**III. Technical and Planning Work Activities**

For the technical work activities of the WRAP organization to support air quality planning needs and initiatives of WRAP member agencies, a Western Regional Modeling Framework (Framework) is proposed to provide analytical services and store the various data in a warehouse. The Framework is described next in conceptual terms. The technical details and specifications, development plans, and the implementation schedule are discussed in Appendix D. Several administrative mechanisms are in place to begin providing support for the Framework; those are described in sub-Appendices D.1, D.2, and D.3.

*focusing on a Western Regional Modeling Framework utilizing data from WRAP members and applying photochemical modeling tools:*

Following the Framework description, three technical objectives within the 5-year time horizon of this plan are identified and described. These objectives are:

1. **Support and provide Regional Haze analysis and planning support.**
2. **Continue developing, refining, and analyzing regional data and analysis tools for strategic evaluation of ongoing and future air quality control programs, utilizing data from WRAP members and applying photochemical modeling tools.**
3. **Effects of Changing Sources and Climate on Western Air Quality.**

These technical objectives are aligned with the WRAP Charter and the organizational structure for the WRAP discussed in Section II, above. The details of the three objectives are presented next and reference Appendix D and its sub-Appendices, as well as Appendices E and F. If and when funded, the work activities proposed in Appendices G and H would also align and support the three technical objectives.

1. **Support and provide Regional Haze analysis and planning support**
2. Regional Haze Analysis and Planning - Background

Regional Haze technical work will be a prime focus area, given that it is the regulatory driver we know is on the horizon. Technical analysis must begin immediately to be completed in time for states to meet complete planning and procedural requirements by the July 2018 deadline.

Challenges

The RHR requirements for reasonable progress in 40 CFR 51.308(d) and (f), as currently defined and understood, provide an uncertain basis for conducting the 2018 to 2028 planning phase of the Regional Haze program.

* 1. Natural visibility conditions, the visibility goal in 2064, are based on assumptions about average contributions from natural events and are not adequately capturing actual observed contributions from natural events. Uncertainty in natural conditions makes difficult to demonstrate state’s progress in controlling anthropogenic emissions that cause haze.
	2. The uniform rate of progress (URP), as currently defined and calculated, does not account for all natural and anthropogenic emissions outside a state’s control.
	3. The critical metric for measuring success (improving 20 percent worst days) is dominated at many Class I areas by emissions from natural events (e.g. fire and windblown dust).
	4. Procedures and criteria to identify candidate anthropogenic sources and evaluate control options for reasonable progress are ambiguous.
	5. The four-factor analysis for setting reasonable progress goals (RPGs) does not include a factor for visibility improvement, the goal of the program.
	6. States may not have legal authority to require controls on sources for reasonable progress, and the RHR may lack enforceable requirements.

Based on the identified challenges, the following general principles are proposed for the WRAP to implement the WESTAR Regional Haze Plan to guide the details of the technical effort on making reasonable progress in the 2018 to 2028 phase of the program.

Principles for Regional Haze Analysis and Planning Support

1. Focus on analysis and planning of a state’s controllable anthropogenic emissions and the contribution of those emissions to haze in one or more Class I areas.
2. Consider using the emission reductions that improve visibility in the 2018-2028 planning period as a measure of success in the state’s SIP process instead of focusing directly on the amount of progress toward natural visibility conditions. Recognize that the natural visibility goal remains the desired outcome of the program.
3. Rely on clearly defined procedures and criteria to identify and evaluate sources of haze, to estimate effects on visibility, and to measure progress toward Reasonable Progress goals.
4. Simplify and streamline the SIP planning process by setting clear and timely expectations for the structure and contents of the plans as well as the supporting technical information.
5. With a shift in focus to measuring a state’s reasonable progress, ensure Class I areas with the worst haze or least progress receive special attention.
6. If a state lacks clear regulatory authority to require emissions controls, state air regulatory agencies will work with their appropriate state agency or legislature to establish appropriate authority
7. WRAP technical activities for Regional Haze
	1. Monitoring Data Analysis – The WRAP regional haze assessment begins with an assessment of pollutant contributions to visibility impairment at each Class I area for the period 2010-2014. The purpose of this analysis is to understand which pollutants are controllable and which are pollutants are most important to target for emissions reductions. The regional progress report produced in 2013, analyzing the 2000-2004 and 2005-2009 monitoring data provides a logical format for this contribution assessment.
	2. Emissions Development and Analysis for Regional Modeling projections
8. Identify modeling protocol to be used.

Recognizing that CAMx and CMAQ produce different results, and even the same model can produce different results for different years, identify which model versions will be used and what sensitivity testing or comparisons are needed.

* + - * 1. Develop the 2011 base year inventory and modeling scenario; conduct model performance evaluations identified above using both CAMx and CAMQ.

2011 is the most recent NEI year that will be available for developing a base year; this year can be linked to the most current (2008-12) monitoring averages. Specific considerations may need to be give to

1. Oil and gas sources in states where these activities are growing and changing rapidly.
2. Area sources, some categories of area sources are poorly accounted for and may need additional development.
3. Mobile sources – previous SIPs relied on MOBILE for emissions modeling, MOVES is now being used for mobile source modeling.
	* + - 1. Develop an emissions and modeling scenario with updated “rules and permits on the books” to assess expected progress toward existing 2018 reasonable progress goals and determine the combined effects of BART controls. The actual year modeled will be in the 2018 to 2021 range and will be selected based on the needs of other planning requirements.
4. Leverage 3-State Air Quality Study (CO, UT, WY) work already underway by expanding emissions inventory.
5. States will need to supply data on state and local rules that will be in place for the year modeled.
6. Recognize that proposed Clean Air Act §111(d) requirements for greenhouse gas emissions from the electricity generation sector will change emissions from this sector. A program to meet the §111(d) goals could have BART sources retiring or being repowered.
7. Recognize that changes to meet a new Ozone NAAQS may change emissions from multiple sectors across many western states.
8. Evaluate emissions scenarios to understand relative benefits to visibility from changes in emissions from different source sectors, pollutants, and/or regulatory assumptions. A combination of sensitivity analyses, rollback analyses, and/or source apportionment analyses could be conducted. Using the 2018 model platform would allow states to test alternative approaches and inform the required four factor analyses. Using the 2028 model platform would account for “on the books” controls and allow states to evaluate benefits of further controls.
	* + - 1. Develop 2028 emissions and modeling with scenario(s) projecting growth and additional controls to be put in place in the 2018-28 time period. At least one scenario will need to include controls developed through 4-factor analysis to help states set 2028 reasonable progress goals. The western states anticipate redefining the 2028 reasonable progress goal based on emission reductions achievable during the upcoming progress period.

1. 4-factor and other Emissions Control Analyses
	* + - 1. Establish a working group to develop a common 4-factor analysis method for use by the western states.

Identify which sources or source categories will be evaluated, possibilities include oil and gas, area sources (residential wood heat, ??).

* + - * 1. Analyze sources or source categories according the 4-factor analysis method developed.
				2. Identify a robust method to determine visibility effects, options include:

Q/d – Quantity / distance – looking at the emissions strength over distance provides a simple screening method to identify the sources or source categories most likely to affect visibility.

WEP – Weighted emissions potential - integrates back trajectory residence time with gridded emissions to identify which source categories and where emissions affecting visibility in a Class I area typically come from.

 Positive matrix factorization to attribute mass on filters to different sources

* + - 1. Technical Support System
				1. Update and improve the Technical Support System to deliver results so all western states can readily access needed data (their own and other states’ data).
			2. Additional analysis
				1. Provide appropriate analysis to Alaska and Hawaii outside of the regional modeling process. Alaska and Hawaii will need to identify they type of analysis needed to support their SIPs and request assistance from the WRAP. Potential analysis includes WEP and back-trajectory analysis similar to what was performed for the first SIPs.
				2. Develop methodology for addressing and incorporating the contribution of wildfire emissions to visibility degradation. Methodology may include identifying a range of fire effects, bounding the uncertainty, which could be incorporated in baseline and future years’ scenarios. See Appendix E as cross-reference.
				3. Develop an approach for dealing with area sources. Currently, the data provided in progress reports is so dependent on methodology that it is hard to make comparisons about changes in actual emissions.

Uncertainty in emissions and emission factors

What categories are most uncertain? Most important?

What are the most significant categories? Biggest?

* + - * 1. Investigate natural conditions – reconsider how natural conditions are determined and achievability of natural conditions.

**Work Products and Deliverables -** Updated Schedule of WRAP Analysis and State Planning Activities



The budget for WRAP technical support for Regional Haze planning can be found in Appendix C.

**B. Continue developing, refining, and analyzing regional data and analysis tools for strategic evaluation of ongoing and future air quality control programs, utilizing data from WRAP members and applying photochemical modeling tools.**

Background

In 2008 EPA completed a review of the Ozone National Ambient Air Quality primary and secondary Standards (NAAQS) and lowered the Ozone primary and secondary standards from 0.08 ppm to 0.075 ppm (75 ppb). EPA designated nonattainment areas (NAAs) for the 2008 ozone standard in 2012 which in turn established requirements for states and tribes to develop implementation plans (SIPs and TIPs) in order to attain the standard by December 2015. For areas designated as marginal nonattainment (including parts of AZ, CA, CO, and WY), photochemical modeling is not required to be submitted as part of a SIP or TIP. For these areas, it was presumed that national VOC and NOx control measures would be sufficient to attain the standard.

For areas designated as moderate to extreme, including some districts and tribes in California, SIPs and TIPs are required to include a photochemical model attainment demonstration with sufficient emissions control measures to attain the NAAQS by December 2015. Additionally, under the “good neighbor” provision of the Clean Air Act, all states are required to submit ozone transport SIPs or TIPs that demonstrate that their emissions do not interfere with attainment or maintenance of the standards in downwind areas. The ozone transport SIPs were due in May 2011, however, due to court challenges and legal uncertainty, EPA has not yet provided guidance for the development of ozone transport SIPs, and many states have not yet submitted transport SIPs for the 2008 Ozone standards.

In December 2012, EPA revised the annual NAAQS for fine particles (PM2.5) to 12.0 micrograms per cubic meter (µg/m3). EPA anticipates making initial attainment/nonattainment designations by December 2014, with those designations likely becoming effective in early 2015. States or tribes with designated nonattainment areas will be required to submit SIPs or TIPs in 2018 detailing how they will reduce pollution to meet the standards. States or tribes would then have until 2020 (five years after designations are effective) to meet the revised annual PM2.5 health standard. Similar to the Ozone standards, under the “good neighbor” provision of the Clean Air Act, all states are required to submit PM2.5 transport SIPs that demonstrate that their emissions do not interfere with attainment or maintenance of the PM2.5 standard in downwind areas. PM2.5 transport SIPs will be due March 18. 2016. EPA has not yet provided guidance for the development of transport SIPs. However, it is likely that states and tribes will need to rely on available regional modeling products, such as those produced for Regional Haze SIPs, for their technical demonstrations. A key objective of the WRAP Work Plan is to develop updated regional modeling products that can be used to support Ozone and PM2.5 transport SIPs.

As required by the Clean Air Act, EPA is currently reviewing the Ozone standard, and is required under court order to propose revised standards in December 2014, which would become final in October 2015. Assuming a schedule similar to the 2008 Ozone standard, states and tribes would submit recommendations for nonattainment area designations in 2016, and EPA would finalize designations for the 2015 ozone standard in 2017. SIPs and TIPs for moderate areas would require photochemical modeling and would be due in 2020. Ozone transport SIPs will also be required for those areas not attaining the revised Ozone NAAQS. The Clean Air Scientific Advisory Committee (CASAC) has recommended that the Ozone primary (health) standard be set lower than 70 ppb within a range down to 60 ppb, and also recommends that a secondary (welfare) Ozone standard (referred to as “W126”) be set within a range of 7 to 15 ppm-hrs.

Federal land managers (FLMs) have lead responsibility for protecting air resources in Class I areas In addition to Ozone, important air quality-related values at Class I areas include visibility and deposition of nitrogen and acids. Planning needs for visibility are discussed in Section III.A of this Work Plan. FLMs have identified critical loads or thresholds for nitrogen and acid deposition that should not be exceeded. Measurements at the CASTNet and NADP monitoring sites are used to evaluate deposition, and air quality models can be used to assess the sources that contribute to nitrogen and acid deposition at Class I areas. Emissions of both NOx and ammonia (NH3) contribute to nitrogen deposition. While NOx emissions are regulated as precursors to both ozone and NO2 criteria pollutants, NH3 is not regulated as a criteria pollutant. Agricultural activity is the largest source of NH3 emissions. While NOx emissions are projected to decrease in the future, NH3 emissions are projected to increase and therefore represent a growing source of nitrogen deposition. Another key objective of the WRAP Work Plan is to develop updated regional modeling products that can be used to support analysis of air quality related values, including deposition of nitrogen and acids, at Class I and sensitive Class 2 areas.

Several WRAP member states (including UT, WY, CO, CA, WA, OR, and AK) have nonattainment areas for daily 8-hour maximum Ozone and/or daily average PM2.5 due to violations of the standards that occur in winter during persistent cold pool conditions with very strong inversions. These NAAs are not specifically addressed in this Work Plan because regional transport does not contribute significantly to pollution levels during these winter inversion conditions, and regional modeling studies are not needed to address these local pollution problems. However, the emissions inventories and regional modeling datasets being developed by WRAP will be useful in local air quality modeling and planning efforts.

The WRAP region nonattainment areas for PM2.5 or Ozone associated with winter inversion conditions and the high pollutant concentrations occurring under stagnant conditions with emissions in a very shallow and persistent inversion layer require significant technical work to complete attainment SIPs. Meteorological models often perform poorly for persistent cold pool inversion conditions, so there is a need for additional applied research to evaluate these events. As winter inversions with poor air quality affect several WRAP region States, it is recommended that WRAP facilitate shared research through periodic workshops and maintain a project team to address this issue.

Finally, EPA has direct emissions inventory reporting requirements for greenhouse gas emissions for industrial sources from the same source categories tracked by WRAP member states, tribes, and local air agencies for the triennial National Emissions Inventory. These include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and chlorofluorocarbons. There are large uncertainties in greenhouse gas emissions for some source categories, including methane emissions from oil and gas production, livestock, and agriculture. Greenhouse gases also have minor to moderate effects on ambient photochemical reactions and may be important for regional air quality analyses. The WRAP may also be able to facilitate collaborative efforts to develop improved emissions factors and inventories for these sources.

Key Topics

The WRAP faces several key issues as it continues developing, refining, and analyzing regional data and analysis tools and applying photochemical modeling tools to address ozone and particulate transport and attainment issues for the member States. Evaluating the contributions of non-anthropogenic emissions, transported pollutants both intra- and inter-continental, and US anthropogenic emissions to modeled/monitored values will provide important tools for States to address air quality planning. The characterization of these contributions is fundamental to understanding the unique drivers of background ozone and particulate concentrations in the West. It is the WRAP’s desire in addressing these issues to not only advance the understanding of the issues, but to also build capacity within the member agencies and share our gains with EPA and other sister agencies.

It has been suggested that EPA may provide regional haze modeling support to the RPOs in lieu of providing funding for additional RPO work. For this reason it is very important for the WRAP and other RPOs to stay engaged and continue collaboration with EPA while it continues to develop its modeling platforms. Many of the key goals of this work plan are similar to the challenges faced by EPA with the current development of 2011 and 2018 modeling platforms to be used for regulatory analysis. On June 1, 2014, the WESTAR Council submitted comments identifying member States’ concerns with the 2011 and 2018 modeling platforms developed by EPA/OAQPS.

The letter identified six areas of regional concern with the development and treatment of emissions for certain source categories, including; fire, oil and gas, biogenics, boundary conditions, Mexico and Canada national emission inventories, and electric demand models. These areas of concern have significant influence on transported pollution and modeled background concentrations. EPA’s addressing of these inter-related issues will provide greater confidence in the model results, and increase our understanding of the influence of emissions from these sources on regional air quality.

The WRAP Work Plan addresses the areas of concern described above, and is specifically intended to consider the inter-related transport and background concerns identified in the WESTAR letter. To better understand the role of these interactions for air quality planning across the West, this Work Plan will focus on the contribution of boundary conditions; updated international emission inventories; fire and biogenic emissions; and background ozone and PM concentrations, especially the role of the exceptional events rule.

The key topics identified below are further complicated by the policy issues related to the application of the exceptional events rule and treatment of rural transport areas.

1. Background ozone: It is recognized that background ozone levels are higher in the western U.S., especially at high-elevation sites in the intermountain region compared to other areas in the U.S. A wide variety of sources contribute to background ozone levels, and background levels can vary from day to day and between different years. (For example, see Fiore et al., 2014). There is uncertainty in the sources that contribute to background ozone and model estimates are uncertain for the relative importance of background versus interstate transport of anthropogenic sources of ozone. It is also possible that background ozone levels in the West might be increasing over time because of effects of a changing climate, wildfires, and changes in international emissions (for example, see Cooper et al., 2012). Evaluation of present and future background ozone impacts will be conducted by the Western Modeling Framework.
2. International Transport: The ozone implementation rule is expected to provide some relief for international transport of ozone. For example, NAAs would not be bumped up to moderate if international transport was responsible for violations of the standard. It remains difficult to quantify contributions of international transport to ozone in the western United States.
3. Rural transport areas: EPA might also provide special planning requirements for rural and remote areas that have few emissions sources and that exceed the 2015 ozone standard. It is likely that modeling analyses will be needed to evaluate the sources that contribute to high ozone levels in rural and remote areas.
4. The Exceptional Events Rule provides that certain unusual events, such as ozone from large stratospheric intrusions and wildfires, can be flagged and excluded from monitoring data used to assess compliance with the ozone standard. However, it is difficult to quantify the contribution of these events to exceedances of the ozone standard.
	1. Fire plays a significant role in air quality planning in the West and future wildfire activity is expected to increase. Baseline and projected fire emissions are generally modeled either as actual emissions or as “typical emissions” based on averaging fire emissions over some multi-year period. There are concerns with the OAQPS approach of using typical emissions and holding fire emissions constant without a projection methodology to evaluate the possible range of future fire impacts in its 2018 modeling platform and their related assumption that large fire events would qualify for Exceptional Event flags (July 22, 2014 phone conversation between OAQPS staff and WESTAR Committee members). Because pollutants from fire can be transported hundreds to thousands of miles it is possible that fire impacts can contribute to ozone and regional haze. However, it might be difficult to consider these contributions as exceptional events. Evaluation of present and future Fire impacts will be conducted by the Western Regional Modeling Framework.
	2. The frequency of exceptional events, the level of effort required by agencies to prepare and approve the exceptional event waiver application, and the huge backlog of exceptional event applications awaiting resolution in EPA Regional offices suggest that analysis of fires is fraught with potential pitfalls for States. As proposed in Section III.C and Appendix E of this Work Plan, a Fire Working Group addressing applied research tasks would be useful in quantifying emissions that influence regional haze, ozone, and PM2.5 transport and planning analyses. Analyzing fire’s contribution to exceptional events and developing improved modeling or analysis tools to estimate the contributions of various sources to exceptional events is also addressed. These analytical results from the Fire Working Group would be applied in the Western Regional Modeling Framework.
	3. The relationship of monitored background concentrations, the temporal and spatial model representation of fire emissions, and the role of exceptional event waivers requires investigation to further the understanding of how the treatment of fire emissions impacts model-predicted concentrations in a regulatory context. National efforts are in progress to improve the regulatory process for treating exceptional events caused by fire. EPA will propose a revised Exceptional Event rule in mid-2015 and a final rule in mid-2016. There is also proposed legislation to address regulatory treatment of exceptional events (S. 2526, the Commonsense Legislative Exceptional Events Reform [CLEER] Act). Additional technical analyses of fires by WRAP through the Fire Working Group and Western Modeling Framework are needed to inform the development of improved approaches to address fire impacts on air quality.
5. While there is a downward trend in U.S. anthropogenic emissions of in many sectors as a result of state and national control measures, rapid expansion of oil and gas production in the U.S. has resulted in increasing emissions from this sector. Additionally, NH3 emissions are projected to increase in the future. Emissions factors are not well quantified for these source sectors and studies are needed to improve emission data and to assess the impacts of these sectors on regional ozone and nitrogen deposition. Evaluation of present and future inter-jurisdictional contributions of ozone and nitrogen will be conducted by the Western Regional Modeling Framework, including a good accounting of the federal emission reduction strategies and rules that reduce air pollution across all sectors: point source, on-road, non-road, mobile).
6. Technical analysis tools by the Western Regional Modeling Framework using consistent, comprehensive, and reproducible data across the WRAP region are needed for reporting, evaluation and quality assurance of emissions inventories and modeling results.

Regional air quality modeling and emissions inventory development is needed to address each of the topics listed above. Work plan tasks to support planning for regional ozone and PM2.5 transport and nitrogen deposition include development of emissions inventories, meteorological and photochemical air quality modeling, analysis of ambient monitoring data trends, and technical analysis tools for quality assurance and analysis of these data. Regional photochemical modeling in the western US will be required to support ozone SIPs and TIPs for the 2015 primary and, if adopted, the secondary ozone standards. Regional photochemical modeling will also be required to support ozone and PM2.5 transport SIPs, as well as estimates of nitrogen and acid deposition. The model scenarios developed for analysis of ozone will also be used to evaluate Regional Haze SIPs, as discussed in Section III.A and Appendix C, as well as deposition of nitrogen and acids.

Technical Milestones and Deliverables for regional emissions and modeling studies in this Work Plan by the Western Regional Modeling Framework are discussed in detail, in Appendix D.

Available tools and resources supporting WRAP Regional Emissions and Modeling Activities

A variety of high-quality data and decision support systems were built during the 2000-09 Regional Haze analysis and planning effort of the WRAP membership. Some of these systems continue operating or have evolved into the next generation. It will be necessary to identify needs for additional development in order to support delivery of regional analytical results for air quality planning by WRAP members. Identification of funding mechanisms for that development as well as the ongoing operations of these systems will also be needed.

Through WESTAR contracts, two decision support systems are operated and used daily by WRAP members.

The [Technical Support System](http://vista.cira.colostate.edu/tss) (TSS) is used for regional haze planning and progress tracking, and integrates a number of different data support resources under one web-based decision support umbrella for regional haze planning and implementation. This system can be extended to other pollutant and air management issues.



The TSS and operational needs are discussed in more detail in Appendix B. WRAP Regional Haze Data Analysis and Decision Support System (TSS).

The [Fire Emissions Tracking System](http://www.wrapfets.org/favicon.ico) (FETS) is a database with a web interface for tracking and managing planned and unplanned fire events, used by numerous WRAP region state, tribal, and federal smoke management programs. Users can view fire data on-screen with a mapping tool and query the database for downloads of data.



WRAP has developed the [WRAP Fire Tools system](https://www.wraptools.org/) on top of the FETS with funding provided by the federal Joint Fire Sciences Program. WRAP Fire Tools offers data and tools for evaluating the contributions of Fire to Ozone Impacts with the DEASCO3 project (<https://deasco3.wraptools.org/>). In addition WRAP is completing analysis to provide data and tools for evaluating the contributions of Fire to Particulate Matter events through the PMDETAIL project (<https://pmdetail.wraptools.org/>).

The FETS, WRAP Fire Tools, and operational needs are discussed in more detail in Appendix E: Impacts of Natural-Uncontrollable Fire on Western Air Quality.

Through a cooperative agreement, WRAP/WESTAR coordinates a Western Air Quality (3-State) Data Warehouse (DW) and Regional Modeling Center. The DW handles monitoring, emission, and modeling results from internal and external studies. The current 3-State Air Quality Study domain example is found at: <http://views.cira.colostate.edu/tsdw/>.

The National Park Service and other federal land managers operate the Federal Land Manager Environmental Database (FED) (<http://views.cira.colostate.edu/fed/>). FED is linked to the DW and WRAP Fire Tools as a data provider and uses a common database.

References

**C. Effects of Changing Sources and Climate on Western Air Quality**

Background

As mentioned in Section III.B and reiterated here, the WRAP faces several key issues for emissions sources important in the West that are rapidly changing and/or largely uncontrollable. These sources will become increasingly important in regional analysis as the WRAP implements the work defined in Section III.A and III.B of this Work Plan, to develop, refine, and analyze regional data and analysis tools to address ozone and particulate transport and attainment issues for WRAP member agencies. Evaluating the contributions of non-anthropogenic emissions, transported pollutants both intra- and inter-continental, and U.S. anthropogenic emissions to modeled/monitored values will provide important tools for WRAP members for use in air quality planning efforts. The characterization of these contributions is fundamental to understanding the unique drivers of background ozone and particulate concentrations in the West. It is the WRAP’s desire in addressing these issues not only to advance the understanding of the issues, but also to build capacity within the WRAP member agencies and share our gains with U.S. EPA and federal land managers at NPS, FS, FWS and BLM.

Outline of Key Topics

The WRAP Work Plan addresses the areas of concern listed below and is specifically intended to consider the inter-related concerns of increasing levels of transported and background concentrations of ozone,, PM, haze-causing species , and their precursors. Improved assessments are needed of international emission inventories, fire emissions, and biogenic emissions contributions to boundary conditions and background concentrations. Research and analysis is also needed of the role of the exceptional events rule in addressing contributions from these sources. Rapid development in Asia during the last two decades has caused increased international transport of ozone and PM and this growth is projected to continue in the future. Additionally, NH3 emissions are projected to increase in the future because of population growth and resulting increases in agriculture and livestock production. Emissions factors are not well quantified for the agriculture and oil and gas sectors. Studies are needed to develop improved data for emissions of NH3 and methane from these sectors. Emissions for all these sources are also needed for the parts of Mexico and Canada included in the WRAP modeling domain.

As a region, Western states are not as densely populated as the eastern part of the country, which means that non-anthropogenic emissions play a larger role in the annual inventories. In addition, due to proximity and prevailing winds, international sources make measureable and sometime significant contributions to air quality measured at monitors. Separate international temporal and spatial inventories must be prepared to model present and future conditions. Not included in this discussion is the uncertainty in existing models caused by significant elevation changes in the western terrain.

The key topic areas are outlined below with a short explanation of the anticipated challenges in quantifying future emissions. The first critical element in developing State Implementation Plans is defining the base year and future year inventories. For the western region, some of the issues presented below are especially challenging because the changes include recent development needing new estimation methodologies. Some anticipated changes will be intermittent, or geographically-specific, affecting some regions more than others at different times. Planning requires forecasts of emissions into the future, with anticipated growth and control measures applied in order to attain future year goals for air quality measured at monitors. Not all air quality regulatory programs have the same out-year goals, requiring different inventory and modeling years. Intermittent activities in the inventories make scaling and interpolation an additional challenge.

1. Changes and Progression of Oil and Gas Development

While there is a downward trend in U.S. anthropogenic emissions in many sectors as a result of state and national control measures, rapid expansion of oil and gas production in the U.S. has resulted in increasing emissions from this sector in some western basins and states. This location-specific growth has some uncertainty as to the timing and duration of exploration versus production technology over the air quality planning horizon. Existing production basins can be in production decline or growth; and new basins are being developed in some but not all states. *Was there supposed to be a comment here about NH3 (ammonia) or CH3 (methane) emissions (GHG) increases from NOx controls, venting, and leaks etc. during production and transshipment.* Emissions factors are not well quantified for the oil and gas sector and may vary by basin and formation[[1]](#footnote-1) *(EPA, 2013)*. Studies are needed to improve emission data and to assess the impacts of oil and gas. Finally, the transportation/transshipment components (truck, train, pipeline, ocean-going vessel) and a community support components (VMT and area sources) will also vary with development stages and locations in each state inventory, critical for good interstate (regional) modeling.

## *Insert western O&G map of exploration and development, existing and new*

The existing Oil & Gas Working Group, *comprised of* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ has completed projects and prepared inventories and other analyses described on the WRAP website at: \_\_\_\_\_\_\_\_. They will continue to support.... Given that similar oil and gas exploration is occurring throughout the country, the O&G Working Group will involve U.S. EPA and other regional and national public and private sector expertise to study the effects of Oil & Gas development and production activities on visibility and regional air quality.

1. Changing Fire Emissions - wildfire Increases and wildland management policy

The emissions from wildfire are highly variable both spatially and temporally. Wildfire activity can vary dramatically from year to year in the same state, causing large inter-annual variability in visibility and regional air quality. The graphs below illustrate the year to year variability by depicting the high, low, and median values of acres burned by wildfire for the respective year’s fire activity data from statistics from the National Interagency Fire Center (NIFC) web page (<http://www.nifc.gov/fireInfo/fireInfo_statistics.html>). While this data does not reflect the size of each state, nor the amount of wildland vs. urbanized areas, nor the type of vegetation consumed by the burns, nor the emissions that resulted from them, it does show that acres burned increased twofold in the west between the time that IMPROVE monitors fist started collecting data in the late 1980s and current conditions of the last decade.



Figure x. Variance in Wildland Acres Burned by Western State: 1984 through 1997

 

Figure x. Range of Acres Burned by Western State – 2002 through 2013

Figure x. Variance in Wildfire Acres Burned 2002 through 2013 in each Western State

Depending on the frequency and magnitude of the unplanned wildfire events, EPA guidance and the Natural Haze Levels II Committee estimates of natural background visibility conditions may not accurately represent actual background visibility conditions. Stakeholders have expressed concern that the visibility improvements resulting from emissions reduction programs for industrial, mobile, and other anthropogenic sources may be masked by visibility impacts from wildland fires. Concomitantly, the demonstration of reasonable progress is complicated by haze from unplanned wildland fires which actually may be part of the natural background conditions in the western U.S. and other regions of the country with a natural fire-prone ecosystem.

The air quality impacts from fires can be substantial over short-term periods, but fires occur relatively infrequently in any one place and thus skew single years and the five-year averages for Worst Days containing containing high-fire year(s). Unplanned wildland fires events that occur relatively infrequently may have a lower contribution to long-term averages of full-year data sets and will not affect the calculations for the 20% Best Days. However, if unplanned wildfire events have a significant contribution to visibility impacts for several of the five years used to calculate the baseline or current conditions, the visibility progress portrayed would be misleading.

Unplanned fire emissions also impact regional air quality and contribute to background concentrations of ozone and particulate matter, as well as monitored design values. Waivers issued under the Exception Events Rule can lessen the influence of fire emissions on design values but the role of fire emissions in ozone and particulate matter background concentrations is not well documented. Future projection of unplanned fire emissions in modeling is a key planning issue with significant consequences given the magnitude, frequency, and location of these emissions.

Based on the variability and the magnitude of wildfire emissions, it is recommended that, with involvement of EPA, a WRAP Fire Working Group, encompassing regional and national expertise, be formed to study the effects from unplanned wildfire events on visibility and regional air quality. Subjects for the Fire Working Group would include: improved methodologies for establishing baseline, current, and natural background visibility conditions; background ozone and particulate matter concentrations; and the demonstration of reasonable progress. Other air quality planning issues such as tools for demonstrating Exceptional Events for Ozone and Particulate Matter are mentioned in Sections III.A and III.B. The proposed Fire Working Group will also be tasked with identifying and evaluating various methodologies to project unplanned fire emissions.

Two WRAP projects investigated the role of fire on monitored ozone and particulate matter respectively, Deterministic and Empirical Assessment of Smoke’s Contribution to Ozone (DEASCO3) and Particulate Matter Deterministic and Empirical Tagging and Assessment of Impacts on Levels (PMDETAIL). The results of these projects will be key components in the assessment of the role of unplanned fire emissions on regional air quality and visibility.

1. Changing Temperatures and Shifts in Biologic Resources

Western States are experiencing ecosystem impacts from climate change. Shifts in temperature and precipitation have the potential to shift the geographic ranges of plant and animal species, especially those with narrow capability to adapt to changing environmental conditions. Interactions between plants and pests are also being disrupted. For example, increasing wintertime minimum temperatures at higher elevations are no longer cold enough to kill bark beetle larvae and as a result several tree species are experiencing mortality due to bark beetles. Widespread dead and dying forests provide additional risk of catastrophic fire. Western states may need to consider the implication of changing climatic factors, including temperature, precipitation, and landscape features, in projecting future air quality conditions.

Air quality is currently impacting ecosystems in western states. In particular, Federal Land Managers are concerned about impacts of excess nitrogen deposition to sensitive aquatic systems and foliar injury to sensitive plants caused by ambient ozone. WRAP modeling results will be applicable to interpreting risk of future impacts under different emissions scenarios.

Changing climate in the western United States is likely to result in more variable precipitation where droughts become more severe than has been the norm in recent history. This in turn would in vegetation that is more drought tolerant being able to outcompete other plant species. There would also likely be less ground cover as a result. Less ground cover and less soil moisture would result in a greater propensity for dust from surfaces that have been disturbed in some way being susceptible to wind erosion, i.e., windblown dust. This could result in more particulate matter nonattainment areas, especially in the Intermountain West.

Increasing temperatures due to climate change would be a result of more solar radiation at the surface which would contribute to higher concentrations of ozone in the presence of precursors. This could result in more ozone nonattainment and greater impacts on ozone sensitive plant species. This could be offset to some degree by increased boundary layer depth because of higher temperatures.

1. Shifts in Energy Facility Source Types and Locations

Renewable energy facilities are becoming a more important part of the energy generation picture in the West as time goes on. In the U.S. as a whole, renewable energy capacity is forecasted to have increased by almost 50% from the years 2006 through 2015. Much of that increase is in the western U.S. This trend should certainly suggest the possibility for renewables to take up capacity that is currently provided by fossil fuel fired generation hence reducing air pollution emissions. However, to achieve that end it will likely be necessary for the way the regional power grids are managed to change to fully take advantage of the increasing amount of renewable energy being produced.

EPA has proposed carbon reductions from existing electric utilities under the authority of Clean Air Act §111(d). EPA proposes state specific targets for Best System of Emissions Reductions that states would be required to meet between 2020 and 2030. EPA proposes that Best System of Emissions Reductions would shift electric generation away from higher carbon emitting facilities (e.g., coal-fired power plants), increase generation from natural gas, solar, and wind energy, and encourage energy efficiency to reduce electricity demand. EPA intends to finalize the rule in June 2015. States would be required to submit state plans in June 2016, although plans could be submitted as late as 2018 if states are cooperating in regional trading programs. Any WRAP modeling of 2018 or later years needs to acknowledge that a carbon reduction rule would greatly shift the current electric generation fleet and have implications for energy dispatch and emissions. Given that state plans would be due in the same time frame as regional haze or revised PM or ozone plans, WRAP may need to conduct sensitivity modeling analyses to test how possible shifts would affect emissions. After 2018, WRAP, in cooperation with regional and state energy commissions, should evaluate one or more modeling scenarios to estimate the air quality implications of implementing §111(d) in the West.

Under the requirements of Best Available Retrofit Technology, several facilities in the West will be required to install controls. In the light of §111(d) requirements or shifting market conditions, some facilities may choose instead to shutdown rather than install controls. WRAP will incorporate BART controls in the planned regional haze 2018 modeling (see Appendix C). Western states may want to also develop emissions scenarios assuming additional shutdowns beyond those considered in the Regional Haze scenarios.

 *Add info on electrical system and distribution, including graphics*

*Use WESTAR Planning Committee’s BART Progress Table*

1. International Sources
	1. Pacific and Arctic Ocean Offshore shipping (primarily affecting coastal locations)
	2. Asian transport (primarily dust and industrial pollution affecting all western states)
	3. Mexican transport (primarily uncontrolled burning, dust, and industrial pollution, affecting CA, AZ, NM)
	4. Canadian transport (primarily landscape fires, dust, and industrial sources affecting WA, ID, WY, and ND and more states in the case of smoke from large wildfires)

*Add info on international transport, including graphics - may be something from the WRAP Regional Haze Progress Summary Report and WestJumpAQMS.*

1. Population Changes and Impacts
	1. Growth in the West –VMT, other changes - where, at what rate, why
	2. Agricultural Development Patterns - stability, shifts in farming/ranching, concentration of production, more residential/agricultural mixes

*Add info from the WRAP Regional Haze Progress Summary Report*

*Add info on population changes, including graphics*

The WRAP Work Plan addresses the areas of concern described above to some degree in Sections III.A and III.B, and is specifically intended to consider the inter-related transport and background concerns. Improved understanding of the contributions of boundary conditions, updated international emission inventories, fire emissions, and biogenic emissions in background ozone and PM concentrations and the role of the exceptional events rule in addressing contributions from these sources will further the understanding of the interplay of sources in future air quality planning across the West.

Milestones and Deliverables:

1. Where and whenever possible, address the key topics in regional background and transport analyses through the Regional Modeling Framework in support of regulatory planning by WRAP members.
	1. Appendix F describes suggested work on Oil & Gas to support Work Activities for Sections III.A, III.B, and this Section, III.C.
	2. Appendix E describes suggested work on Fire to support Work Activities for Sections III.A, III.B, and this Section, III.C.
	3. Efforts on Regional Haze Analysis and Planning described in Section III.A and Appendix B will assess Key Topics 1, 2, 3, and 4 in particular, to some degree.

1. On an annual basis, the Technical Steering Committee will identify new and improved sources of data related to the key topics, and prioritize resources to implement analyses of those data in the Regional Modeling Framework.
2. In response to applied research funding opportunities, the Technical Steering Committee will develop and submit proposals to improve and augment data about these sources in the West and contribution to western U.S. air quality.
3. In 2017, the Technical Steering Committee and WRAP staff will prepare a white paper for the WRAP Board, describing improvement in the quality and quantity of the data for the key topics, and recommend the next steps on the key topics listed in this Section, as well as emerging issues.

While there is a downward trend in U.S. anthropogenic emissions of in many sectors as a result of state and national control measures, rapid expansion of oil and gas production in the U.S. has resulted in increasing emissions from this sector overall or west-wide or nationally (some basins are decreasing emissions as a result of less gas production, for example, the South San Juan). Additionally, NH3 emissions are projected to increase in the future *because of ….* Emissions factors are not well quantified for the oil and gas sector and vary by basin and formation. Studies are needed to improve emission data and to assess the impacts of oil and gas.

*Add need description for Oil & Gas Working Group, to involve EPA and encompassing regional and national expertise, be formed to study the effects of Oil & Gas development and production activities on visibility and regional air quality.*

 *Add more info on O&G, including graphics*

**References**

Cooper, O. R., R.-S. Gao, D. Tarasick, T. Leblanc, and C. Sweeney (2012), Long-term ozone trends at rural ozone monitoring sites across the United States, 1990–2010. *J. Geophys. Res.,* 117, D22307, doi:10.1029/2012JD018261

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See discussion of background ozone in the EPA “Policy Assessment for the Review of the Ozone National Ambient Air Quality Standards” available at: <http://www.epa.gov/ttn/naaqs/standards/ozone/data/20140131pa.pdf>.

USEPA greenhouse gas reporting requirements are described at: <http://www.epa.gov/ghgreporting/reporters/index.html>

USEPA, 2014, Policy Assessment for the Review of the Ozone National Ambient Air Quality Standards, Second External Review Draft, Available at: <http://www.epa.gov/ttn/naaqs/standards/ozone/data/20140131pa.pdf>

WESTAR Council, Letter to U.S. EPA OAQPS on 2011/2018 national modeling platforms, (2014) <http://www.westar.org/Docs/WESTAR_NEI_framework%20comments.pdf>.

1. Cite IG report [↑](#footnote-ref-1)