

I. PURPOSE, OBJECTIVES AND RELVANCE

Oil and gas (O&G) development in the inter-mountain western United States has undergone rapid increases over the last decade. This is especially true in the Bakken Shale formation in Montana and North Dakota where oil production has increased dramatically over the last few years. O&G development releases emissions of oxides of nitrogen (NO_x), volatile organic compounds (VOCs), carbon monoxide (CO), sulfur dioxide (SO₂), hazardous air pollutants (HAPs) and greenhouse gases (GHG). These emissions can lead to elevated air pollution levels that may threaten National Ambient Air Quality Standards (NAAQS), cause HAPs levels that may cause health effects and have potential adverse effects on air quality related values (AQRVs), which include visibility and acid deposition. To address these potential air quality and AQRV impacts requires and accurate and comprehensive emissions inventory of O&G sources. Over the last several years, the Western Regional Air Partnership (WRAP) and the Western Energy Alliance (WEA) have funded ENVIRON International Corporation to develop such a detailed and comprehensive O&G emissions for 8 basins in the inter-mountain west (the WRAP Phase III project). ENVIRON is performing the WRAP Phase III project under project management from the Western Governors' Association (WGA) using the same team structure and personnel we propose to use in this study. The Phase III study is an important part of the suite of emissions and modeling studies conducted through WRAP's regional technical analysis program, that supports air quality management and planning activities of western states and federal agencies. To date, WRAP Phase III O&G emissions have been developed for the 2006 baseline year for the South San Juan Basin in New Mexico, the North San Juan, Piceance and Denver-Julesburg Basins in Colorado, the Unita Basin in Utah, and the Greater Green River, Powder River and Wind River Basins in Wyoming. The WRAP Phase III emissions inventories are proving to be a valuable resource for air quality modeling and planning including BLM Resource Management Plans (RMPs) and Environmental Impact Statements (EISs) and the Denver ozone State Implementation Plan (SIP).

The BLM Montana/Dakotas state office will need to perform RMPs in the near future to address the potential air quality and AQRV impacts associated with oil and gas development in the three states¹. They need a comprehensive O&G emissions inventory that can be used for air quality modeling and planning. The objective of this work is to develop a detailed and comprehensive O&G emissions inventory for the 2011 baseline year (or another baseline year of BLM's choosing) and a projection 5-7 years in the future using the WRAP Phase III methodology and procedures. This work will allow the BLM to obtain more accurate air quality and AQRV impact assessments due to current and future O&G development activities in the Montana/Dakotas region.

The more detailed and comprehensive O&G emission inventories for the Montana/Dakotas will allow BLM to perform more accurate and certain air quality planning that result in numerous benefits to the public. There will be more certainty that the O&G development would not cause any violations of the primary National Ambient Air Quality Standards (NAAQS) that is designed to protect public health. More accurate estimates of O&G HAPs emissions will also reduce the likelihood that HAPs concentrations will exceed the threshold levels for causing cancer. In addition to the benefits to public health, there will also be benefits to public welfare by assuring the visibility impacts due to O&G emissions are below perception levels and that acid deposition due to O&G emissions is below levels that may degrade ecosystems.

II. TECHNICAL APPROACH

The technical approach for developing the inventories for the Williston Basin and the Great Plains Basin that covers active O&G development areas in the Montana/Dakotas region is presented below. This technical approach mirrors the procedures used in the WRAP Phase III development of basin-level inventories performed by ENVIRON under the auspices of WRAP, and utilizes the technical and project experience and management skills of ENVIRON and WRAP staff. ENVIRON has extensive experience developing these inventories using the WRAP Phase III methodology that is summarized below, having completed baseline and projected inventories for eight (8) basins in the Intermountain West. WRAP staff have managed the ENVIRON work to develop these inventories, provided technical and coordination assistance to ENVIRON and the affected stakeholders, and served to more closely connect the operators and state/EPA regulators through the collaborative nature of the data collection, analysis, and dissemination in the Phase III project. More details on the WRAP Phase III O&G emission development methodology can be found in the numerous reports, spreadsheets and displays on the WRAP's Phase III project web page².

¹ http://www.blm.gov/pgdata/etc/medialib/blm/mt/blm_programs/energy/oil_and_gas.Par.36589.File.dat/ogproducingareas.pdf

² <http://www.wrapair2.org/PhaseIII.aspx>

In general the technical approach for the baseline and midterm projected inventories follows a number of key steps which are listed below, more details can be found in the WRAP O&G inventory development reports³. Steps (1)-(5) below describe the development of baseline inventories, and steps (6)-(8) below describe the development of the midterm projected inventories.

- (1) Production statistics compilation: ENVIRON proposes to use a commercially available [IHS] database (for which BLM has a license for use) to compile production statistics for both basins including historic data; production statistics that include well counts, spud counts, and gas, oil and condensate production;
- (2) Survey process: A survey process would be conducted similar to the approach used in the Phase III project that targets the top companies in each basin with surveys that request data on wellhead equipment and processes, and some midstream sources that would be considered survey-based (i.e., for which no permits exist); the survey process would include identification of companies, outreach, development of a survey instrument, transmittal of surveys, and compilation of the survey data;
- (3) Survey data aggregation and emissions analysis: The survey responses from companies operating in each basin in the baseline year would be aggregated using a production-weighted methodology described below to form the required input data for calculation of emissions from survey-based source categories; the emissions calculations would proceed following the technical methodologies described in detail in the Phase III studies in order to be consistent with the previous analyses;
- (4) Permit data compilation: Some midstream sources, particularly larger sources such as gas processing plants and large compressor stations, may be permitted by state agencies and/or EPA for tribal sources; data from permits would be gathered from the agencies and compiled as the permitted point sources in the inventory;
- (5) Final aggregation: Final baseline inventories would be compiled from the survey-based emissions estimations and the permitted point source data, with allocation to county-level emissions by production surrogates (for survey-based sources) or by specific source locations (for point sources) to generate complete baseline inventories;
- (6) Projected activity: Companies would be queried for information they can provide on planned activities in the basins for purposes of the “midterm” projected inventories; company plans could include drilling information and well decline curves, and these would be combined with historical data to generate scaling factors for each of the key production statistics for a future year of interest (to be determined by BLM);
- (7) Controls analysis: For purposes of the midterm projected inventories, analysis will be conducted to determine the impact of regulatory requirements on the inventories, including any state or federal regulations that would impact oil and gas source categories; and
- (8) Midterm projected inventories: the activity projections in step (7) would be used to generate “uncontrolled” projected emissions for each basin, and the controls analysis in step (8) would be used to adjust these uncontrolled projections to develop final midterm emissions projections for each basin.

A detailed description of each of these steps is provided below.

Temporal and Geographic Scope

These inventories will consider both a baseline year and a midterm projected year, consistent with the WRAP Phase III study. For the baseline year, we propose to use 2011 as this will be the most current year for which a complete, reliable data set on production statistics will be available. Because of the rapidly changing nature of oil and gas production in the Williston Basin particularly, the use of a 2011 baseline year is critical to capture the recent boom in oil production in this basin. A similar baseline year would be used for the Great Plains Basin. 2011 is also a National Emissions Inventory (NEI) triennial update year. These inventories will be made available to the respective states for their 2011 NEI reporting, or reported on the states’ behalf with their prior approval.

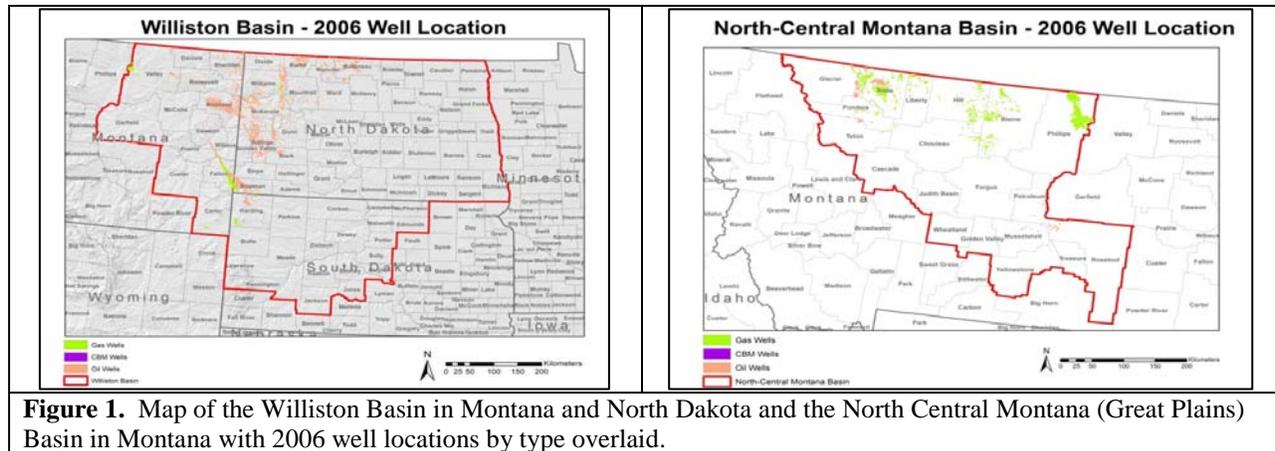
The midterm projected inventories will be developed for a single future year that is expected to be 5-7 years in the future, consistent with the WRAP Phase III study. The midterm projection year will be chosen in discussion with BLM to determine the most appropriate year suitable for use in any future emissions analyses or future modeling efforts. WRAP’s and ENVIRON’s experience indicates that a far future year should not be used for midterm projections since developing estimates of planned activities from oil and gas operator data input becomes intractable. Oil and gas operators typically

³ <http://www.wrapair2.org/emissions.aspx>

are only able to provide limited future activity plans for the near term. We will work with BLM and discuss these constraints as well as any specific needs to determine the midterm projection year.

The geographic scope of the inventories will be the Williston Basin in Montana and North Dakota and the Great Plains Basin in Montana. For the purposes of this study, we recommend that the boundaries for these two basins be modified from those of the US Geological Survey (USGS) (USGS, 2008) to wholly include all counties that fall within these basins. This is both consistent with the WRAP Phase III study, and also allows for the efficient development of county-level emission inventories for use by state agencies in ongoing inventory development and in air quality modeling studies.

Figure 1 show the proposed boundaries of the Williston and Great Plains Basins that we recommend for use in these inventories. Overlaid on these figures are well locations current as of 2006 that were compiled in the initial stages of the WRAP Phase III study. These well locations and statistics will be updated to the current 2011 base year. Also shown in Figures 1 and 2 for these two basins are Indian Tribal land within the boundaries of the basins.



Production Statistics Compilation

Oil and gas related activity data in the Williston and Great Plains Basins will be obtained from the IHS Enerdeq database queried via online interface. The IHS database uses data from each state’s Oil and Gas Conservation Commission (OGCC) or equivalent as a source of information for oil and gas activity. The IHS database is typically more accurate and complete than the OGCC databases from which it obtains data. The use of the IHS database is also consistent with the methodology used in other Phase III basins.

Two types of data will be queried from the Enerdeq database: production data and well data. Production data includes information relevant to producing wells in the basin while well data includes information relevant to drilling activity (“spuds”) and completions in the basin. Production data will be obtained for the counties that make up the Williston and Great Plains Basins in the form of PowerTools input files. PowerTools is an IHS application which, given PowerTools inputs queried from an IHS database, analyzes, integrates, and summarizes production data in an ACCESS database. The Williston and Great Plains Basins’ PowerTools input files will be loaded into the PowerTools application. From an MS ACCESS database created by PowerTools, extractions of the following data relevant to the emissions inventory development will be conducted:

1. Baseline year active wells, i.e., wells that reported any oil or gas production in the baseline year (2011 or another year of BLM’s choosing).
2. Baseline year oil, gas, and water production by well and by well type.

The production data are available by API number. The API number in the IHS database consists of 14 digits as follows:

- Digits 1 to 2: state identifier
- Digits 3 to 5: county identifier
- Digits 6 to 10: borehole identifier

- Digits 11 to 12: sidetracks
- Digits 13 to 14: event sequence code (recompletions)

Based on the expectation that the first 10 digits, which include geographic and borehole identifiers, would predict unique sets of well head equipment, the unique wells will be identified by the first 10 digits of the API number.

Well data will also be obtained from the IHS Enerdeq database for the counties that make up the Williston and Great Plains Basins in the form of “297” well data. The “297” well data contain information regarding spuds and completions. The “297” well data will be processed with a PERL script that ENVIRON has developed as part of past Phase III basin inventory work to arrive at a database of by-API-number, spud and completion dates with latitude and longitude information. Drilling events in the baseline year will be identified by indication that the spud occurred within that year. If the well API number indicates the well was a recompletion, it will not be counted as a drilling event, though if the API number indicates the well was a sidetrack, it will be counted as a drilling event.

Survey Process

Our team will leverage our extensive experience with conducting surveys and gathering survey-based data from the oil and gas industry. ENVIRON has led the survey development and surveying process for all WRAP Phase III basins, as well as ongoing work on the CenSARA oil and gas inventory study which is also survey-based. Using our experience in this area, we propose the following survey process for the Williston and Great Plains Basins inventories.

Survey Instrument Development

ENVIRON will prepare a spreadsheet-based survey instrument for use in the Williston and Great Plains Basins’ baseline inventory development. The survey instrument will request detailed equipment, process, controls and chemical composition data for all major source categories associated with upstream oil and gas development. ENVIRON has already reviewed the permitting requirements and thresholds in Montana and North Dakota and determined that a majority of emissions sources will be unpermitted in these states.

A survey process will be conducted similar to the approach used in the Phase III project that targets the top companies in each basin with surveys that request data on wellhead equipment and processes, and some midstream sources that would be considered survey-based (i.e., for which no permits exist); the survey process would include identification of companies, outreach, development of a survey instrument, transmittal of surveys, and compilation of the survey data.

The list of source categories to be surveyed will be based on the WRAP Phase III inventories, however special consideration will be given to the flaring of gas in the Williston Basin from the development of the Bakken Shale oil formation. Preliminary data and research on the practices in the Bakken Shale suggests that infrastructure for capturing and processing of gas is lacking in this area and much of the gas is flared. Additional flaring and venting source categories will be added as appropriate, and with consultation with BLM. It should be noted that on-road mobile sources and most off-road mobile sources (with the exception of drilling/workover rigs and some portable engine types) are not considered a part of this inventory study. A draft of the survey spreadsheets will be provided to BLM for review and comment and finalized with BLM’s approval.

Outreach

The IHS database analysis of both the Williston and Great Plains Basins’ production statistics will include the development of a ranked list of oil and gas companies’ production levels and well ownership. This includes gas production ownership, oil/condensate production ownership, and well ownership. Companies representing the top 70% of ownership in each basin will be identified as targets for the survey process. ENVIRON will review this list with BLM, and modify it as necessary if BLM wishes to expand or reduce the number of companies. If the number of companies required to achieve 70% ownership exceeds 20 in either basin individually, ENVIRON will discuss the option of limiting the survey to the top 20 companies in that basin. Past survey efforts indicate that gathering more than 20 surveys will require significantly more resources and time than may be possible in the scope of this study.

Once the ranked list of companies is identified for each of the two basins the Project Team will conduct an outreach effort designed to inform these companies. We will discuss the reasons behind the project, the benefits to the involved stakeholders of compiling these emission inventories, the methodology to be used to complete the inventories, as well as assuring and clarifying that ENVIRON will hold the companies' survey response data confidential and aggregate those data to the Basin level, and review the level of involvement required of the companies to complete the project. This work will include identification of primary contacts within each organization, explanation to them of the survey content, procedures for distribution and response to the survey requests and the proposed schedule the companies would be requested to adhere to in order to meet the project timetable. It is envisioned that this initial outreach effort will include electronic and telephone contact, and probably will require scheduling one or more in-person meetings with the companies near their district offices.

We will designate a Survey Coordinator (SC) within our Project Team who lives near the Williston and Great Plains Basins and can coordinate the collection of the survey responses with BLM. We also anticipate that BLM will assist in getting the operators in these two basins to respond to the survey. Once the surveys are distributed, the SC will conduct follow-up to assure timely progress to obtain the necessary responses. This will include periodic checks on the status of the data collection, and identification of any problems and reasonable assistance for individual companies with survey completion and/or quality of response. The SC will serve as the primary point of contact to assist industry participants with questions, and to provide technical support to industry staff in their data compilation and submission. It is anticipated that the SC will make several trips to the Williston and Great Plains Basins to visit with operators and BLM to assure that sufficient survey responses are received so that detailed and comprehensive O&G emission inventories can be generated.

Survey Aggregation and Emissions Analysis

Once information is received from the participating companies in each basin and from the States, these survey data will be compiled. Compilation includes the development of summary spreadsheets that incorporate the survey responses of each company by source category. These compilation spreadsheets form the basis of by-source-category emissions estimates.

The survey data responses will be aggregated by response type using a weighted averaging scheme to combine company responses per source category. For each source category a production statistic surrogate will be assigned, for example well counts will be assigned the surrogate for the pneumatic device emissions. The input data for each source category – equipment, process-related data, gas compositions, emission factors, etc. – will be aggregated by the weighted average contribution of each company using the surrogate as the weighting factor. This methodology allows each company's source data to impact the emissions from that source category in proportion to the company's ownership of the surrogate assigned to that category. If only summary emissions data is provided by some companies rather than the requested format, these data can still be utilized by aggregating with other companies' data at the summary emissions level. In general, every effort will be made to incorporate company data in whatever format it is received. This task can be challenging considering that many companies track equipment and process data in different formats and with varying degrees of precision, and may be willing to share only high-level summary data or very detailed data. ENVIRON will leverage our experience with reviewing and aggregating survey data from the past Phase III studies and other relevant project experience. As part of the survey data aggregation, quality assurance/quality control (QA/QC) review will occur – company data identified as outliers or that clearly indicates that the data is inconsistent with other data will be flagged for further review. Follow-up discussions may be conducted with companies to clarify survey responses as part of the QA/QC process, or some data may be restricted from further use in the inventory analysis if determined to be incorrectly submitted or inconsistent.

The end result of this task will be a series of spreadsheets for each source category representing aggregated survey data for use in developing basin-wide emissions.

Survey-based source category emissions will then be estimated from the aggregated survey data. The exact methodology for estimating each emissions source category has been described previously in detail in the technical methodologies developed for the WRAP Phase III project. We propose to use similar methodologies in this study, with differences to account for any unique source categories or considerations related to source categories specific to the Williston Basin. Emissions are estimated using either standard approaches for combustion source categories and vented/fugitive source categories, or using specific software modeling programs as applicable (e.g. E&P TANK or GRI GLYCalc). Natural gas

composition data, including produced primary gas, produced associated gas, flash gas and dehydrator vented gas compositions will be gathered and used to estimate VOC fractions in the vented and fugitive gas by source category as applicable. The aggregated survey data is not expected to represent 100% of any source category surrogate in these basins, and therefore additional scaling will be conducted to develop basin-wide emissions for each source category from the aggregated survey responses.

Permit Data Compilation

Emissions from large sources in the Williston and Great Plains Basins, including compressor stations, gas processing plants, and associated equipment will not be estimated based on survey data. For these large sources, permit data gathered by the Montana Department of Environmental Quality (MTDEQ), the North Dakota Department of Health (NDDH) Division of Air Quality, the South Dakota Department of Environment and Natural Resources (SDDENR), and/or EPA Region 8 office (for tribal sources) will be queried. ENVIRON has worked extensively with state air agencies and EPA databases on permitted sources throughout the Rocky Mountain states and will structure queries to these agencies leveraging that experience. For purposes of consistency with the WRAP Phase III inventories, queries will use a combination of SCC and SIC/NAICS codes developed in the Phase III study to identify oil and gas sources that are within the permit databases maintained by MTDEQ, NDDH, SDDENR, and EPA. The SCCs used to report the resulting emissions inventory will be those used by BLM, EPA, States, WRAP, and others in regional photochemical modeling studies. Permit data provided by these agencies in response to the queries will be reviewed and where information on equipment parameters such as engine size (hp), emission factors or controls information are identified, these will be logged for use in the midterm projections. Where actual emissions are provided for permitted sources these will be used in place of potentials-to-emit. Location data in the form of latitudes/longitudes and county codes (FIPS) will also be compiled. The status of permitted sources will be reviewed to exclude any sources that were inactive during the baseline year. Sources will be grouped by SCC and by source type to assist in the development of basin-level emissions summaries. If necessary, follow-up will be conducted with state agencies to address any issues or questions that arise in the process of compiling the permit data.

Regarding these data for large permitted midstream sources, the Project Coordinator (PC) will work with Montana, South Dakota, and North Dakota State air programs, and with EPA Region 8 to obtain the necessary permit data for use by ENVIRON. ENVIRON will identify the specific data needed and the PC will serve as liaison to convey the requests to the Federal/State agencies, as well as to track the progress in compilation and submittal of what data is available from those agencies.

Final Aggregation

As a final step in the development of the basin-level emissions inventories for the Williston and Great Plains Basins, the survey-based source category emissions and permit data will be aggregated into complete inventories. Summary spreadsheets with emissions estimates for the permit sources, surveyed sources will be developed for each basin. As part of these summary spreadsheets, basin-wide emissions from surveyed sources will be allocated to the county level using the fractions of each surrogate occurring in each county in the basin. Permitted sources will be assigned to counties based on the county codes or location information. Summary tables and graphics will be generated providing a breakdown of the emissions by county, by source category and by tribal and non-tribal land. The summary spreadsheets will follow closely the format developed as part of the WRAP Phase III study. These will be provided to BLM for review and results discussed with BLM. Modifications requested by BLM will be discussed and implemented as applicable to each source category.

A draft technical report summarizing the methodology, input data, and summary results of the basin-level inventories for each basin will be developed and provided to BLM for review. Based on BLM comments, a final technical report will be developed for each basin. The final technical report and the summary basin-level emissions spreadsheets will be considered the final products for the baseline emissions inventory tasks for each basin.

Projected Activity

Midterm projected emissions inventories will be developed for each basin. These projected inventories make use of the baseline year inventories, and scaling and control factors to project the baseline inventories forward to some future year.

The selection of the future year will be conducted in consultation with BLM to meet any specific inventory or modeling needs. Constraints associated with projection data from oil and gas companies will also be discussed with BLM.

Once a midterm projection year is agreed upon with BLM, oil and gas companies will be queried for information they can provide on planned activities in the basins for purposes of the midterm projected inventories. Company plans could include drilling plans (number of wells drilled in particular areas) and well decline curves by well type. The IHS database will be used to develop historical trend lines of oil and gas production activity for every surrogate used in the baseline year inventories. Similar to the methodology used for the Phase III midterm projected inventories, a combination of company plans and well decline curves, and historic data will be used to develop projections of the oil and gas activity in each basin from the baseline year to the midterm year. Preference will be given to company-supplied specific plans if sufficient data is provided to characterize the projections. If insufficient company data is provided, extrapolation of historic trends in specific production surrogates would be conducted.

The ratio of the value of a surrogate in the midterm year to the baseline year will be calculated for each surrogate. These “scaling factors” will be considered the metrics for tracking growth or decline in activity in each basin for purposes of the midterm projections.

Controls Analysis

Analysis will be conducted to determine the impact of federal and state regulatory requirements on the oil and gas sources in the inventories for each basin. Federal regulatory requirements include NSPS requirements for engines, and the recent federal oil and gas regulations compiled under Subpart OOOO. State regulatory requirements will be reviewed to determine any specific state regulations in Montana, South Dakota, and North Dakota that would apply during the time period of the midterm projections.

Using a detailed analysis of the characteristics of sources in the baseline year, control factors will be developed to account for each regulatory requirement in the midterm year. Control factors will take into account the fraction of existing sources in the baseline year that are already controlled or achieve the requirements of the controls regulations. Extensive analysis has already been conducted by ENVIRON on applicable federal regulations including a methodology to account for NSPS requirements for compressor engines or other stationary engines. We will leverage this analytical tool for use in the Williston and Great Plains midterm projections.

Midterm Projected Inventories

Midterm projected inventories will be developed in two steps. The activity scaling factors will be applied to the baseline year inventories to develop “uncontrolled” midterm projections – i.e., prior to application of any regulatory requirements. Subsequently, the control factors described above would be applied to the uncontrolled projections to develop final projections. Similar to the baseline year inventories, draft and final summary spreadsheets and technical reports would be provided to BLM for comment on the midterm projections for each basin. The summary spreadsheets would be similar in format to the baseline year summary spreadsheets, but also include information on the activity scaling factors and controls used in the development of the midterm projections. The summary spreadsheets and technical reports would be finalized after addressing comments from BLM.

Inventory Reporting and Distribution

The PC will coordinate reviews with BLM and state air programs during the project, as well as organize and schedule data publication and facilitate distribution of reports to O&G stakeholders to meet BLM’s objectives for project reporting and transparency. It is envisioned that at least one conference telephone call will be held with a broad list of O&G stakeholders to publicize results when reports/emission spreadsheets are completed for each of the Montana Great Plains and North Dakota Williston basins. And the reports would be posted on the Western Regional Air Partnership website for reference and recall by any interested stakeholder.

Revised Project Schedule for MT-Dakotas O&G Emissions Inventory Project – February 27, 2013

<u>Task Description</u>	<u>Target Completion Date</u>
<u>Part 1: Outreach</u>	
Prepare Surveys, Ranked List of Companies, Query for State/Federal Agencies, Access IHS database at BLM, identify Contacts from Ranked List of Operators from Production Statistics, Contacts from Agencies	November 2012 early December
Schedule and Hold Outreach Calls/Meetings	December 2012/January 2013
Distribute Survey Instruments and Agency Queries	early March
Agencies Complete/Submit Query Response	March 31st
Williston Basin Future Projections Workshop with Operators and BLM	Week of April 15th
Companies Complete/Submit Survey Instruments	May 7th
<u>Part 2: Emission Inventory Compilation</u>	
BLM Provides Future Projection Inputs for Montana Great Plains Basin	Week of May 20
Compile Survey and Query Data	May 24th
Complete Emission Calculations and Draft Reports/Spreadsheets	July 10th
Report Review & Comment	July 24th
Complete Final Reports/Spreadsheets	August 7th
Prepare Stakeholder Summary	August 15th
Hold Stakeholder Review Calls	August 30th