information are:

- Emissions Inventory and Air Quality Modeling over 3-year Cycle: \$1.15 million
- Operation of Current Two Monitoring Sites Per Year: \$70K
- Operation and Maintenance of Data Warehouse Per Year: \$230K
- Project Coordination: As needed and subject to on-going evaluation

In addition, all the Cooperating Agencies have contributed significant in-kind resources. In the future, the Cooperating Agencies will continue to seek funding on an annual basis to maintain the operations of the IWDW and support the air quality monitoring and modeling work. Each Cooperating Agency will also continue to elect and retain representatives or staff to participate and contribute to each board, committee, and workgroup of the WAQS.

It is unlikely that sufficient federal and state funding will be available to fully fund the IWDW-WAQS in the future. The goal of Cooperating Agencies is that future funding, beyond the Cooperating Agencies' ongoing support, will be supplemented by external agencies or other public or private clients that use the data products. Two options have been considered for receiving and managing funding provided by clients of the IWDW-WAQS, including:

1. Users providing grants to the U.S. Department of the Interior. Grants are monies provided with no expectation of particular outcomes. These funds would then be managed using the current NPS budget and procurement approach.
2. Users directly funding WESTAR-WRAP for project management and specified contract technical work. WESTAR-WRAP may work with clients by potentially augmenting project funding.

In either of these approaches, Department of the Interior agencies may make IWDW-WAQS funding needs known to proponents of projects on federal lands. The proponents will benefit from this collaboration through the use of the IWDW-WAQS data, which will enable required air quality analyses to be completed more timely and efficiently, with data that have been reviewed and approved by the Cooperating Agencies. The availability of approved data will promote consistency in air quality analyses. Keeping both options available maintains flexibility as some situations may favor one over the other or may even lead to a combined approach for a particular task.

6. IWDW-WAQS Administration

The processes outlined in this section will continue unless changes are documented in future plans and approved by the IWDW-WAQS Governing Board.

6.1. Project Coordination and Collaboration

As outlined in the most recent MOU, the Lead Agency of the IWDW-WAQS is responsible for coordinating the activities of the study with coordination and administrative support from WESTAR-WRAP. This includes arranging and coordinating meetings for the various committees, recommending the creation of special-purpose groups and organizing their meetings, keeping records of IWDW-WAQS activities, awarding and directing cooperative agreements and contractor support for the IWDW-WAQS, and ensuring that procedures outlined in the MOU and supplemental agreements and plans are followed by the Cooperating Agencies.

Collaboration and communication among the IWDW-WAQS Cooperating Agencies and WESTAR-WRAP regarding external funding and outreach efforts, proposed projects through the IWDW-WAQS, and in-kind resources are very important for ensuring the continued support of the work. Therefore, the IWDW-WAQS Cooperating Agencies and WESTAR-WRAP will be informed of all projects, outreach, and external efforts, and all products will be readily available through the IWDW.

WESTAR-WRAP will continue its roles in managing the day-to-day operations of the IWDW-WAQS efforts, evaluating and arranging training and capacity-building opportunities as appropriate, and ensuring the ongoing viability and performance of the IWDW-WAQS, using recommendations from the IWDW-WAQS Cooperating Agencies.

6.2. Project Management

The IWDW-WAQS Governing Board has overall budget and resource allocation authority for the long-term, on-going operations of the study. The Oversight Committee sets specific work priorities and funding levels for work tasks based on the most current approved work plan, and may make revisions to the work plan and create sub-workgroups to address the objectives of the Cooperating Agencies. The Technical Committee is a group of expert technical and program staff representing the Cooperating Agencies that supports the Oversight Committee and oversees the IWDW, the WAQS, and associated regional

monitoring and modeling efforts.³ The Data Stewards Committee is a sub-group of the Technical Committee that reviews data requests submitted through the IWDW in order to distribute the IWDW data to the recipients in an efficient and expeditious manner.⁴ WESTAR-WRAP provides contract support to the IWDW-WAQS. WESTAR-WRAP coordinates activities with the IWDW-WAQS Lead Agency representing the Cooperating Agencies, including the Oversight and Technical Committees and sub-workgroups, manages the work completed by IWDW developers and WAQS modeling contractor teams, provides point-of-contact outreach to potential outside funding groups, and provides status and progress reports on all IWDW-WAQS activities.

6.3. Financial Management

The National Park Service (NPS) currently provides financial management for funds provided by the Cooperating Agencies for the IWDW-WAQS, including cooperative agreement and budget management. In the current approach, federal funds are transferred to the NPS through interagency agreements. The NPS then awards task agreements to WESTAR-WRAP for IWDW-WAQS coordination and WAQS modeling studies, and to Colorado State University (CSU) for IWDW development and operations. WESTAR-WRAP contracts for emission inventory and air quality modeling services as a part of its project coordination responsibilities. The management of project equipment and the IWDW should be consistent or incorporated into these cooperative agreements.

6.4. Management of In-Kind Resources

To date, there has been considerable non-financial assistance to the IWDW-WAQS from staff of the Cooperating Agencies. This assistance has included project planning, financial management, data analysis and evaluation of IWDW-WAQS work products. Cooperating Agency staff assistance is expected to continue and in fact may need to increase if sufficient funding is not available to support IWDW-WAQS activities.

Other in-kind assistance may come from other state and federal agencies, industry, or academic and research groups. This assistance could include measurement studies and emissions and modeling studies that provide important leveraging opportunities. In general, it is expected that these leveraging opportunities will be approved if they are consistent with the goals of the IWDW-WAQS Cooperating Agencies and do not interfere with the ability of the IWDW-WAQS to support the goals of the Cooperating Agencies.

6.5. Management of Project Equipment and IWDW

³ Intermountain West Data Warehouse (IWDW) Technical Committee, March 2016. http://views.cira.colostate.edu/tsdw/Resources/project_documents/WAQS_IWDW_TechnicalCommittee_Description_03222016.pdf

⁴ Intermountain West Data Warehouse (IWDW) Data Stewards Committee (“Project Stewards”), March 2016. http://views.cira.colostate.edu/tsdw/Resources/project_documents/WAQS_IWDW_DataStewards_Description_03222016.pdf

Other IWDW-WAQS resources primarily include monitoring equipment that was purchased with 3SAQS/WAQS funds and the IWDW itself (i.e., computer hardware purchased with study funds and intellectual property such as software code developed by IWDW staff). The Oversight Committee will develop a recommendation for ownership of monitoring equipment to be transferred to the Cooperating Agency that is functioning as the primary site operator for a given location. Guidelines for IWDW data quality, representativeness, and uses are under the direction of the Cooperating Agencies through documented recommendations of the Technical Committee.

Datasets currently held by the IWDW were developed with federal funding and are in the public domain, and as such, any organization may request the data. However, IWDW staff have limited resources to fulfill data requests. Therefore, the IWDW-WAQS Cooperating Agencies and their contractors receive first priority for fulfillment of data requests. The IWDW Data Stewards subgroup will develop procedures to manage other data requests, including a description of information that will be required from requesters.

Through the NPS-CSU task agreement, IWDW computer hardware purchased with study funds is the property of CSU while the IWDW operations are physically located at CSU. The need to transfer equipment would be decided if and when the IWDW were to be physically located elsewhere.

The IWDW software is also in the public domain and can be used by, or transferred to, the Cooperating Agencies or other authorized users. CSU will track any requests for software copies and report those activities on a quarterly basis as needed. If and when the IWDW were to be physically located elsewhere and CSU was no longer operating the IWDW, CSU would provide complete and up-to-date copies of all software used and data stored in the IWDW to the Lead Agency of the IWDW-WAQS before CSU operational responsibilities end.

Procedures for data distribution may change in the future depending on how the IWDW and WAQS is funded. Future changes might include a cost for software or data access to support routine IWDW operations after 2017. Also, the funding sources and associated assessment activities by the WAQS may change over time. These decisions will be made after consultation among WESTAR-WRAP, CSU and the Cooperating Agencies.

6.6. Communication and Outreach

Effective communications with respect to the IWDW-WAQS are essential for maintaining support for the work both inside and outside of the Cooperating Agencies. This will entail an ongoing commitment to build upon and strengthen the intended message that will generally focus on the accomplishments of the IWDW-WAQS by the Cooperating Agencies and the benefits derived from them, as well as describing what is planned for the future. The primary communications tools so far have been a brochure⁵ and PowerPoint presentation⁶ about the

⁵ Reaching New Heights Flyer, August 2015.

http://views.cira.colostate.edu/tsdw/About/Files/outreach/IWDW_WAQS_OutreachFlyer_08212015.pdf

⁶ Reaching New Heights PowerPoint, November 2015.

http://views.cira.colostate.edu/tsdw/About/Files/outreach/IWDW-WAQS_Outreach_Final_Nov16_2015.pdf

project and presentations at various meetings and conferences. These materials are available on the IWDW.⁷ Continued development of communication tools will be necessary for conducting effective outreach, and will be developed through IWDW-WAQS workgroups.

Communication and outreach products will be approved by the Oversight Committee for use and distribution. The Cooperating Agencies may also seek assistance from WESTAR-WRAP to communicate the IWDW-WAQS products to internal and external groups.

7. Scope of Technical Work for New Work Plan

As resources allow, the IWDW-WAQS intends to complete a base and future year air quality modeling platform that includes monitoring data and a base case Model Performance Evaluation (MPE) for the years associated with the National Emissions Inventory (NEI). The NEI is developed and released by the EPA every three years (i.e., 2014, 2017, etc.). Therefore, the focus of new technical work and associated plans should start with years corresponding to NEI years with 3-year life spans. The air quality modeling activities should also include the Comprehensive Air Quality Model with eXtensions (CAMx) and the Community Model for Air Quality (CMAQ) photochemical grid models (PGMs) and 36/12/4 kilometer (km) model domain that sufficiently covers the Cooperating Agencies' areas of interest, unless changes are documented in the new work plan and approved by the Cooperating Agencies.

Each new 3-year IWDW-WAQS work plan should be approved by the Governing Board at least six months prior to the end of the previous work plan. The completion of the tasks outlined in each new work plan should anticipate the release date and content of the next NEI, and the associated steps in building the new WAQS modeling platform, unless changes are documented and approved by the Governing Board. With approval by the Cooperating Agencies, the IWDW-WAQS may also complete a base model platform for non-NEI years or additional future-year model platforms, or revise the new work plan within the work-cycle to account for additional work.

The sections below outline the oversight and management of the technical work and the recommended 3-year work plan components. The components of the new work plan should include monitoring, emissions inventories and modeling, meteorological modeling, air quality modeling, and updating and maintaining the data warehouse. The information below also describes the general objectives, work tasks, and deliverables that should be considered for each component and addressed in a new work plan.

7.1. Oversight and Management Efforts

It will be necessary for the IWDW-WAQS Project Lead Agency on behalf of the Cooperating Agencies, the NPS for financial management on behalf of the Cooperating Agencies, and WESTAR-WRAP in the IWDW-WAQS coordinator role, to ensure that the appropriate technical and funding resources are available to accomplish the tasks outlined in this section or in a new work plan in a cost-effective and timely manner. This includes:

⁷ Intermountain West Data Warehouse - <http://views.cira.colostate.edu/tsdw/>

- Continuing and updating Cooperative Agreements for IWDW operations and IWDW-WAQS coordination as needed;
- Assuring the bidding and awarding of firm, fixed price contracts with defined deliverables over time to perform the technical work which includes emission inventory development and modeling in consultation with the Technical and Oversight Committees;
- Overseeing and coordinating the modeling contractor(s) in consultation with the Technical Committee and with approval of final work products by the Oversight Committee;
- Providing regular updates to the Governing Board and the Oversight Committee;
- Promoting collaboration with other projects that may be synergistic;
- facilitating technical training and capacity building within Cooperating Agencies as needed;
- Managing the receipt and use of project monies;
- Coordinating the communications and outreach activities; and
- Providing logistical and facilitation support, as needed.

The Project Lead will also need to ensure that the IWDW has the capacity to accommodate the IWDW-WAQS work products and user needs.

Each component of a new work plan should include a protocol, progress reports, and final report of the activities to be reviewed and approved by the Technical and Oversight Committees. Periodic meetings among the Cooperating Agencies should also occur throughout the work plan 3-year cycle to discuss the progress, challenges, and potential changes to the work. All associated documents and meeting notes will be prepared by IWDW-WAQS staff and contractors, as well as Cooperating Agencies, and maintained on the IWDW.

7.2. Monitoring Efforts

It will be necessary to review the monitoring network periodically to ensure it is still meeting the needs of the IWDW-WAQS. The monitoring network is important for understanding air quality trends and to support model performance evaluation (MPE). An evaluation of the air quality monitoring network will occur once in a 3-year technical cycle that aligns with the air quality modeling work until the network configuration becomes stable and few changes are recommended during the review process.

The general objectives of the monitoring network assessment should include:

1. Assess the network adequacy to determine whether:
 - The current monitoring network meets objectives of the Cooperating Agencies to understand air quality trends and support MPE;
 - The regional air quality monitoring network is adequately characterizing impacts from existing and potential future sources are adequately captured; and
 - AQRVs in representative Class I and sensitive Class II areas, as determined by the Cooperating Agencies, are adequately monitored.

2. Determine optimal network configuration that recommends:
 - Additional monitoring sites;
 - Removing or re-locating redundant monitors to save money;
 - Measurements of other pollutants or AQRVs; and
 - Incorporation of new equipment or new technologies.

The approach of the monitor network assessment should also include:

1. Review of previous assessments for lessons learned and to build upon for new work.
2. Analyses of monitoring goals to ensure they are still relevant to the needs of the Cooperating Agencies.
3. Data gathering that includes:
 - Complete list of monitoring sites, parameters measured, period of record, AQS monitoring objective (i.e., population oriented, source oriented, background), etc.;
 - Trends analyses of annual and seasonal ozone and particulate matter at each monitoring site;
 - Summaries of emissions by oil and gas basins for each state, area and mobile sources by county, major point sources within each state; and
 - Maps of monitoring sites, active oil and gas wells, major point sources, surface ownership, political boundaries, population density, seasonal wind and temperature climatology and key episodic conditions (e.g., winter stagnation or cold pool events).
4. Literature review of new technologies that could be beneficial for the study.
5. Cost analyses to address:
 - new monitoring sites;
 - potential site removal or re-location;
 - funding needs and sources; and
 - costs associated with current network and for any recommended network changes.

The deliverables of the monitoring network assessment should include:

1. Protocol outlining specific work objectives, procedures, and activities, type of assistance and information needed from the Cooperating Agencies, and timeframes.
2. Progress reports outlining completed and upcoming work, challenges, changes to the Protocol, and resources.
3. Monitoring Network Assessment Final Report that addresses the objectives of the evaluation and provides recommendations to the Cooperating Agencies.
4. Transfer of all work products to the IWDW.

7.3. Emissions Inventories Efforts

The intent of the IWDW-WAQS is to develop a complete set of base year emissions on a 3-year cycle that corresponds to NEI (i.e., 2014, 2017, etc.) and future year emissions inventories. The future year emissions inventory will include projected future emissions changes relative to the base year inventory, and will represent a “no action” case that can be used as a basis for evaluating effects of proposed development projects. The future year will

be determined by the Cooperating Agencies based on the needs of upcoming air quality planning projects.

The general objectives of the emissions inventories work in a new work plan should include:

1. Development of a complete set of base year emissions inventories; and
2. Development of a complete set of future year emissions inventories.

The approach for developing the emissions inventories should also include:

1. Review of previous emissions inventories work for lessons learned and to build upon for new work.
2. Oil and gas surveys and emissions that accurately characterize oil and gas sources in the study area.
3. Evaluation and use of the latest version of EPA's NEI and western air agency inputs to calculate emissions for the following source categories:
 - Point (permitted or registered)
 - Non-Point
 - Mobile (option for IWDW-WAQS version vs. MOVES from NEI)
 - Ammonia
 - Methane
 - Fire (including recommendations from WRAP Fire and Smoke Work Group)
 - Dust (including recommendations from WRAP Regional Technical Operations Work Group)
 - Biogenics (including evaluation of options other than MEGAN)
4. Performance of emissions quality assurance assessments recommended by the Cooperating Agencies.⁸
5. Completion of a trends analysis using previous emissions information.
6. Review of the data and forecasting tools for projecting a future year emissions inventory, including updates to projections of future year oil and gas emissions and the development of gridded emissions data for future projections of area, point and mobile source emissions.
7. Emissions estimates developed with the latest versions of available emissions models.⁹

The deliverables of the emissions inventories work should include:

1. Protocol outlining specific work objectives, procedures, and activities, type of assistance and information needed from the Cooperating Agencies, and timeframes.
2. Progress reports outlining completed and upcoming work, challenges, changes to the Protocol, and resources.
3. Quality assurance reports characterizing the completeness, representativeness, and uncertainty of each source category.

⁸ Recommendations for Evaluating the Performance of the WSAQS Photochemical Grid Model Platform, August 2015.

http://vibe.cira.colostate.edu/wiki/Attachments/Modeling/FINAL_Recommended_PGM_MPE_Analyses_WSAQS_v08172015.pdf

⁹ Including the Motor Vehicle Emission Simulator (MOVES) and the Model of Emissions of Gases and Aerosols from Nature (MEGAN).

4. Survey data on activity, equipment, processes and gas compositions for the source categories.
5. Base and Future Year model-ready gridded emissions files.
6. Final report that addresses the objectives and summarizes the work products, trends analysis, and lessons learned in building the emissions inventories.
7. Transfer of all emissions inventories and work products to the IWDW.

7.4. Meteorological Modeling Efforts

Meteorological information is needed for the emissions model and photochemical grid models (PGMs) in order to predict air quality impacts. The meteorological information will be obtained using the latest version of the Weather Research and Forecasting (WRF) model or equivalent in order to produce nested 36/12/4 km gridded data.

The combination of unique meteorological conditions, complex terrain, and types of development in the intermountain west can generate significant environmental impacts that do not typically exist in other parts of the United States. For instance, stagnant weather conditions, extensive snow cover, and shallow temperature inversions have the potential to trap pollutants and produce elevated ground-level ozone that can be harmful to human health and the environment. The unique meteorological conditions in the intermountain west also produce elevated or unhealthy ozone and particulate matter concentrations from international transport, stratospheric intrusions, dust events, and wildfires. Therefore, it is imperative for the IWDW-WAQS to utilize state-of-the-science information and tools to predict the meteorological conditions needed for the emissions model and PGMs. When model performance issues are identified, new work plans may be updated or revised to attempt to improve the model performance when or if resources are available.

The general objective of the meteorological work should include the development of meteorological files for the emissions model and PGMs. The approach for accomplishing this objective should also include:

1. Review of previous meteorological modeling work for lessons learned and to build upon for new work.
2. Evaluation of the model performance using the recommended analyses by the Cooperating Agencies.¹⁰
3. Running the WRF with the most accurate and representative input data and configuration options.
4. Optional Based on Available Resources: Perform sensitivity tests to improve specific performance issues.

The deliverables of the meteorological work should include:

1. Protocol outlining specific work objectives, procedures, and activities, type of assistance and information needed from the Cooperating Agencies, and timeframes.

¹⁰ Recommendations for Evaluating the Performance of the WSAQS Photochemical Grid Model Platform, August 2015.

http://vibe.cira.colostate.edu/wiki/Attachments/Modeling/FINAL_Recommended_PGM_MPE_Analyses_WSAQS_v08172015.pdf

2. Progress reports outlining completed and upcoming work, challenges, changes to the Protocol, and resources.
3. MPE report characterizing the completeness, representativeness, and uncertainty of meteorology.
4. Model-ready files for emissions model and PGMs.
5. Final report that addresses the objectives and summarizes the work products and lessons learned for building meteorological platform.
6. Transfer all files and work products to the IWDW.

7.5. Emissions Modeling Efforts

The emissions inventories need to be processed and formatted for the PGMs in order to predict air quality impacts. The latest version of the Sparse Matrix Operator Kernel Emissions (SMOKE) model should be used to process the emissions for the 36/12/4 km domains of the PGMs.

The general objective of the emissions modeling work should include the development of emissions files for the 36/12/4 km domains of the PGMs. The approach for accomplishing this objective should also include:

1. Review previous emissions modeling work for lessons learned and to build upon for new work.
2. Running SMOKE with the most accurate and representative input data and configuration options.

The deliverables of the emissions modeling work should include:

1. Protocol outlining specific work objectives, procedures, and activities, type of assistance and information needed from the Cooperating Agencies, and timeframes.
2. Progress reports outlining completed and upcoming work, challenges, changes to the Protocol, and resources.
3. Model-ready files for PGMs.
4. Final Report that addresses the objectives and summarizes the work products and lessons learned to build the emissions modeling platform.
5. Transfer all files and work products to the IWDW.

7.6. Air Quality Modeling Efforts

The intent of the IWDW-WAQS is to have the highest quality air quality modeling platforms that are endorsed by multiple regulatory and authorizing agencies to address the complex environmental conditions that exist in the intermountain west. Another goal of the IWDW-WAQS is to provide air quality modeling products that reduce the uncertainty, time, and expense of starting an air quality analysis from scratch. To accomplish these goals, the IWDW-WAQS air quality modeling work will complete the base case, base case MPE, and future-year baseline scenario, and provide model input files for users to run the PGMs for individual air quality projects.

To give the Cooperating Agencies and their contractors more flexibility in conducting various analyses, the IWDW-WAQS will run both the CMAQ model and CAMx model for the 36/12/4 km domains. Further, the Cooperating Agencies will review the advances made to the PGMs to ensure the models can characterize and predict air quality impacts at a high level of accuracy and to determine whether model improvements and additional model simulations are necessary.

The general objectives of the air quality modeling work should include:

1. Develop and evaluate initial and boundary conditions using a Global Model (GM);
2. Develop and evaluate a base case CMAQ modeling platform for 36/12/4 km domains;
3. Develop and evaluate a base case CAMx modeling platform for 36/12/4 km domains;
4. Provide a detailed assessment of the base case CMAQ and CAMx platforms for the National Ambient Air Quality Standards (NAAQS) pollutants and AQRVs (i.e., visibility and deposition), including quantitative evaluation of background and transport;
5. Develop a future-year baseline scenario for the CMAQ and CAMx 36/12/4 km domains; and
6. Source apportionment and other diagnostic analysis as directed by the Cooperating Agencies.

The approach for accomplishing this objective should also include:

1. Review previous air quality modeling work for lessons learned and to build upon for new work.
2. Evaluation of the GM and PGM performance using the recommended analyses by the Cooperating Agencies.¹¹
3. Comparison of CMAQ and CAMx model results.
4. Running PGMs with the most accurate and representative input data and configuration options for the base case and future-year baseline scenarios.
5. Optional Based on Available Resources: Perform sensitivity tests to improve specific performance issues.
6. Optional Based on Available Resources: Use CAMx and CMAQ source apportionment tools for source apportionment simulations.

The deliverables of the air quality modeling work should include:

1. Protocol outlining specific work objectives, procedures, and activities, type of assistance and information needed from the Cooperating Agencies, and timeframes.
2. Progress reports outlining completed and upcoming work, challenges, changes to the Protocol, and resources.
3. MPE report characterizing the completeness, representativeness, and uncertainty of the PGMs. The report should also outline any performance issues and recommend sensitivity tests to inform model improvements.
4. Final Report that addresses the objectives and summarizes the work products, lessons learned for building the air quality model platforms, and when/how the PGMs should be used in future air quality projects.

¹¹ Recommendations for Evaluating the Performance of the WSAQS Photochemical Grid Model Platform, August 2015.

5. Transfer all files and work products to the IWDW.

7.7. Data Warehouse Efforts

One goal of the IWDW-WAQS is to maintain a robust and reliable data warehouse to store and distribute work products to the Cooperating Agencies and the public. Another goal is to provide tools for visualization and quality assurance (QA) of modeling results, along with data mining capabilities for various types of data, housed within the data warehouse. The data warehouse will contain large volumes of air quality modeling input and output data, along with all available ambient monitoring data in the region to accomplish these goals.

The data warehouse capabilities will likely be characterized by different requirements for Cooperating Agencies than for outside entities, and may be different depending on the data being asked for by the users. Making operational decisions regarding the data warehouse will almost certainly impact the level of effort required to sustain the data warehouse and will likely require resources for additional personnel at the IWDW over time. This will require periodic updates to the data warehouse as the volume of data grows, as improvements are identified, and as software changes. An evaluation of the data warehouse needs and sustainability will occur on an annual basis until the sustainability and resources become stable and few changes are recommended during the review process.

The general objectives of the data warehouse assessment should include:

1. Assess the hardware and software needs to maintain a robust and reliable data warehouse for storing and distributing the IWDW-WAQS products; and
2. Update or develop new visualization tools to review model results and monitoring data.

The approach of the data warehouse assessment should also include:

1. Outline the current hardware and software specifications/configurations, volume of data, file transfer capability, and remaining resources available to the data warehouse (i.e., available hard drive space, etc.).
2. Outline the future hardware and software specifications, volume of data, file transfer capability, and resources needed to sustain to the data warehouse.
3. Analyze data warehouse goals to ensure they are still relevant to the needs of the Cooperating Agencies.
4. Literature review of new technologies that could be beneficial for the study.
5. Cost analyses to address the data warehouse needs and sustainability.

The deliverables of the data warehouse work should include:

1. Protocol outlining specific work objectives, procedures, and activities, type of assistance and information needed from the Cooperating Agencies, and timeframes.
2. Progress reports outlining completed and upcoming work, challenges, changes to the Protocol, and resources.
3. Data Warehouse Assessment Final Report that addresses the objectives of the evaluation and provides recommendations to the Cooperating Agencies.
4. Transfer all work products to the IWDW.

8. Scope of Expansion Criteria and Guidelines

There are many benefits of expanding the IWDW-WAQS to include additional federal, state, and authorizing agencies. Expansion makes a more attractive product for industry and researchers, provides a more comprehensive project to support or justify the use of agency resources, and offers more robust and comprehensive analyses that encompass all oil and gas basins in the intermountain west. The consideration of expansion includes planning for the incremental costs and resources needed to ensure that the monitoring, air quality modeling, and data warehouse can support the joining agencies. While subject to change, the estimated costs to expand the IWDW-WAQS per state using past budget information are:

- Emissions Inventory and Air Quality Modeling over 3-year Cycle: \$60K to \$120K
- Operation of Monitoring Sites Per Year: \$20K to \$40K per site
- Operation and Maintenance of Data Warehouse Per Year: \$30K to \$50K
- Project Coordination: case-by-case determination

The IWDW-WAQS process for expansion should include:

- State and federal agencies within the particular state become cooperators at the same time.
- Commitment from current and future Cooperating Agencies to support incremental cost increase in data warehouse scope and air quality modeling effort.
- Participation in monitoring network assessment and implement expansion if desirable and feasible.
- Approval from Governing Board and signed Letter of Invitation.
- Amendment to the MOU.

Methods for Contributions could include:

- Funding: Each agency is assumed to seek and leverage monies on an on-going basis.
- In-Kind Resources: Each agency is assumed to provide and retain representatives or staff to participate and contribute to each board, committee, and workgroup through the duration of the study.

Table 1 outlines the estimated funding and in-kind resources provided by the Cooperating Agencies between 2011 and 2016. This information could help inform the resources (funding and in-kind) needed to expand the study.

Table 1. Estimates of Historic Cooperating Agencies Contributions to IWDW-WAQS between 2011 and 2016.

| Method of Contribution | State of Colorado | State of New Mexico | State of Utah | State of Wyoming | USFS | BLM | NPS | FWS | EPA |
|------------------------------------|-------------------|---------------------|---------------|------------------|--------|--------|-----|-----|--------|
| In-Kind Full-Time Equivalent Staff | 1.7 | 0.5 | 1.0 | 2.4 | 1.0 | 2.4 | 2.3 | 0.3 | 1.6 |
| Funding | \$422K* | | | \$597K* | \$3.6M | \$1.7M | | | \$395K |

FTE time = Annual average estimate. Includes time spent on preparing data, participating in conference calls and meetings, and review of data products and reports.

Funding = Total contributions since 2008. USFS and EPA include totals since 2008.

*Funding = Grant money from EPA/NPS for monitoring. For WDEQ, about \$296K covered Hiawatha establishment and 1-year operations, and Wamsutter methane/non-methane hydrocarbons and speciated canister operation for 3-years. About \$301K came from Wyoming to cover (Hiawatha operation and maintenance for 5-years, and Wamsutter methane/non-methane hydrocarbons operation and maintenance for 3-years.

9. Leveraging and Coordinating with other Air Quality Analysis, Management, and Planning Groups

The Cooperating Agencies have recognized that it is beneficial to create and operate a shared data warehouse and modeling platforms for air quality management decisions that may be made by each agency as a consolidation of funding and in-kind services will save both time and money by reducing duplication of efforts. To that same end, leveraging data collected by other air quality monitoring, analysis, management, and planning groups will also reduce the time and money needed from the Cooperating Agencies to improve and maintain the IWDW-WAQS and enable those external groups to provide resources and apply data for their management decisions.

Many other agencies and groups with similar air quality management needs and technical capabilities obtain air monitoring data, develop inventories, and perform data analyses and modeling, both on a regular basis and for specific projects. Much of this information is at a fine resolution and can provide a wealth of information to support and enhance the quality of the IWDW-WAQS. Having these additional data would alleviate the need for additional refinements by the IWDW-WAQS to NEI data for those areas. Collaboration and communication with other agencies and groups will be important to the overall goals of the project.

The types of agencies and groups can vary. Some examples are:

- NW AIRQUEST/AIRPACT: A regional modeling consortium between the states of Washington, Oregon, Idaho, Montana, and Alaska in the United States, and the provinces of British Columbia and Alberta in Canada
- WRAP: A voluntary partnership of states, tribes, federal land managers, local air agencies and the US EPA whose purpose is to understand current and evolving regional air quality issues in the West
- NCAR: A federally funded research and development center devoted to service, research and education in the atmospheric and related sciences
- CIRES: A partnership of NOAA and CU Boulder to understand the dynamic Earth system
- Universities
- States, Tribes, local agencies

Information and data from the various agencies and groups can take many forms. They include routine air monitoring data, special projects data, forecasts, refined emission inventories, modeling outputs and other spatial data analyses. Many of these data can and are used in State (or Tribal or Federal) Implementation Plans and for making regulatory decisions, which indicates the high quality of the products.

It is expected that the Cooperating Agencies will make available quality-assured data from their own or contracted projects to the IWDW-WAQS at no cost as part of their commitments. It is assumed that the Cooperating Agencies will be aware of other groups, projects and studies being performed in their respective jurisdictions and will collaborate as needed to leverage those data and analyses for incorporation in the IWDW. The preferred goal would be for other groups to provide quality-assured data at no cost to the IWDW and in a form that can be readily incorporated into the IWDW, including supporting documentation. This will need to be an on-going effort and will require the Cooperating Agencies to work with the other groups or agencies to express the desire and value for the data, information and analyses, and to coordinate the transfer of products to the IWDW.

Data and information from other projects and agencies/groups that may be useful to the IWDW-WAQS will be reviewed by the Data Stewards subgroup for possible inclusion in the IWDW and recommended to the Oversight Committee for approval. If additional review is needed, then the Governing Board will make a final determination.

10. Preparation and Approval Process and Timelines for Each New Work/Contingency Plan

It is anticipated that future work plans will outline activities on a three-year cycle, with possible updates throughout the cycle to account for any resource or objective changes. Previous work plans for the IWDW-WAQS have covered the following time periods: mid-2012 to mid-2014; mid-2014 to mid-2017; and mid-2017 to mid-2020. The work plan should be reviewed every year to determine whether updates are needed to account for any changes (e.g., objectives and resources). The Oversight Committee will be responsible for revisions to the work plan and the development of a new work plan. Once the Oversight Committee has agreed on a revised or new work plan, the work plan will be shared with the Governing Board for approval and determination of an effective/implementation date.

A new 3-year work plan should be implemented and be effective at the beginning of September of the first year of the work plan. To meet this deadline, the Oversight Committee should begin the planning process about twelve months before the implementation date (i.e., September). Approximately three months should be allocated for the planning process to develop and to agree on the work plan elements. Once an outline of the work plan elements is determined, the Oversight Committee should create a workgroup and use the outline to develop the new work plan. About four months should be allocated to complete the work plan. The Oversight Committee should allocate about three months to seek approval from the Oversight Committee and agree to a version for approval by the Governing Board. The Governing Board should approve the new work plan at least one month before the implementation date. An example of a timeline to follow for future work plans is outlined below. The example timeline is based on the schedule followed for the 2017 to 2020 work plan.

- Develop and agree on Work Plan Elements: December 2016 to February 2017
- Work Plan Workgroup: March to May 2017
- Oversight Committee approval of Work Plan: June to August 2017
- Governing Board approval of Work Plan: August 2017
- Start Date of Work Plan: September 2017

A review and any revisions of a work plan that is already effective could follow the same schedule outlined for a new work plan but completed on an annual basis. The goal should be to make any changes to the already effective work plan and receive the approvals from the Oversight Committee and Governing Board at least one month before September of that year.