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EARTHJUSTICE

ALASKA CALIFORNIA FLORIDA MID-PACIFIC NORTHEAST NORTHERN ROCKIES
NORTHWEST ROCKY MOUNTAIN WASHINGTON, DC INTERNATIONAL

July 19, 2012

Ms. Lisa P. Jackson
Office of the Administrator
Environmental Protection Agency
Room 3000
Ariel Rios Building
1200 Pennsylvania Ave., NW
Washington, DC 20460
Email: Jackson.Lisa@epa.gov

BY FED-EX AND EMAIL

Re: Petition for Reconsideration of 2008 National Standards for Ozone and Petition for New Final Nonattainment Designation for the Uinta Basin, Utah

Dear Administrator Jackson,

The following organizations file this petition for reconsideration and petition for a new final rule pursuant to Clean Air Act § 307(d)(7)(B), 42 U.S.C. § 7607(d)(7)(B): WildEarth Guardians, 516 Alto Avenue, Santa Fe, NM 87501, (505) 988-9126; Southern Utah Wilderness Alliance (SUWA), 425 East 100 South, Salt Lake City, UT 84111, (801) 486-3161; and Utah Physicians for a Healthy Environment, 4091 Splendor Way, Salt Lake City, UT 84124, (801) 243-9089 ("Petitioners"). Petitioners request that you reconsider certain aspects of the final rule titled "Air Quality Designations for the 2008 Ozone National Ambient Air Quality Standards." 77 Fed. Reg. 30,088 (May 21, 2012). Specifically, we ask the Environmental Protection Agency (EPA) to reconsider its decision to classify the Uinta Basin in Utah as "unclassifiable" and to issue a new final rule designating the area as "nonattainment."

EPA must consider this petition for reconsideration because EPA did not provide a rationale for its failure to consider monitoring data from the Uinta Basin showing severe violations of the 2008 ozone standard as evidence of nonattainment until the response to public comments, which was published after the final rule. Additionally, there is new information that arose after the public comment period closed demonstrating there will be significant increases in ozone precursor emissions as a result of oil and gas development in the Uinta Basin, which will make the existing problem worse. It was impracticable for petitioners to raise objections to EPA's rationale prior to the close of the public comment period or to comment on the new information, and these issues are of central relevance to the final rule. *See* 42 U.S.C. § 7607(d)(7)(B) (setting forth the standard for petition for reconsideration).

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BACKGROUND

The Uinta Basin in northeastern Utah is now home to some of the worst ground-level ozone pollution in the nation as a result of rampant oil and gas development and meteorological conditions. This 9,000 square mile basin includes lands under the jurisdiction of the federal government, the State of Utah, and the Ute Tribe.[1]

Ground-level ozone, or smog, forms from a chemical reaction between volatile organic compounds ("VOCs") and nitrogen oxides ("NOx") in the presence of sunlight. Ozone is a dangerous air pollutant that impairs breathing, aggravates asthma, sends thousands of people to emergency rooms and hospitals, and likely causes thousands of early deaths each year.[2] Children, the elderly, and people with existing respiratory conditions are the most at risk from ozone pollution.[3]

Ozone pollution has long been recognized as a big-city problem that peaks in the summertime, caused by VOC and NOx emissions from automobiles and industrial sources. It has only recently been recognized as a wintertime problem in rural areas with significant oil and gas development, such as the Uinta Basin and Sublette County, Wyoming.[4] In these areas, significant quantities of NOx and VOCs from oil and gas activities are trapped near the ground by stagnant air and converted to ozone by intense sunlight reflecting off snow.[5] When these conditions occur, these rural areas experience ozone levels that exceed those of the most heavily populated cities in the U.S.[6]

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[1] Bureau of Econ. Research, The Structure and Economic Impact of Utah's Oil and Gas Exploration and Production Industry Phase I - The Uinta Basin 28-9 (2007). Copies of documents cited in this Petition are included in an Appendix.

[2] *See* 77 Fed. Reg. at 30,089–90.

[3] *See id.*; *see also* 75 Fed. Reg. 2938 (Jan. 19, 2010). EPA has recognized the adverse health effects that can occur at ozone levels even below the current federal standard of 0.075 ppm, especially for children and the elderly, leading to a proposal to lower the standard. *See id.* at 2944. A recent study confirms the dire consequences of ozone exposure, even at levels below the standard, estimating that a 0.005 ppm decrease from the current standard would avoid over 1,000 premature deaths per year. Jesse Berman et al., *Health Benefits from Large-Scale Ozone Reduction in the United States*, http://dx.doi.org/10.1289/ehp.1104851 (published online July 18, 2012).

[4] *See* Energy Dynamics Lab. & Utah St. U. Research Foundation, Uinta Basin Winter Ozone and Air Quality Study 15 (2011) ("Uinta Basin Winter Ozone Study").

[5] EPA Region 8, Wyoming Area Designations for the 2008 NAAQS Standards Technical Support Document, Doc.# EPA-HQ-OAR-2008-0476-0652, at 4 (2011) ("Wyoming TSD").

[6] *Compare* Uinta County Monitor Value Reports 2010 and 2011 *with* Los Angeles Monitor Value Reports 2010 and 2011, *available at* http://www.epa.gov/airquality/airdata/ad_rep_mon.html (generated July 16, 2012) (Uinta County peak ozone concentrations are 0.123 ppm in 2010 and 0.139 ppm in 2011, while Los Angeles County peaks at 0.105 and 0.122).

The wintertime ozone violations were first recognized in 2005 in Wyoming.[7] By 2008, ozone values in Sublette County, Wyoming had increased over 20% from 2005 levels.[8] The "uncommon problem" of extreme wintertime ozone readings in rural valleys was attributed to emissions from the natural gas industry.[9] In response, Wyoming "move[d] forward to solve the problem," recommending a nonattainment designation for the affected area.[10] EPA finalized this designation as part of the final rule at issue here.[11]

EPA has recognized the same wintertime ozone problem in the Uinta Basin. In response, EPA has undertaken efforts to gather additional data and impose controls on NOx and VOC emissions from oil and gas activities. Unlike in Wyoming, however, EPA has stopped short of designating the area nonattainment despite monitored exceedances of the 2008 standard. Through a series of consent decrees, EPA has required private companies to "fund, install, and operate 'ambient air quality and meteorological monitoring stations' in the Uinta Basin to gather data necessary for use in air quality monitoring under federal and state laws and regulations."[12] The two monitors EPA required, known as the Redwash and Ouray monitors, have been monitoring ozone levels since 2009.

In that time, the monitors have measured numerous, severe violations of the 2008 ozone standard of 0.075 parts per million (ppm) established to protect public health and welfare.[13] In the first three months of 2010, the Redwash and Ouray monitors measured more than 68 exceedances of this standard. Between January and March 2011, there were 24 days with violations.[14] The highest daily 8-hour concentrations in 2010 and 2011 were 0.125 ppm and 0.139 ppm respectively—well above the federal standard set to protect public health and

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[7] *See* 2005 Sublette County, WY Monitor Value Reports, *available at* http://www.epa.gov/airquality/airdata/ad_rep_mon.html (generated July 18, 2012).
[8] 2008 Sublette County, WY Monitor Value Reports, *available at* http://www.epa.gov/airquality/airdata/ad_rep_mon.html (generated July 18, 2012).
[9] Letter from David Freudenthal, Governor, to Carol Rushin, EPA Regional Adm'r, Regarding Wyoming 8-Hour Ozone Designations (Mar. 12, 2009).
[10] *Id.*
[11] 77 Fed. Reg. at 30,157–58.
[12] The consent decrees resulted from a series of EPA enforcement actions against oil and gas companies operating in the Uinta Basin. In addition to the required monitoring, the consent decrees required emission reductions from certain oil and gas activities, such as compressors. *See U.S. v. Kerr-McGee Corp.*, No. 07-CV-01034-EWN-KMT, 2008 WL 863975, at *2 (D. Colo. Mar. 26, 2008); *see also United States v. Kerr-McGee Corp.*, Case 1:07-cv-01034-EWN-KMT, ¶ 80–82 (D. Colo. May 17, 2007) ("KM Decree"); *United States v. Colo. Interstate Gas Co.*, Case 2:09-cv-00649-TS, ¶ 11–14 (D. Utah, July 23, 2009) ("CIG Decree"); *United States v. Miller, Dyer & Co., LLC*, Case 2:09-cv-00332-DAK, ¶ 42 (D. Utah, Sept. 23, 2009) ("MD Decree").
[13] *See* 40 C.F.R. § 50.15(a).
[14] *See* Uinta County Monitor Value Reports 2010 and 2011.

welfare.[15] For comparison, the highest ozone levels monitored in Los Angeles County in 2010 and 2011 were 0.105 and 0.122 ppm respectively.[16]

EPA regulations also establish a method for determining when a particular monitoring station demonstrates a violation of the 0.075 ppm standard. To avoid reliance on anomalous high-level events, EPA determines compliance based on the three-year average of the annual fourth-highest daily maximum eight-hour average measured at the site.[17] Using the procedures established in 40 C.F.R. § 50, Appendix P, the Uinta Basin monitors demonstrate severe violations of the standard. The three-year average of the fourth-highest values from 2009 to 2011 for the Redwash monitor was 0.088 ppm and for the Ouray monitor was 0.100 ppm.[18] These three-year averages are both higher than the three-year average from the monitor in Sublette County (0.078 ppm), which the State of Wyoming and EPA relied upon to designate the county and portions of two others as "nonattainment" for ozone.[19]

A Utah Division of Air Quality (DAQ) study conducted between December 2010 and March 2011 confirmed the extreme ozone levels measured by the Redwash and Ouray monitors.[20] In conjunction with Utah State University and the Energy Dynamics Laboratory, the Utah DAQ compiled data from six existing monitors and installed ten new monitors throughout the Uinta Basin to determine the extent and severity of the ozone problem.[21] The study included data from the Redwash and Ouray monitors.[22] In total, the monitors measured 186 ozone exceedances.[23] With respect to the highest 8-hour concentrations, seven sites exceeded 0.115 ppm, with three of those sites measuring between 0.120 ppm and 0.134 ppm, and two sites exceeding 0.134 ppm. With respect to the fourth-highest, 8-hour concentrations, seven sites exceeded 0.100 ppm, with three sites exceeding 0.115 ppm, and one site exceeding 0.120 ppm.[24] According to the study, "the monitoring locations with the greatest number of nearby wells also tended to have the highest ozone concentrations . . . and the greatest number of NAAQS exceedances."[25]

Data from a tribal monitor on Indian lands within the Uinta Basin and a National Park Service monitor within Dinosaur National Monument, which is just east of the Uinta Basin, also confirmed multiple violations of the federal ozone standard. In 2011, the Myton tribal monitor

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[15] *Id.*; *see also* BLM, Greater Natural Buttes Final Environmental Impact Statement, Chapter 3, at 3-6 (2012) ("Greater Natural Buttes FEIS").
[16] *See* Los Angeles Monitor Value Reports 2010 and 2011.
[17] 40 C.F.R. § 50.15(b); *see also* 40 C.F.R. § 50, App. P.
[18] Comment by WildEarth Guardians to EPA Regarding Ozone Designation Recommendations for the 2008 Ozone NAAQS, Doc. # EPA-HQ-OAR-2008-0476-0440, at 14–16 ("WildEarth Guardians Comments").
[19] Wyoming TSD, at 5.
[20] Uinta Basin Winter Ozone Study (2011).
[21] *Id.* at 19.
[22] *Id.*
[23] *See id.* at 42.
[24] *Id.* at 42, 97.
[25] *Id.* at 44.

recorded 19 exceedances, with a high value of 0.124 ppm and a fourth-highest value of 0.111 ppm.[26] Also in 2011, the Dinosaur National Monument monitor recorded eight exceedances of the ozone standard.[27] The highest value was 0.106 ppm, and the fourth-highest value was 0.090 ppm.[28] In sum, all available monitoring evidence points unambiguously to the fact that the Uinta Basin is in violation of the 2008 ozone standard.

Despite the considerable and uncontroverted evidence showing a serious ozone pollution problem that poses a threat to human health in the Uinta Basin, EPA failed to designate the Uinta Basin as a nonattainment area. Although EPA recognizes that the Redwash and Ouray monitors recorded ozone levels well-above the federal standard, EPA claims that it cannot use this data to support a nonattainment designation because the monitors are "non-regulatory."[29] EPA did not explain why it considered the monitoring conducted pursuant to the consent decrees "non-regulatory" at any point during the designation process.

It was not until EPA published its response to public comments on or around May 17, 2012 that EPA provided its explanation of why the monitors are "non-regulatory."[30] EPA was responding to Petitioner WildEarth Guardians' comments demonstrating that the data from the Redwash and Ouray monitors supports a finding that the Uinta Basin is nonattainment under EPA's own procedures found in 40 C.F.R. § 50, Appendix P (three-year average of the annual fourth-highest daily maximum).[31] Notably, EPA does not dispute that the data shows violations of the standard under 40 C.F.R. § 50, Appendix P. Moreover, EPA concedes that the monitors "meet the siting, methodology, and operational requirements" of EPA's regulations. EPA also concedes that the monitoring data is being "collected in a manner reasonably calculated to meet the EPA's quality assurance/quality control ('QA/QC') requirements."[32] Despite these assurances, however, EPA claims that the data cannot be used for regulatory purposes because of three alleged quality assurance problems. As explained in more detail below, EPA's arguments have no rational basis and are not supported by the record. Because EPA offered its rationale for the first time in response to comments, this Petition for Reconsideration is the first opportunity that Petitioners have had to respond.

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[26] 2011 Utah Air Monitor Report for Ozone 4, *available at* http://www.epa.gov/airquality/airdata/ad_rep_mon.html (generated July 17, 2012).
[27] *Id.* at 5.
[28] *Id.*
[29] 77 Fed. Reg. 30,088, 30,089; *see also* Letter from James B. Martin, Region XIII Adm'r, EPA to Gary R. Herbert, Governor of Utah (Dec. 8, 2011), *available at* http://www.epa.gov/ozonedesignations/2008standards/rec/eparesp/08_UT_resp.pdf; Letter from James B. Martin, Region XIII Adm'r, EPA to Gary Hayes, Chairman, Ute Mountain Ute Tribe (Dec. 8, 2011), *available at* http://www.epa.gov/ozonedesignations/2008standards/rec/eparesp/T_UteMountainUte_resp.pdf.
[30] EPA, Responses to Significant Comments on the State and Tribal Designation Recommendations for the 2008 Ozone NAAQS, Doc. # EPA-HQ-OAR-2008-0476-0675, at 72–73 (dated Apr. 30 2012; published May 17, 2012) ("RTC").
[31] WildEarth Guardians Comments, at 14–16.
[32] RTC at 72–73; *see also* KM Decree ¶ 81; CIG Decree ¶ 12; MD Decree ¶ 42(b).

EPA's arbitrary decision to ignore the data from the Redwash and Ouray monitors has significant legal and health implications. Instead of finding nonattainment, as the data requires, EPA designated the Uinta Basin unclassifiable. This designation does not include any additional legal requirements to reduce pollution from that of an attainment area and will therefore do nothing to curb oil and gas pollution that currently threatens the public health.

ARGUMENT

Data from the Redwash and Ouray monitors, corroborated by numerous sources, unequivocally demonstrates that the ambient air quality in the Uinta Basin is not meeting federal air quality standards and poses a threat to public health. On the basis of this data, EPA must reconsider its decision to designate the Uinta Basin unclassifiable, rather than nonattainment. EPA's rationale for failing to consider the Uinta Basin monitoring data, provided for the first time in response to public comments, violates the Clean Air Act and lacks a rational basis. EPA should also reconsider its decision because information that arose after the close of the public comment period demonstrates that the existing ozone pollution problem is likely to get worse.

I. EPA's Rationale For Failing to Consider the Uinta Basin Monitoring Data Violates the Clean Air Act and Lacks a Rational Basis

Data from the Redwash and Ouray monitors, corroborated by numerous sources, unequivocally demonstrates that the ambient air quality in the Uinta Basin is not meeting federal air quality standards and poses a threat to public health. EPA claims that it cannot rely on this data to make a nonattainment designation because these are not "regulatory" monitors. However, that is not the standard provided by the Clean Air Act. The plain language and legislative history of the Act demonstrate that EPA must consider sound data that is available. In this case, EPA concedes that the data is "reliable and of good quality." Furthermore, EPA's three justifications for not considering the data lack a rational basis and have no support in the record. Finally, EPA's position is inconsistent with its interpretation of the Act in other circumstances and is therefore not entitled to deference.

A. Under the Clean Air Act, EPA cannot disregard sound, reliable data.

Under the Clean Air Act, EPA sets National Ambient Air Quality Standards (NAAQS) to protect public health and welfare. 42 U.S.C. § 7409(b). NAAQS designations are based on an assessment of whether the concentration of pollutants in the ambient air exceeds the standard set by EPA to protect public health and welfare. Non-attainment is defined as "any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the [NAAQS] for that pollutant." *Id.* § 7407(d)(1)(A)(i). Attainment is defined as "any area . . . that meets the national primary or secondary ambient air quality standards for the pollutant." Unclassifiable is defined as "any area that cannot be classified on the basis of *available* information as meeting or not meeting the national primary or secondary ambient air quality standard for the pollutant." *Id.* § 7407(d)(1)(A)(iii) (emphasis added).

The plain language of the Act demonstrates that Congress intended EPA to rely on "available information." *See Engine Mfrs. Ass'n v. S. Coast Air Quality Mgmt. Dist.*, 541 U.S. 246, 252 (2004) (noting that statutory interpretation begins with "the assumption that the ordinary meaning of that language accurately expresses the legislative purpose"). As the Seventh Circuit has stated, "the only situation in which designation of an area as unclassifiable would be proper" is "if [] data [does] not exist." *Bethlehem Steel Corp. v. EPA*, 723 F.2d 1303, 1307 (7th Cir. 1983).

The legislative history of the 1990 Clean Air Act amendments confirms that Congress intended EPA to consider any "sound data that is available." S. Rep. No. 101-228, at 15 (1989), 1990 U.S.C.C.A.N. 3385, 3401. Congress amended the Act in 1990, in part, to remedy the failure to achieve the carbon monoxide and ozone health standards established in 1977. The Senate Report notes that despite existing requirements, "150 million people still live in areas which exceed one or both of those standards." *Id.* at 3397. To remedy this problem, Congress strengthened the designation process to provide EPA with "significant authority" to "respond to new information about pollution levels and control needs." *Id.* at 3400. Congress required EPA to make designations within six months of modifying a federal standard and gave EPA broad authority to consider available information, subject only to the limitation that it be sound. *Id.* at 3401–02.

The Ninth Circuit recently confirmed that "the legislative history underlying the 1990 amendment clarifies that the EPA may rely on any 'sound data' that is available." *Montana Sulphur & Chemical Co. v. EPA*, 666 F.3d 1174, 1185 (9th Cir. 2012) (upholding EPA's reliance on modeling conducted by private contractors to determine that Montana was in nonattainment for SO_2 after EPA had found that the existing regulatory monitoring network was inadequate). Likewise, the D.C. Circuit has upheld EPA's designation of two counties as nonattainment for particulate matter because EPA relied on the "best available information," including information other than regulatory monitoring such as projected population growth rates and data regarding wind speed and direction. *ATK Launch Sys., Inc. v. EPA*, 669 F.3d 330, 337, 340 (D.C. Cir. 2012) (quoting *Catawba County v. EPA*, 571 F.3d 20, 44 (D.C. Cir. 2009)).

In this case, EPA itself has repeatedly recognized that the available Uinta Basin monitoring data is sound. In its response to comments, EPA concedes that the monitors "meet the siting, methodology, and operational requirements of 40 C.F.R. Part 58" and that the data is being "collected in a manner reasonably calculated to meet the EPA's quality assurance/quality control ('QA/QC') requirements of 40 C.F.R. Part 58, Appendix A." RTC at 72–73. 40 C.F.R. Part 58 governs monitoring conducted by state and local agencies for a variety of purposes, including NAAQS compliance. As EPA recognizes, 40 C.F.R. Part 58 does not apply to private parties operating monitors through consent decrees. RTC at 73; *see also* 40 C.F.R. § 58, App. A, 3. Therefore, EPA mandated substantial compliance with Part 58 requirements in the consent decrees to ensure that the monitors were sited in the proper location, that the data was collected

through an appropriate methodology, and that the data was subject to quality assurance procedures.[33]

In urging the District of Utah to approve one of the consent decrees, EPA stated that the data being collected with the monitors was "*reliable and of good quality* and will be useful in assisting regulators to gauge the impact of future oil and natural gas exploration and development in the Uinta Basin." Mem. In Support of Motion to Enter Consent Decree by United States in *U.S. v. Miller, Dyer & Co., LLC*, Case 2:09-cv-00332-DAK, at 24 (D. Utah Sept. 21, 2009) (emphasis added). EPA has offered no reasonable explanation for why this data is "useful" for gauging the impact of oil and gas development in the Uinta Basin, but cannot be used to support a nonattainment designation. Indeed, the primary purpose for ozone monitoring is to determine whether there is a violation of federal standards and a need to further protect the public health.

In fact, EPA has urged other federal agencies to rely on the monitoring data when assessing the air quality impacts of oil and gas development in the Uinta Basin. For example, in comments on the GASCO Energy Project, EPA notified BLM that "[m]easured ambient concentrations of ozone in the Uinta Basin during the period of January through March 2010 reached levels that are considerably above the NAAQS of 75 ppb for an eight-hour average." Comments by EPA to BLM Regarding the GASCO Uinta Basin Natural Gas Development Project Draft EIS, CEQ # 20100386, at 3 (Jan. 7, 2011) ("EPA Gasco Comments"). EPA urged BLM to rely on these existing ambient air concentrations to determine whether the project would lead to violations of the NAAQS standard. *See id.* at 10.[34] EPA also worked closely with BLM to develop a supplemental air analysis for the Greater Natural Buttes oil and gas development project that incorporated the ozone data from the Redwash and Ouray monitors. BLM, Greater Natural Buttes Record of Decision 7-1 (May 2012) ("Greater Natural Buttes ROD"); BLM, Greater Natural Buttes FEIS, Appendices H–Q, at P-69. Likewise, in recent comments on a 400-well project on national forest lands in the Uinta Basin, EPA commented that the Forest Service needed to strengthen its analysis "given recent ambient concentrations of ozone measured in the project area, which exceed the NAAQS." U.S. Forest Service, South Unit Oil and Gas Development Project Final EIS, Vol. 2, at E-8 to E-9 (Feb. 2012) ("South Unit FEIS"). EPA cannot rationally require other agencies to rely on the data and then refuse to do so itself.

In sum, although EPA refused to use the data to make a nonattainment designation, EPA has failed to demonstrate that the data is not sound. EPA has failed to identify a single problem with where the monitors were sited or the methods through which the data was collected. To the

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[33] In addition to meeting the siting, methodology, operational and quality assurance requirements stated above, the consent decrees also required EPA to approve the contractor selected to operate and maintain the monitors. MD Decree ¶ 42(a); CIG Decree ¶ 11. Additionally, the monitor operators were required to place the monitors in a representative location in the Uinta Basin approved by EPA. KM Decree ¶ 81; *see also* MD Decree ¶ 42(b); CIG Decree ¶ 12. The monitoring stations were also required to meet EPA's requirements for the number of days the monitors need to operate within a year as set forth in 40 C.F.R. § 50. CIG Decree ¶ 12.

[34] This statement is found in EPA's Detailed Comments for the Gasco Draft EIS, at 3, which is attached to EPA's overall comments.

contrary, EPA's own statements and actions indicate that the agency relies on the data in other contexts and is also urging other federal agencies to do so. Furthermore, as discussed above, numerous other monitors in the Uinta Basin have confirmed the severe ozone violations in 2010 and 2011. Because sound monitoring data is available that demonstrates that the Uinta Basin is a nonattainment area under the 2008 ozone standard, EPA's designation of the area as unclassifiable violates the Clean Air Act.

B. EPA's quality assurance arguments are unsupported in the record and fail to draw a rational connection between the facts found and the decision made

EPA offers three reasons for its refusal to rely on the Redwash and Ouray monitoring data, all three related to quality assurance. First, EPA states that it has not approved the quality assurance plan that was developed by the contractor that operates the monitors. RTC at 72–73. Second, EPA claims that the plan does not comply with all of EPA's guidance for quality assurance plans. *Id.* The only deficiency EPA identifies, however, is that the plan does not include a mechanism that would allow EPA or another regulatory agency to "direct corrective actions should quality assurance issues be identified in the monitoring program." *Id.* at 73. Third, EPA claims that although the "raw data" from most of 2010 and all of 2011—the time when the highest violations occurred—is currently reported in EPA's database, it cannot be considered "quality assured." According to EPA, this means there is not three years of data available to make the comparison with the standard under Part 50, Appendix P. Each of these reasons suffers from numerous flaws and is insufficient to justify EPA's failure to rely on data that it concedes is "reliable and of good quality."

1. EPA's failure to approve the quality assurance plan does not call in question the validity of the monitoring data

EPA objects to the use of the Redwash and Ouray monitoring data because EPA reviewed, but never approved, the quality assurance plan developed by the contractor. RTC at 73. EPA does not identify any regulation requiring EPA approval under the circumstances. EPA cites to monitoring regulations that apply to state and local agencies with delegated authority, which require that EPA approve a quality assurance plan before a monitor may begin operations. *See* 40 C.F.R. § 58, App. A, 2.1.2. As EPA recognizes, however, these requirements do not apply to private parties operating monitors pursuant to consent decrees. RTC at 73. Although there is no specific regulation that applies, EPA did ensure quality assurance of the Redwash and Ouray monitoring data through the consent decrees. *See, e.g.*, KM Decree ¶ 81; CIG Decree ¶ 12; MD Decree ¶ 42(b) (requiring that the data "be collected in a manner reasonably calculated to meet the EPA's quality assurance/quality control ('QA/QC') requirements of 40 C.F.R. Part 58, Appendix A"). EPA concedes that the data meets this standard, despite EPA's failure to approve the plan. RTC at 72–73. Given EPA's recognition that the data is sound and that it was collected in a manner reasonably calculated to meet EPA's quality assurance requirements, EPA's failure to approve the plan is nothing more than a technicality and does not provide an adequate justification for refusing to consider the data.

Moreover, the lack of approval is a problem of EPA's own making. The contractor appears to have complied with its quality assurance obligations by producing a quality assurance plan for EPA's review. Approval (or disapproval) of the plan was EPA's responsibility. EPA offers no explanation for its failure to approve the plan. EPA does not argue that it rejected the plan based on any identified deficiencies. Furthermore, even assuming there were deficiencies, EPA does not provide any evidence that it tried to work with the contractor to develop an adequate plan. Based on the record, it appears that EPA reviewed the plan and then did nothing. However, EPA cannot avoid its Clean Air Act responsibilities to protect the public from serious health threats by simply sitting on its hands.

2. Pursuant to the consent decrees, EPA possesses significant authority to oversee the monitoring and direct corrective action if necessary

The only specific deficiency cited by the EPA concerning the quality assurance program for the Redwash and Ouray monitors is the lack of "direct quality assurance oversight by any government agency." RTC at 72. Since 2009, private parties have operated these monitors pursuant to consent decrees, rather than as part of a monitoring network operated by a state or local agency with delegated authority under the Clean Air Act. EPA claims that "[t]he consent decrees . . . have not given EPA authority for oversight comparable to that authorized by the EPA through grant funding of state and local monitoring operations." RTC at 73. This claim is refuted by evidence in the record. *See Am. Trucking Ass'ns v. EPA*, 283 F.3d 355, 362 (D.C. Cir. 2002) (noting that EPA decisions must be supported by the record). In fact, EPA negotiated specific measures within the consent decree to ensure that the agency would have extensive control of the Uinta Basin monitoring, including the ability to direct corrective action, if required.

Since 2009, the relevant consent decrees have required private companies to "fund, install, and operate 'ambient air quality and meteorological monitoring stations' in the Uinta Basin to gather data necessary for use in air quality monitoring under federal and state laws and regulations." *U.S. v. Kerr-McGee Corp.*, 2008 WL 863975, at *2. The operators were required to certify to EPA their compliance with all requirements of the consent decree, including the monitoring. *See* MD Decree ¶ 42(c); CIG Decree ¶ 13. The consent decrees also required the operators to provide substantial information to EPA regarding the monitoring operations, including the recorded data and an annual report describing all work and other activities performed under the decree. *See* KM Decree ¶ 110(a),(b); MD Decree ¶ 50(a),(b).[35] With limited exceptions, EPA was authorized to use any information provided by the operator to enforce the decrees. *See* KM Decree ¶114; MD Decree ¶ 54; CIG Decree ¶ 18.

[35] The consent decree required all operators to include the following certification on all required reports and submissions to EPA: "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete." KM Decree ¶ 112; MD Decree ¶ 52; CIG Decree ¶ 16.

EPA also had authority to enter any facility covered by the decrees for the purpose of monitoring compliance with any of their provisions, including monitoring the progress of required activities, inspecting equipment and facilities, and inspecting and copying documents or other information required to be maintained in accordance with the Decrees. KM Decree ¶ 140; MD Decree ¶ 79; CIG Decree ¶ 43. Accordingly, EPA had all the authority it needed to oversee the monitoring operations and ensure that they were producing sound, reliable data with adequate quality assurance.

Moreover, there is no question that EPA could have directed corrective action through a contempt proceeding if it had identified any problems with the monitoring. The consent decrees constitute final judgments. *See* KM Decree ¶ 175; MD Decree ¶114; CIG Decree ¶ 73; *see also Sinclair Oil Corp. v. Scherer*, 7 F.3d 191, 193 (10th Cir.1993) ("A consent decree is a negotiated agreement that is entered as a judgment of the court."). As judgments, consent decrees can be enforced with the full range of enforcement tools, including contempt. *See* Fed. R. Civ. P. 70(e); *Local No. 93, Int'l Ass'n of Firefighters v. City of Cleveland*, 478 U.S. 501, 518 (1986). In fact, each of the courts that approved the consent decrees retained jurisdiction to effectuate and enforce the decrees. *See* KM Decree ¶ 163; MD Decree ¶ 102; CIG Decree ¶ 62. Given the extensive authority provided by the consent decrees, EPA's claim that there is no oversight mechanism is incorrect.

3. EPA's refusal to consider the wintertime data from 2010 and 2011 violates its own regulations

EPA's third stated reason for not using some of the Uinta Basin monitoring data is that "data from the monitors for 2010 and 2011 cannot be considered quality-assured data." RTC at 72. According to EPA, "[i]n the case of the Uinta Basin data, raw data between August 2009 and September 2011 is current in [EPA's ambient air quality database], but quality assurance data are only currently available for August 2009 through January 2010." *Id.* at 73–74. This statement confirms that data from the monitors is quality-assured, even if EPA has not approved the quality assurance plan. Although not fully explained, EPA seems to be basing the date restriction on the fact that state and local agencies are not required to certify their data for the prior year until May 1 of the following year. *See* 40 C.F.R. § 58.15(a). Therefore, as of early December 2011, when EPA notified the states of any intended revisions to their recommended ozone designations, states had only certified data through the end of 2010. RTC at 7. Therefore, EPA limited the data available for consideration to the three year period from 2008 through the end of 2010, unless a state specifically requested consideration of data from 2011 and agreed to certify by February 29, 2012. *Id.* Notably, this date restriction would eliminate the severe ozone violations measured in the winters of 2010 and 2011.

EPA's refusal to rely on 2010 and 2011 data is inconsistent with EPA's own regulations, which require the three-year average to be determined "using the three most recent, consecutive calendar years of monitoring data." 40 C.F.R. § 58, App. P, 2.2. Moreover, even under EPA's interpretation, it is unclear why the Uinta Basin data for the winter of 2010 would not have been certified by EPA's December 2011 deadline. Regardless, both the 2010 and 2011 data should

now be certified. Petitioners request that EPA reconsider the final rule based on the now "quality assured" data.

C. EPA's Refusal to Rely on Information Other Than "Regulatory Monitoring" is Inconsistent with EPA's Own Policies and Past Practice

EPA takes the position that it is prohibited from relying on data that it required to be collected because EPA and the companies have not jumped through all of the hoops that would be required if the monitors were part of the official state or local monitoring network. Not only is EPA's narrow view of "available" data inconsistent with the Clean Air Act, as discussed above, but it is also inconsistent with EPA's own prior interpretations of the Act. *See Catawba County v. EPA*, 571 F.3d 20, 52 (D.C. Cir. 2009) (rejecting nonattainment designation based on "apparent inconsistency in EPA's approach"); *Am. Farm Bureau Fed'n v. EPA*, 559 F.3d 512, 521 (D.C. Cir. 2008) (giving EPA no deference for "an unexplained change of position"). EPA has repeatedly recognized that the official monitoring network is not the only source of valuable data for determining compliance with the NAAQS.

For example, EPA has taken a much broader view of available information in making SO_2 designations. When it adopted a new SO_2 standard, EPA recognized that the existing regulatory monitoring network was inadequate. 75 Fed. Reg. 35,520, 35,552 (June 22, 2010); *see also id.* at 35,525 (noting that there were no minimum regulatory monitoring network requirements at the time of the rule). Accordingly, EPA adopted a hybrid approach, utilizing both monitoring data and modeling to predict SO_2 concentrations. EPA decided whether to use modeling on a "case-by-case basis, informed by th[e] area's factual record." *Id.* at 35,552 n.22; *see also id.* at 35,553 (noting that EPA would make SO_2 designations "based on the record of information that will be before EPA regarding each area"). This site-specific approach stands in sharp contrast to the "one-size-fits-all" approach EPA adopted for ozone in the Uinta Basin.

The Ninth Circuit recently upheld EPA's reliance on modeling conducted by private contractors to determine that the State of Montana was not assuring compliance with the SO_2 NAAQS, despite the lack of regulatory monitors showing any violations. *Montana Sulphur*, 666 F.3d 1174, 1184–85 (9th Cir. 2012); *see also PPG Industries, Inc. v. Costle*, 659 F.2d 1239, 1248 n.18 (D.C. Cir. 1981) ("EPA expressly prefers modeling over monitoring in many cases to make non-attainment designations. . . . This practice is permitted by the statute, and has been upheld by the courts."). As discussed above, the court in *Montana Sulphur* relied on the fact that "the legislative history underlying the 1990 amendment clarifies that the EPA may rely on any 'sound data' that is available." 666 F.3d at 1185. The court also relied on EPA's finding that the monitoring network was inadequate. *Id.* at 1184–85.

In the case of wintertime ozone, just like for SO_2, EPA has recognized that the regulatory monitoring network is inadequate because it focuses on monitoring in large urban areas in the

summertime.[36] EPA addressed the lack of a regulatory monitoring network in the Uinta Basin by requiring private parties to conduct ozone monitoring. But unlike SO_2, where EPA was willing to base decisions on other reliable data, here EPA is ignoring sound, available data that it required to be collected. This inconsistency is arbitrary and capricious.

EPA also relies on information other than regulatory monitoring to determine boundaries for nonattainment areas, including air quality data, emissions data, meteorology, and topography (such as mountain ranges). Mem. from Robert J. Meyers, Principal Deputy Assistant Adm'r, to Regional Adm'rs Regarding Area Designations for the 2008 Revised Ozone National Ambient Air Quality Standards (Dec. 4, 2008). The courts have upheld this practice. *See ATK Launch Sys.*, 669 F.3d at 334. To determine the boundary of the Wyoming nonattainment area, EPA relied on monitors that did not yet have three years of data and that had not yet been certified by the state. Wyoming TSD, at 10-11. EPA has provided no rational basis to conclude that information that is adequate for determining nonattainment boundaries—which determine whether a particular location within an area is in or out of attainment—is somehow inadequate for determining whether the area as a whole is in attainment. Because EPA's approach to available information has been inconsistent, its current narrow view for ozone is not entitled to deference. *See Am. Farm Bureau Fed'n*, 559 F.3d at 521.

II. New Information Since the Close of the Public Comment Period Demonstrates that the Ozone Pollution in the Uinta Basin is Going to Get Worse

EPA should reconsider its decision because information since the close of the public comment period shows that ozone levels in the Uinta Basin that are already well-above federal standards are only going to get worse as oil and gas development increases. BLM anticipates that "reasonably foreseeable" development in just the southern half of the Uinta Basin will include more than 21,000 wells. Greater Natural Buttes FEIS, Chapters 5-9, at 5-1, 5-9 (defining the cumulative impacts analysis area as the southern half of the Uinta Basin and estimating 21,293 wells as a result of "reasonable foreseeable projects"). Since the close of the public comment period in February 2012, federal land managers have approved more than 5,300 new wells. Development of these wells will exacerbate the ozone problem.

On May 8, 2012, BLM approved drilling of up to 3,675 oil and gas wells as part of Greater Natural Buttes Project. BLM, Greater Natural Buttes Record of Decision, at 3-1 (May

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[36] On July 16, 2009, EPA proposed to modify its ozone monitoring regulations to include new minimum monitoring requirements in rural areas and extend the length of the monitoring season (which is typically just the summer months) in some areas. 74 Fed. Reg. 34,525 (Jul. 16, 2009). On November 10, 2010, EPA published a notice identifying new data that further supported the proposed changes. *See* 75 Fed. Reg. 69,036, 69,036 (Nov. 10, 2010). The notice included data from the Redwash and Ouray monitors showing violations of the 2008 standard throughout the winter months. Redwash and Ouray Ozone Data, Doc. # EPA-HQ-OAR-2008-0338-0251 (posted Nov. 3, 2010) (monitor 490472002 is the Redwash monitor, and monitor 49072003 is the Ouray monitor). EPA never finalized the rule. As a result, EPA's existing regulations do not specifically require monitoring in rural areas like the Uinta Basin, nor do they require monitoring during the winter months.

2012). In the FEIS for the project, BLM relies on the data from the Redwash and Ouray monitors to establish the relevant ambient air quality background levels. Greater Natural Buttes FEIS, Chapter 3, at 3-6. BLM acknowledges that even under a "no action alternative," "there likely would be continued observations of winter ozone concentrations above the NAAQS." Greater Natural Buttes Final EIS, Chapter 4, at 4-9. As approved, the project is anticipated to increase NOx emissions by 2,213 tons per year and VOC emissions by 6,617 tons per year (representing emissions increases from existing levels of 22% and 4% respectively). *Id.* at 4-12. BLM modeled a predicted 2.4 ppb increase in ozone levels in the project area, although the model did not allow for predictions of extreme wintertime events. *Id.* at 4-9. Accordingly, as BLM concedes, this project standing alone will increase regional ozone levels. *Id.* at 4-12.

On June 18, 2012, BLM approved the drilling of as many as 1,298 new gas wells in the Uinta Basin as part of the GASCO Energy Uinta Basin Natural Gas Development Project. BLM, Record of Decision for the GASCO Energy Project 3 (Jun. 2012). As requested by EPA, BLM recognizes in the FEIS that the Ouray and Redwash monitors have recorded numerous exceedances of the ozone standard during the winter months. BLM, GASCO Final EIS, Chapter 3, at 3-14 (Jun. 2012). BLM states that the "data are considered viable and representative of the area." *Id.* BLM also acknowledges that the likely dominant source of this pollution is oil and gas operations near the monitors. *Id.* The GASCO project will increase NOx emissions in the area by 1,931 tons per year and VOC emissions by 2,574 tons per year, making the existing ozone pollution worse. Gasco Final EIS, App. H, at H-2. Assuming mitigation measures are fully implemented, BLM predicts an increase of 0.4 ppb of ozone in the project area. Gasco Final EIS, Chapter 4, at 4-440 to 441.

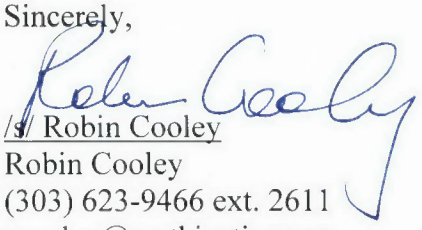
On February 21, 2012, the Forest Service approved drilling of up to 356 new oil and gas wells on the Ashley National Forest in the Uinta Basin. U.S. Forest Service, South Unit Oil and Gas Development Project Record of Decision 5 (Feb. 2012). The final environmental impact statement acknowledged the wintertime violations of the ozone NAAQS in the Uinta Basin, as measured by the Redwash and Ouray monitors. South Unit Final EIS, Volume 1, at 54. The Forest Service also acknowledged that the project would increase ozone precursor emissions. Assuming mitigation measures are fully implemented, the project is estimate to emit 2,866 tons per year of VOCs and 189 tons per year of NOx. *Id.* at 77. In comments on the proposal, EPA stated that the project has the "potential to contribute significant impacts to ambient ozone concentrations." South Unit Final EIS, Vol. 2, at E-8.

These projects provide additional evidence in support of a nonattainment finding. Given the high level of ozone being measured in the Uinta Basin and the additional emissions expected as a result of these projects, there is no question this development will make a bad situation much worse. Although EPA has provided comments to BLM on the high ozone values measured within the Uinta Basin, BLM is still proceeding to approve large numbers of wells. EPA has repeatedly stated "it is clear that the measured values are a concern for public health." EPA Gasco Comments, at 3; Greater Natural Buttes FEIS, Appendices H–Q, at P-69. Under the Clean Air Act, EPA is charged with protecting the public health through the NAAQS and the designation process. *See* 42 U.S.C. § 7409(b)(1). EPA cannot continue to abdicate this responsibility in the Uinta Basin.

CONCLUSION

For the foregoing reasons, Petitioners respectfully request that EPA reconsider its decision to designate the Uinta Basin as an unclassifiable area under the 2008 ozone standard and issue a new final rule designating the area nonattainment. Reconsideration is necessary to fulfill EPA's legal responsibilities under the Clean Air Act and to provide adequate health protections to people living the Uinta Basin.

Sincerely,



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APPENDIX

To Petition for Reconsideration of 2008 National Standards for Ozone and Petition for New Final Nonattainment Designation for the Uinta Basin, Utah

APPENDIX INDEX

South Unit Record of Decision	365
South Unit FEIS, Vol. 1	366
South Unit FEIS, Vol. 2	368

The Paradox Basin, Uncompahgre Uplift, and Thrust Belts all extend over state lines to adjacent states. Many of the workers involved in operating wells in these areas are actually employed in other states. Additionally, coalbed methane operations in Carbon and Emery Counties and the Hingeline are fairly recent discoveries and an oil service industry has not developed in these areas.

Defining the oil and gas E&P industry is a key element for a study of this type. Economists use the North American Industry Classification System (NAICS) developed by the Office of Management and Budget for classifying industries for reporting employment and earnings. The NAICS codes have three industrial classifications that directly apply to the oil and gas E&P industry. These are NAICS 211 - Oil and Gas Extraction, NAICS 213111 - Drilling Oil and Gas Wells, and NAICS 213112 - Support Activities for Oil and Gas Operations. For purposes of this study, these three industries are collectively considered the oil and gas E&P industry. Additional information on the NAICS codes for these three industries is available in Section 6.

The following sections summarize the various oil and gas producing areas in Utah. Also included are economic data for Duchesne and Uintah Countys to place the oil and gas E&P industry in context.

3.1 Uinta Basin

The Uinta Basin in northeastern Utah is the largest oil and gas producing area in the state and a significant producer in the Rocky Mountains. Natural gas was first discovered in economic quantities in the Uinta Basin in 1925 at the Ashley Valley field. In 1949, oil was discovered in the Roosevelt field. Natural gas and crude oil have been produced in the Uinta Basin since then, although production and the accompanying economic impact have varied with prices. The Uinta Basin is currently experiencing a significant economic boom due to increased oil and gas activity and this boom should continue as long as energy prices remain at current levels.

Although the geologic area defined as the Uinta Basin extends into Colorado and includes portions of several other Utah counties (Carbon, Emery, Grand, Wasatch, and Utah), this study focuses on Duchesne and Uintah Counties, Utah. Economic data is released at the county level and almost all of the economic activity associated with E&P activities in the Uinta Basin occurs in these two counties. For this study, the term Uinta Basin refers to Duchesne and Uintah Counties, Utah collectively unless otherwise indicated.

The two counties contain just under five million acres (Table 2), with 54 percent of the land controlled by the federal government. After including land controlled by the

state government and Indian lands, only 21.8 percent of the Uinta Basin is privately owned. With such a large portion of the land controlled by the federal government, the oil and gas E&P industry is highly sensitive to changes in federal land management policy. The largest amount of federal land in the Uinta Basin is controlled by the Bureau of Land Management, which is responsible for 32.7 percent of the land in the two counties. An additional 14.6 percent is administered by the U.S. Forest Service. Lesser amounts are controlled by the U.S. Fish and Wildlife Service and the National Park Service.

The majority of the state land in the basin is controlled by the Utah School and Institutional Trust Lands Administration (SITLA). SITLA administers six percent of the land in the two counties. Lesser amounts are controlled by the Utah Division of Wildlife Resources and the Utah Division of State Parks and Recreation. Indian lands make up 16 percent of the Uinta Basin.

Table 2 Land Ownership in the Uinta Basin

	Duchesne County, acres	Uintah County, acres	Uinta Basin Total, acres	Percent of Total
Bureau of Land Management	206,552	1,411,944	1,618,496	32.7
US Forest Service	453,680	269,380	723,060	14.6
National Wildlife Refuge	0	8,975	8,975	0.2
USFS and BLM Wilderness	263,882	0	263,882	5.3
National Park Service	0	50,682	50,682	1.0
Total Federal	924,115	1,740,981	2,665,096	53.9
State Parks	3,723	956	4,679	0.1
State Wildlife Lands	76,206	9,707	85,913	1.7
State Trust Lands	54,357	240,602	294,959	6.0
Total State Lands	134,287	251,264	385,551	7.8
Indian Lands	395,848	423,353	819,201	16.6
Private	614,070	461,646	1,075,716	21.8
Total	2,068,318	2,877,244	4,945,562	100.0

Source: Utah Governor's Office of Planning and Budget

Production of both crude oil and natural gas have increased in recent years in the Uinta Basin (Tables 3-4). From a low of 7.3 million barrels in 2002, crude oil production in the two counties increased to 11.4 million barrels in 2006. Production is rising faster in the Uinta Basin than in Utah as a whole. While crude oil production increased 55.5 percent in the basin from 2002 to 2006, Production in the state as a whole increased by 30.2 percent. This leading to the concentration of Utah production in the Uinta Basin. In 1997, 48.5 percent of the crude oil produced in Utah came out of the basin. By 2006, the amount of the state's crude oil production originating in the Uinta Basin had increased to 63.4 percent.

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Health Benefits from Large-Scale Ozone Reduction in the United States

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Health Benefits from Large Scale Ozone Reduction in the United States

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Competing Interests

There are no competing interests to report

Abbreviations

BenMAP: Environmental Benefits Mapping and Analysis Program

CAA: Clean Air Act

CASAC: Clean Air Scientific Advisory Committee

C-R: Concentration-Response

EPA: Environmental Protection Agency

HIA: Health Impact Assessment

NAAQS: National Ambient Air Quality Standards

PRB: Policy Relevant Background

Abstract

Background: Exposure to ozone has been associated with adverse health effects, including premature mortality, cardiopulmonary and respiratory morbidity. In 2008, the U.S. Environmental Protection Agency (EPA) lowered the primary (health-based) National Ambient Air Quality Standard (NAAQS) for ozone to 75ppb, expressed as the fourth-highest daily maximum 8-hr average over a 24-hr period. Based on recent monitoring data, U.S. ozone levels still exceed this standard in numerous locations resulting in avoidable adverse health consequences.

Objectives: To quantify the potential human health benefits from achieving the current primary NAAQS standard of 75ppb and two alternative standard levels, 70 and 60ppb, representing the range recommended by the EPA Clean Air Scientific Advisory Committee (CASAC).

Methods: We apply health impact assessment methodology to estimate numbers of deaths and other adverse health outcomes that would have been avoided during 2005, 2006 and 2007 if the current NAAQS ozone standards (or lower standards) had been met. Estimated reductions in ozone concentrations were interpolated according to geographic area and year, and concentration-response functions were obtained or derived from the epidemiological literature.

Results: We estimated that annual numbers of avoided ozone-related premature deaths would have ranged from 1,410-2,480 at 75ppb to 2,450-4,130 at 70ppb and 5,210-7,990 at 60ppb. Acute respiratory symptoms would have been reduced by 3 million cases and school-loss days by one million cases annually if the current 75ppb standard had been attained. Substantially greater health benefits would have resulted if the CASAC recommended range of standards (70 to 60ppb) had been met.

Conclusions: Attaining a more stringent primary ozone standard would significantly reduce ozone-related premature mortality and morbidity.

EDL | Energy Dynamics LABORATORY
Utah State University Research Foundation

Final Report:

Uinta Basin Winter Ozone and Air Quality Study

December 2010 - March 2011

Submitted To:
Uintah Impact Mitigation Special Service District
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- Sonja Norton, Chair
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Uintah County Commissioners

- Darlene R. Burns
- Michael J. McKee
- Mark D. Raymond

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Table of Contents

EXECUTIVE SUMMARY

The Uintah Impact Mitigation Special Service District (UIMSSD) enlisted a team from Utah State University Research Foundation's (USURF) Energy Dynamics Laboratory (EDL) and Utah State University's (USU) Department of Civil and Environmental Engineering to perform an air quality monitoring program to measure baseline ozone concentrations. The program consisted of two integrated elements: (1) a three-month winter ozone monitoring program throughout the Uinta Basin and (2) a more intensive, week-long monitoring program that simultaneously measured ozone, volatile organic compounds (VOCs), nitrogen oxide pollutants (NO_x), fine particulate matter with a diameter less than 2.5 micrometers ($PM_{2.5}$), and vertical profiles of relevant meteorological parameters during a strong winter inversion event at two sites.

Ozone concentrations were measured at 18 locations throughout the Basin during the three-month monitoring program. Eight of the locations had previously established ozone-monitoring stations operated by outside agencies. The other ten locations utilized 2B Technology Model 205 Dual-Beam ozone monitors installed by the EDL-USU team specifically for this study. EDL-USU monitors were strategically located to provide adequate spatial coverage, to account for variations in topography and meteorology, and to avoid results bias due to proximity of potential ozone precursor sources. Every two weeks, the monitors were serviced, data were collected, and recalibrations were performed (if necessary).

The results of the Basin-wide winter ozone study showed elevated wintertime ozone concentrations throughout most of the Uinta Basin during wintertime temperature inversion events. The inversion events had the effect of reducing the vertical movement of the precursors involved in the formation of ozone, resulting in increased ozone formation below the inversion layer. Low surface winds (< 2 m/s) within the inversion layer were also observed throughout the Basin during periods of elevated ozone levels. Low surface winds limited the horizontal movement and dispersion of precursors and pollutants.

Although the data collected for this study cannot be used for regulatory purposes, a high number of 8-hr National Ambient Air Quality Standard (NAAQS) exceedances were observed at multiple locations throughout the Basin, with the fewest exceedances occurring in the higher elevations along the periphery of the study area. The highest ozone values typically were observed in the area centered along the Ouray/Pariette Draw locations and extending north to the Cedarview/Lapoint area, east to the Red Wash area, and west to Duchesne. The highest 1-hr value was observed at Ouray (149 ppb), and Pariette Draw was the site of both the highest observed 8-hr value (134.6 ppb) and the greatest observed fourth-highest (regulatory) ozone value (121.6 ppb). The highest number of 8-hr exceedances (25) was observed at both Ouray and Horse Pool. And while Fruitland and Nine Mile Canyon were the only sites to show no exceedances of the 8-hr standard, the Altamont, Rabbit Mountain, and Rangely, CO, sites (one, three, and three exceedances, respectively) would also be considered attainment areas under the current ozone NAAQS.

These results from the study suggest that the ozone concentrations observed during the wintertime inversion periods are a function of local topography, meteorology, and ozone precursor abundance rather than of any exterior mid- or long-range transport. Results also showed that the lower elevation monitoring locations with the greatest number of nearby wells tended to have the highest ozone concentrations (1-hr and 8-hr averages) and the greatest number of NAAQS exceedances. Locations at higher elevations, approximately 5500-6000 ft above sea

level (asl), had relatively few exceedances despite being near significant numbers of oil and gas wells.

The long-term, Basin-wide ozone measurement was supplemented with a short, high-intensity effort focused on the collection of $PM_{2.5}$, NO_X, and VOCs concentrations during a strong winter inversion event. This intensive monitoring portion of the winter ozone study was conducted from February 21 through February 25, 2011 at the Red Wash and the Vernal/Jensen sites. Ambient samples of NO_X, $PM_{2.5}$, non-methane hydrocarbons (NMHC)/VOCs, and vertical meteorological parameters (temperature, pressure, wind speed, and wind direction) were collected at both sites. Though not part of the proposed study, grab samples for methane analysis (whole air vials) were collected at both sites, and vertical ozone data were taken at Red Wash.

NO_X measured highest at the Vernal location but at levels typical of rural/semi-urban areas. The NO_X measurements also displayed a typical traffic-related diurnal profile. All measured levels of NO_2 were well below the 100 ppb, 1-hr NAAQS. Also, an observed dominance of NO_2 suggests the presence of a readily oxidized air mass, indicating that plenty of ozone was available to convert initially emitted NO to NO_2.

The CH_4 concentrations measured at Vernal were consistent with Northern Hemispheric background levels (1.7-1.8 ppm). The observed CH_4 concentrations at Red Wash (2.7-5.5 ppm) were significantly above the Northern Hemispheric background levels. CH_4 is usually considered non-reactive due to its relatively slow reaction rates, but at such elevated levels, CH_4 could be a significant player in atmospheric photochemistry of ozone formation in the Basin. Measured levels of NMHC at the Red Wash location were more than twice the observed concentrations at the Vernal site. The measured ratio of indicator compounds, benzene-to-toluene, is suggestive of oil and gas exploration and production.

Observed $PM_{2.5}$ concentrations were well below the NAAQS (35 $\mu g/m^3$) at both Vernal and Red Wash, but concentrations at the Vernal location were approximately twice those of the Red Wash location. These results are inconsistent with measurements previously observed by the Utah Division of Air Quality (UDAQ) that showed some exceedances of NAAQS in Vernal in the mid-2000s. The chemical composition of the particulate matter measured at both sites was approximately 80% carbonaceous material, with just under 70% being organic carbon (as opposed to elemental/black carbon). This percentage indicates an abundance of long-chain VOCs characteristic of the oil and gas industry.

Vertical meteorology measurements at the Red Wash site indicate that during an inversion event, the mixing height (surface layer) was on the order of 20-80 m (65-265 ft) above ground level (agl) and was dependent on time of day; vertical ozone data also show similar surface layer depths and patterns. Meteorological data indicate that horizontal winds were light (< 2 m/s) during inversion conditions throughout the Uinta Basin. The higher elevation areas, > 6500 ft above sea level (asl), showed more variable wind directions and higher wind speed during the same period. These higher elevation areas were probably located above the inversion. Limited vertical ozone profiles observed at the Red Wash location showed higher levels of ozone near the ground, an indication that ozone is being formed at ground level rather than from precursors being transported into the Basin.

Meteorological stations at lower elevations (<6500 ft asl) within the Basin indicated that horizontal winds were generally light (< 2 m/s) during inversion conditions. The higher elevation stations (> 6500 ft asl) showed wind data more consistent between sites and at higher

wind speeds than those at lower elevations. This finding suggests that the surface level winds within the lower elevation areas of the Basin, where the temperature inversions and elevated ozone concentrations were measured, were effectively disconnected from the regional air flow.

Modeling of winter ozone was performed as part of this project. The results of these efforts indicated several concerns about the chemical mechanisms used for modeling ozone reactions. For these calculations, a base model was designed to simulate a late-winter day, Feb. 20, 2008 in the Upper Green River Basin (UGRB). Three concerns were identified from these modeling efforts: 1) current mechanisms neglect temperature dependence of all photolytic reactions; 2) many reactions appear with negative activation energies, an indication that their rates may not extrapolate well to lower temperatures; and 3) many non-photolytic reactions also appear without temperature dependence, which probably indicated that they were only measured at a single temperature in the vicinity of 300 K. These concerns may lead to a positive bias in modeled levels of ozone of up to 10 ppb.

LIST OF FIGURES AND TABLES

1. INTRODUCTION

1.1 BACKGROUND

During the winter of 2009-10 in the Uinta Basin, limited air quality monitoring revealed periods of elevated daytime ozone concentrations exceeding the current NAAQS established by the U.S. Environmental Protection Agency (EPA) (data are available on the EPA Air Explorer website, http://www.epa.gov/airexplorer/). Eight-hour averages above 100 ppb were measured during some days, exceeding the current 75 ppb NAAQS for surface ozone. Although the Uinta Basin 2009-10 winter measurements were not made at regulatory stations, the results raised concerns regarding the winter ozone levels in the region. Of particular concern was the potential impact these ozone levels might have on the health of Uinta Basin residents. Concern was also expressed that a failure to meet NAAQS for ozone levels could result in a nonattainment designation for Uinta Basin's counties, a consequence that could severely impact the economy of eastern Utah and the State as a whole. Such pressing concerns moved the Uintah Impact Mitigation Special Service District (UIMSSD) to obtain additional information and understanding about the levels of ozone and associated species in the Uinta Basin.

1.1.1 Problem Statement

At present, UDAQ has yet to determine the cause(s) of the elevated ozone readings from the winter of 2009-10 but has expressed concerns (http://www.airquality.utah.gov) that oil and gas development and production in the Basin may play a significant role. The uncertainty regarding the cause(s) of the elevated ozone levels stems from the region's lack of sound, continuous ambient air quality data. Prior to this study, the existing air monitoring data was very sparse, a fraction of the data necessary to make accurate and successful policy decisions.

If similar ozone levels are measured in subsequent years, the EPA could designate the Uinta Basin as a nonattainment area, and the potential impact on development and utilization of the Basin's energy resources due to air quality is of major concern to the local communities. Such restrictions would significantly impact not only the economy of the Basin but the economies of the State of Utah and of the region as a whole. The potential negative impacts of elevated ozone levels on the health of residents and on the economic development in the Basin compelled the UIMSSD to fund this study to measure ozone, associated species, and meteorological data during the winter months of 2010-11. The main objectives of the study were to establish the geographical extent and significance of elevated ozone within the Uinta Basin and to provide insight into possible anthropogenic influences and mitigation options. The additional data will help to characterize the Basin's wintertime ozone pollution (as a baseline dataset) and to help direct future ozone studies and mitigation strategies, activities and technologies.

The results of this study also provide information to help guide comprehensive, long-term airshed monitoring, analysis, and modeling programs to adequately understand winter ozone formation in the Uinta Basin and to help develop and implement appropriate mitigation strategies.

The UIMSSD enlisted a team from Utah State University Research Foundation's (USURF) Energy Dynamics Laboratory (EDL) and Utah State University's (USU) Environmental Engineering Department to perform an air quality monitoring program to measure baseline ozone concentrations in the Uinta Basin during the winter months of 2010-11. The program consisted

of two integrated elements: (1) a three-month Basin-wide winter ozone monitoring program and (2) a more intensive, week-long monitoring program at two selected sites that simultaneously measured ozone, volatile organic compounds (VOCs), nitrogen oxide pollutants (NO_x), fine particulate matter with a diameter less than 2.5 micrometers ($PM_{2.5}$), and vertical profiles of relevant meteorological parameters during a strong winter inversion event. It should be noted that the measured concentrations of ozone and $PM_{2.5}$ **were** not regulatory data and cannot be used in determining the attainment/nonattainment status of the counties of the Uinta Basin with respect to these pollutants.

1.1.2 Ozone Environmental Regulations

Oxygen exists in several allotropic forms, the most important being ordinary oxygen (O_2) and ozone (O_3) comprised, respectively, of two and three atoms per molecule. Ozone is a strong oxidizing compound found naturally in both the stratosphere and troposphere that readily reacts with most molecules and surfaces. It is also a known health hazard and often contributes to air quality problems in major cities throughout the world (Finlayson-Pitts and Pitts, 2000). For example, maximum ozone levels in Mexico City from 2000 to 2006 were measured above 200 ppb (Sanchez and Garfias, 2008), well above the natural tropospheric background concentrations of 20-40 ppb (Finlayson-Pitts and Pitts, 2000; Seinfeld and Pandis, 2006). Ironically, ozone is also critical to the preservation of life on earth because the so-called ozone layer (in the stratosphere at altitudes from about 15 to 40 km) absorbs nearly 99% of the harmful ultraviolet radiation produced by the sun (Finlayson-Pitts & Pitts, 2000, p. 56).

The U.S. Environmental Protection Agency (EPA) is authorized by the Clean Air Act (CAA) and its amendments to set ambient air quality standards for pollutants of primary concern with respect to impacts on human health at levels sufficient to protect the health of at-risk members of the population (i.e., children, elderly, and those with compromised health), based on the best available science. Even at low concentrations, ozone has been shown to adversely affect human health by irritating the linings of the nasal, throat, and lung passages, irritating the eyes and skin, reducing lung functionality, and increasing susceptibility to respiratory illnesses (Ilhorst et al., 2004; EPA, 2006a, 2006b, 2007). Adverse effects on both short- and long-term mortality have also been detected (Bell et al., 2004; Jerrett et al., 2009). Due to these effects, ozone is one of the pollutants of primary concern, referred to as a "criteria pollutant," and currently has a NAAQS of 0.075 parts per million (ppm), or 75 part per billion (ppb), based on the three-year average of the fourth-highest daily maximum 8-hour average for each year (EPA, 2010a). The EPA is mandated by the CAA, however, to review NAAQS standards periodically in light of new scientific data, and the NAAQS value for ozone is currently under review, with announcement of a new, lower NAAQS (presumably in the 60 - 70 ppb range) anticipated as early as July 2011 (C&E News, 2010; EPA, 2011).

1.1.3 Ozone Photochemistry

Ozone does not have a significant direct emission source but instead is formed in the atmosphere when solar radiation initiates a series of chemical reactions between volatile organic compounds (VOCs) and nitrogen oxides (NO_x). As such, ozone is often referred to as a secondary pollutant. The VOCs and NO_x are considered precursor compounds, and their emissions are regulated as a means of controlling surface ozone concentrations. Consequently, measurements of VOCs, NO_x,

and relevant meteorological parameters (i.e., wind, temperature, water, incident sunlight) are important to understanding the ozone formation processes in a given region.

The overall reaction process for ozone formation may be represented in simplest form as adapted from Finlayson-Pitts and Pitts (2000):

$$VOC + NO_x + \text{sunlight} \rightarrow O_3 + \text{other products} \qquad \text{(Eq. 1-1)}$$

where "other products" may include nitric acid, aldehydes, peroxyacetyl nitrate and sulfate, nitrate particles, and others, many of which may further contribute to ozone production or destruction. Almost all of the sunlight responsible for these reactions occurs in the near ultraviolet (UV-A) wavelength. Finlayson-Pitts and Pitts (2000) and Seinfeld and Pandis (2006) describe detailed chemical reactions involved in ozone formation and destruction.

Sources of NO_x are generally combustion processes; VOCs are emitted from a variety of sources that include but are not limited to oil and natural gas production, liquid fuel or other solvent evaporation, incomplete fossil fuel combustion, and vegetative or biogenic processes (Finlayson-Pitts and Pitt, 2000). Since solar radiation provides the energy for many of these reactions, a diurnal pattern of ozone concentrations is typically evident with the lowest concentrations occurring in early morning and the highest concentrations in early to mid-afternoon. Temporal and spatial variations in the concentrations of ozone precursors, such as elevated NO_x emissions during rush hour, may affect diurnal ozone patterns.

Significant factors that contribute to the formation of ozone are the concentrations of ozone precursors, availability of solar radiation energy (a function of time of day, time of year, elevation, cloud cover, and surface albedo), and meteorological conditions (temperature, air movement, relative humidity, etc.). General conditions found to enhance the production of ozone above the NAAQS include but are not limited to stagnant high pressure systems (inversions), degree of cloud cover, high solar intensity, calm or low wind speeds, and abundant and widespread ozone precursor sources (Cooper and Alley, 2002). This combination of conditions has historically been found during the summertime in metropolitan areas such as Los Angeles, Houston, and Mexico City (Finlayson-Pitts and Pitts, 2000); however, unexpectedly elevated ozone concentrations were observed by the State of Wyoming Division of Air Quality in the Upper Green River Basin (see Fig. 1-1) that exceeded the NAAQS multiple times during January-March of 2005 and during several subsequent winter periods.

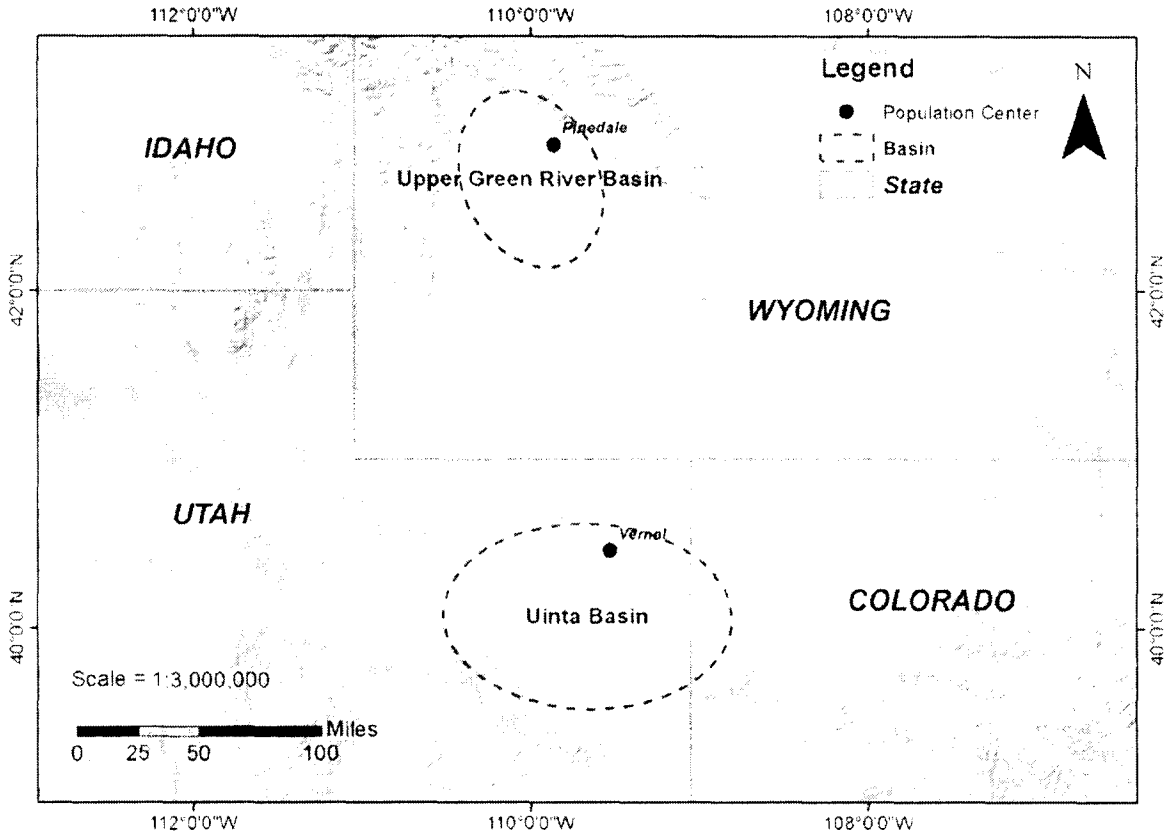

Figure 1-1. Geographic location of the Uinta Basin relative to Wyoming's Upper Green River Basin.

1.2 RELATED STUDIES

Very high wintertime ozone concentrations with patterns similar to those experienced in the Uinta Basin in 2009-10 have been recorded in the rural Upper Green River Basin (UGRB) of Wyoming since 2005. The UGRB is in rural Sublette County (2010 population: 10,247; population density: 0.8 people per km^2) in western Wyoming and covers roughly 5600 km^2 (Census Bureau, 2011). Since 2005, annual wintertime air quality studies have been conducted in the UGRB to understand the causes of elevated ozone concentrations and the most effective remediation strategy for the area. These studies (i.e., Schnell et al., 2009) have shown that severe, low level temperature inversions during periods of stagnant winds, a shallow mixing layer (<100 m), clear skies under synoptic high pressure systems, combined with snow cover and abundant VOCs and NO_x result in, "rapid photochemical production of ozone at high concentrations in a rural site during winter."

In contrast to the typical atmospheric condition in which ambient temperature *decreases* with increasing altitude, a temperature inversion refers to the condition in which ambient temperature *increases* with increasing altitude. These inversions engender ozone because they form stagnant pools of air that prevent dispersion and vertical mixing of ozone precursors. Schnell et al. (2009) point out that strong temperature inversions can last several days in the UGRB, during which time all precursor emissions originating near the surface are trapped in the shallow mixing layer.

The low surface wind conditions allow precursor concentrations to build dramatically through decreased advection and dispersion.

Snow cover is also important in the UGRB for two reasons. First, snow has a noontime surface albedo (~90%) that is much higher than most other surface types and can nearly double the amount of solar energy available to drive photochemical reactions through reflection. Second, snow cover reinforces the temperature inversion by preventing the heating of the ground and the air immediately above the ground. The high elevation of the UGRB (~2,300 m at the lowest point) is also significant in that the total attenuation path length through the atmosphere is reduced, resulting in greater incoming solar radiation than at lower elevations, all other factors being equal. Schnell et al. (2009) note that surface level wintertime ozone production may be occurring in other areas of the U.S. and the world with similar fossil fuel production, terrain, and meteorological conditions. Measurements in such locations, however, were lacking at the time of their report.

One-hour average ozone levels above 140 ppb were recorded in February 2008 in the UGRB, and the EPA's 8-hr average standard was exceeded 14 times during the corresponding winter months. It should be noted that the only significant industrial sources of ozone precursors in the UGRB are associated with the production of natural gas in the 400 km^2 Jonah-Pinedale Anticline gas fields, which have seen a large increase in extraction activities over the past decade. Changes to the equipment used for drilling and production were made in an attempt to reduce these emissions and avoid nonattainment status. However, in March 2009, the state of Wyoming submitted a letter and supporting technical documents to the EPA recommending that Sublette County in the UGRB be designated a nonattainment area for ozone due to persistently high values over multiple years (http://deq.state.wy.us). EPA's designation of Sublette County, WY, as a nonattainment are has been delayed until after the release of the new ozone NAAQS currently under review.

The Uinta Basin has meteorological conditions and oil and gas exploration and production processes similar to those attributed to high winter ozone levels in the UGRB of Wyoming. These parallels suggest that the high winter ozone levels in the Uinta Basin result from factors similar to those observed in Wyoming. Despite these similarities, however, each region has unique air quality characteristics and patterns that must be considered to achieve a thorough and accurate environmental study.

Such seemingly atypical wintertime, photochemically-driven secondary pollutant issues have also been observed in other areas around the region. Similar meteorological conditions (very low, persistent temperature inversions with clear skies) in Utah's Cache Valley and Wasatch Front have been shown by USU and UDAQ to lead to high wintertime $PM_{2.5}$ problems with slight increases in surface level ozone. During such episodes, fine particles are formed as another product of photochemical reactions that include additional precursor gas-phase species such as ammonia which is in relative abundance locally. Although similar meteorological conditions prevail in these areas, the ultimate pollutant problem ($PM_{2.5}$) is reflective of the differing precursor species.

1.3 PROGRAM OBJECTIVES

The Uinta Basin Winter Ozone and Air Quality Study reported herein consisted of two integrated components. First, a study was performed to provide a preliminary assessment of general ozone

concentrations in the Uinta Basin during a three-month period starting in late December 2010 and concluding in March 2011. Second, a more intensive study was performed over a five-day period during a winter inversion. Data collected and analyzed during this time included ozone, VOCs, NO_X, $PM_{2.5}$, and relevant meteorological parameters at two selected locations. The general intent was that these data be used by the larger community to help identify possible causes of ozone formation, possible sources of NO_X and VOCs accumulation, and variables key to future monitoring studies and photochemical airshed models.

The monitoring program outlined above had the following specific objectives:

1. To provide baseline data of ozone concentrations throughout the Uinta Basin during the 2010-2011 winter months,
2. To provide information on the ambient concentrations of VOCs, NO_X, $PM_{2.5}$ and relevant meteorological parameters during a winter inversion event,
3. To contribute to the long-term understanding of the relationship between winter inversion events and VOCs, NO_X, $PM_{2.5}$ and relevant meteorological parameters,
4. To provide sufficient information to enable some preliminary photochemical modeling activities,
5. To provide insights regarding possible anthropogenic factors involved in winter ozone formation and possible mitigation steps to reduce winter ozone levels, and
6. To guide the design of a more comprehensive, long-term airshed monitoring, analysis, and modeling program of the Uinta Basin. The intent of the more comprehensive, multi-year, air quality study would be to understand the physical and chemical processes significant to ozone formation and to determine and implement mitigation steps to reduce winter ozone levels in the Basin.

As a particular note, this effort was only the first step toward identifying mechanisms of ozone or ozone precursor generation in the Basin. Measuring, understanding, and modeling air quality impacts that originate from numerous sources, including oil and gas development, pose a significant challenge. It will take multiple efforts spanning several years to fully understand the winter ozone problem in the Uinta Basin.

In addition, pollutant concentrations measured during this study shall not be used to determine the attainment status of the counties of the Uinta Basin. The motive of this effort, rather, grew from a central goal shared by many federal, state and local organizations including the Uintah Impact Mitigation Special Service District (UIMSSD), the Utah Bureau of Land Management (BLM), the Utah Department of Environmental Quality (UDEQ) and its Division of Air Quality (UDAQ), Utah State University (USU), industry, and others ultimately to understand the spatial extent and physical and chemical processes leading to wintertime ozone production in the Basin. This information will assist in developing a meteorological and photochemical airshed model capable of addressing the environmental and economic needs of the Basin. One of the first steps in developing this comprehensive model was to determine "baseline" ozone levels in the Uinta Basin, a significant milestone accomplished by this study. The air quality and meteorological data obtained during this study will guide future measurement efforts and the construction of an environmental model that will lead to a better understanding of the factors contributing to ozone formation in the Basin.

2. MONITORING PROGRAM

As previously mentioned, the monitoring program consisted of two integrated elements: (1) a three-month, Basin-wide winter ozone monitoring program and (2) a more intensive, short-term monitoring program that simultaneously measured ozone, VOCs, NO_X, $PM_{2.5}$, and vertical profiles of relevant meteorological parameters during a strong winter inversion event. These two program elements are described in separate sections below.

2.1 BASIN-WIDE WINTER OZONE MONITORING

Ozone concentrations were measured at 18 locations in the Uinta Basin (Fig. 2-1 and Table 2-1) over the course of this study. None of the 18 monitors was established for regulatory purposes and, therefore, cannot be used in official consideration for NAAQS compliance.

2.1.1 Established Monitoring Stations

The USU/EDL team sought access to data from eight previously established Uinta Basin area ozone-monitoring stations that would be in operation during the planned study period (responsible agency in parentheses):

- Dinosaur National Monument (National Park Service - NPS)
- Fruitland (UDAQ for BLM Utah)
- Myton (Meteorological Solutions, Inc. for Ute Tribe)
- Nine Mile Canyon (BLM Utah)
- Ouray (Golder Associates, under EPA consent agreement)
- Rangely, CO. (NPS for BLM Colorado)
- Red Wash (Golder Associates, under EPA consent agreement)
- Whiterocks (Meteorological Solutions, Inc. for Ute Tribe)

Golder Associates provided access to the data from the Ouray and Red Wash monitoring stations, and BLM Utah permitted access to the data from the Fruitland station. BLM Utah and NPS agreed to provide access to the data from the Nine Mile Canyon and Dinosaur National Monument sites, respectively; and NPS and BLM Colorado granted access to the data from the station at Rangely, CO. Data from the Whiterocks and Myton monitoring stations were not available when this report was finalized.

2.1.2 New Monitoring Stations

The USU/EDL team deployed ten additional ozone monitors throughout the Basin to enhance the existing ozone monitoring network for the purposes of this study. The ten monitors were in place only during the study period of this project and were strategically located to provide adequate spatial coverage and to account for variations in topography and meteorology and to avoid biasing the monitor results by proximity to potential ozone precursor sources. The monitor locations were developed through consultation among the USU/EDL sampling team, UDAQ, BLM, county government, industry, local contacts, and others. Monitor placement provided a diverse sampling of environments: population centers, oil/gas fields, farms/ranches, open ranges, wetlands, etc.

2B Technology Model 205 Dual-Beam ozone monitors were used. For reliable operation, the Model 205 required 120 V AC power and a temperature-consistent enclosure for proper operation; these requirements were among the considerations in the selection of monitor

locations. The 2B Technology Model 205 ozone monitor has a dynamic range of 1.5 ppb to 250 ppm with an accuracy of 2% of the reading, and baseline drift of less than 2 ppb/day and less than 5 ppb/year. Ozone concentrations were logged as 5 min averages and subsequently compiled into 1-hr and 8-hr averages. Such fine time resolution could be essential to future high fidelity airshed regional modeling efforts.

2.1.3 Ozone Monitor Placement

In an effort to determine optimal placement of the ten ozone monitors installed for this study, discussions were held with several stakeholders. Placement decisions were guided by the stipulations that candidate sites:

- Fulfill guidelines given in 40 CFR 58 Appendix E, "Probe and Monitoring Path Siting for Ambient Air Quality Monitoring," including the avoidance of proximity to potentially interfering air pollutant sources;
- Represent adequate spatial distribution throughout the Uinta Basin, including the consideration of existing monitoring stations operated by other organizations that allow data access; and
- Provide winter access to allow adequate monitor servicing.

Once general monitoring areas were determined, Uintah and Duchesne County commissioners, local and state officials, local residents, and local businesses and industries proved very helpful in determining precise locations for the monitoring stations.

During the week of December 26, 2010, the USU/EDL team and a representative from the Utah Division of Air Quality (UDAQ) placed ozone monitors at seven locations:

- Altamont (city ambulance garage)
- Cedarview (private residence)
- Duchesne (city fire station)
- Lapoint (city fire station)
- Roosevelt (USU campus utility shed)
- Vernal (USU Highway 40 building)
- Horse Pool (QEP pump house, Wonsits Valley)

On January 11-13, 2011, the remaining three sites were determined, and monitors were installed in the following locations:

- Jensen (commercial nursery shed)
- Rabbit Mountain (private meteorological/air quality station)
- Pariette Draw (BLM field building)

The average above ground height of the installed probes was 6.9 m (min. 3.0 m/max. 15.0 m), with an average above-roof height of 1.2 m (min. 1.0 m/max. 2.0 m). Geospatial coordinates for each site were collected on multiple site visits using a handheld GPS unit and are given in Table 2-1. It should be mentioned that where the flexibility existed, the above sampling locations were selected using the previously listed site selection criteria.

Table 2-1. Uinta Basin ozone monitoring site location and above sea level elevations (per GoogleEarth™).

Location	Responsible Organization	Longitude (°W)	Latitude (°N)	Elevation (m)
Altamont	USU & EDL	110° 17' 8.609"	40° 21' 36.785"	1947
Cedarview	USU & EDL	110° 4' 34.189"	40° 22' 7.862"	1692
Dinosaur NM	NPS/ARS	109° 18' 16.785"	40° 26' 13.439"	1463
Duchesne	USU & EDL	110° 24' 3.895"	40° 9' 41.260"	1681
Fruitland	UDAQ/AMC	110° 50' 25.179"	40° 12' 31.433"	2021
Horse Pool	USU & EDL	109° 28' 1.849"	40° 8' 37.339"	1567
Jensen	USU & EDL	109° 21' 7.993"	40° 22' 1.595"	1451
Lapoint	USU & EDL	109° 48' 56.700"	40° 24' 14.717"	1672
Myton	Ute Tribe	110° 3' 43.82"	40° 11' 41.25"	1550
Nine Mile Canyon	BLM	110° 12' 12.67"	39° 47' 30.70"	1732
Ouray	Golder Assoc.	109° 40' 37.68"	40° 5' 18.39"	1419
Pariette Draw	USU & AMC	109° 49' 48.2"	40° 2' 4.57"	1424
Rabbit Mountain	USU & EDL	109° 5' 50.361"	39° 52' 7.318"	1879
Rangely, CO	NPS/BLM	108° 45' 41.8"	40° 5' 12.8"	1648
Red Wash	Golder Assoc.	109° 21' 9.00"	40° 11' 49.79"	1689
Roosevelt	USU & EDL	109° 58' 42.302"	40° 18' 2.630"	1543
Vernal	USU & EDL	109° 33' 39.67"	40° 26' 35.73"	1661
Whiterocks	Ute Tribe	109° 55' 49.59"	40° 28' 9.80"	1841

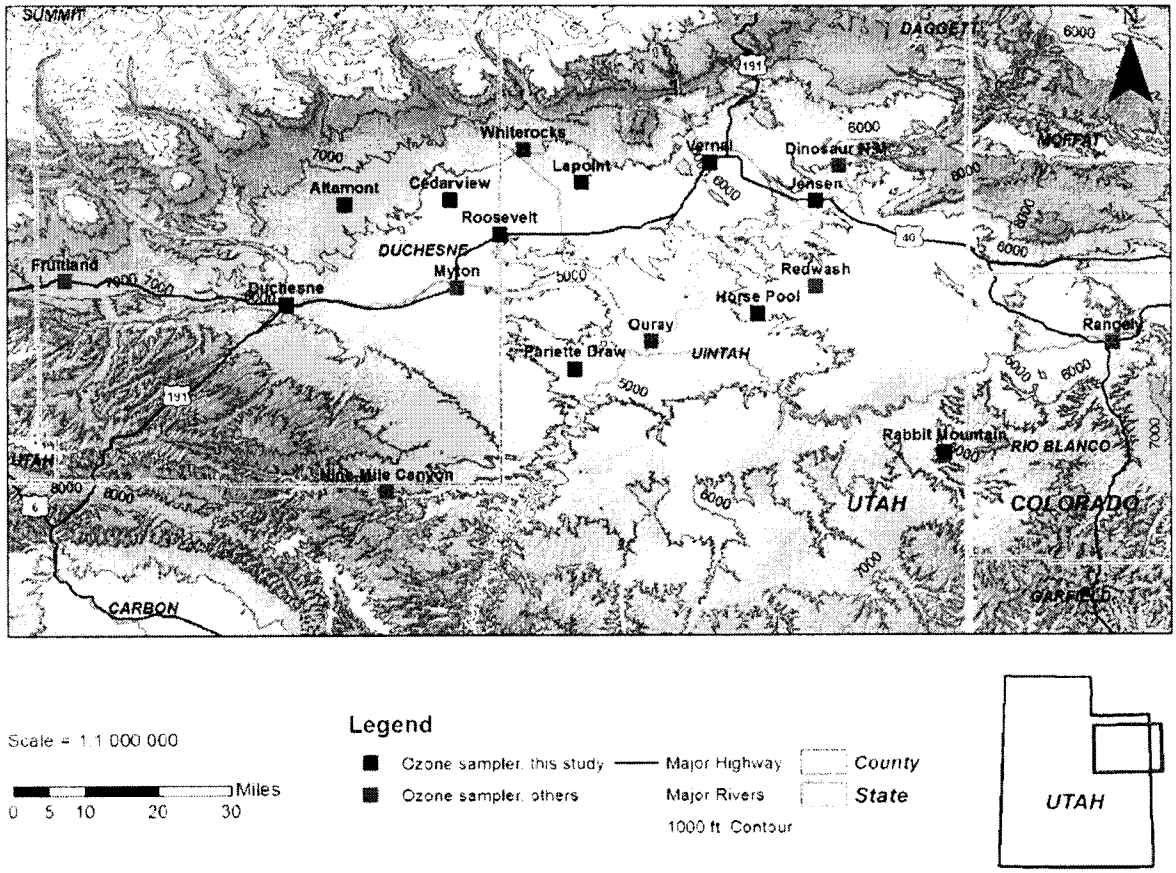

Figure 2-1. Locations of ozone monitors operated in the Uinta Basin during the winter of 2010–11.

It is of interest to examine the site locations in terms of relative proximity to potential ozone precursor (hydrocarbons, oxides of nitrogen) sources. Fig. 2-2 shows the same information as Fig 2-1, with the added complexity of known locations of permitted precursor point sources and active oil/gas wells.

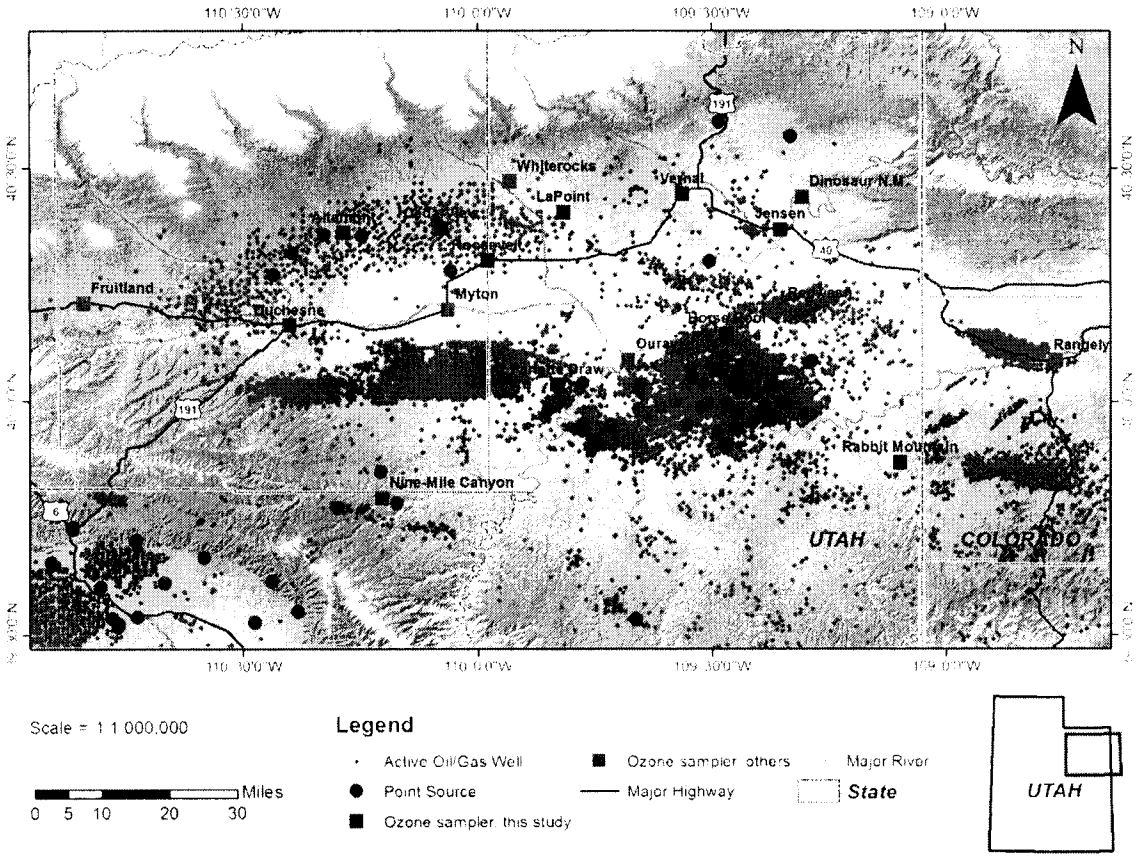

Figure 2-2. Winter 2011 Uinta Basin ozone sampling locations with an overlay of known ozone precursor point sources and active oil/gas wells.

2.1.4 Data Acquisition Procedures

Every two weeks, the study's ten ozone monitors were serviced, data were collected, and units were recalibrated (if necessary, as determined by audit procedures). These procedures were performed according to specific QA/QC protocols. The ozone monitoring was performed continuously for the entire winter season, with the exceptions of planned down time for periodic servicing and calibration checks.

2.2 INTENSIVE, SHORT-TERM OZONE, $PM_{2.5}$, NO_X, AND VOCS MONITORING

The long-term, Basin-wide ozone measurement was supplemented with a short, high-intensity effort focused on the collection of $PM_{2.5}$, NO_x, and VOCs concentrations during a strong winter inversion event. This intensive monitoring portion of the Winter Ozone Project was conducted from February 21 through February 25, 2011 at the Red Wash and the Vernal/Jensen sites. In addition to the ongoing measurement of ground-level ozone, ambient samples of NO_x (FRM chemiluminescence monitor), $PM_{2.5}$ (five parallel, filter-based samplers), non-methane hydrocarbons/VOCs (staged activated carbon sorption tubes), and vertical meteorology (tethered balloon with a sonde package) were collected.

Throughout the test period, vertical meteorological parameters, including temperature, pressure, wind speed, and wind direction were collected via tethered balloons. These measurements were collected multiple times during daylight hours at both the Red Wash and Jensen locations. It should be noted that Federal Aviation Administration regulations prohibited vertical balloon operations in the Vernal area. The Jensen site, located at the commercial nursery, served as a reasonable substitute for the Ashley Valley vertical meteorology.

The maximum above ground elevations (agl) monitored were from approximately 800 - 1200 feet agl (244 - 366 m), depending on location and meteorological conditions. A separate 2B Technologies ozone monitor, purchased and modified for balloon and UAV flight as part of another project, was deployed at the Red Wash location for a single day of data collection. On February 24, 2011, multiple vertical ozone profiles were collected throughout the day, when ground level ozone at the collocated Red Wash location measured over 80 ppb.

Additionally, though not part of the proposed study, collocated methane samples were collected at the Red Wash and Vernal sites. Methane was measured at each field location by whole vial collection and later analyzed at USU's Utah Water Research Laboratory (UWRL) in Logan, UT, via gas chromatography. Owing to its slow reactivity, methane (CH_4) is generally not considered a significant contributor to tropospheric photochemistry; however, when present in high enough concentrations, methane has been shown to be a significant factor in ozone formation (e.g., Pinedale, WY).

3. METHODOLOGIES: INSTRUMENTATION AND ANALYTICAL PROTOCOLS

3.1 GROUND LEVEL OZONE

The instruments deployed during this study were Model 205 Dual-Beam Ozone Monitors from 2B Technologies (Boulder, CO). These instruments were approved by the EPA in 2010 as an ambient ozone monitoring Federal Equivalent Method (FEM; EPA, 2010b) and are routinely used by the NPS, UDAQ, BLM, and other research groups in ambient ozone monitoring. Five minute-averaged data were recorded and averaged up to 1-hr and 8-hr intervals in post processing. The monitors were located within structures or buildings, with a ¼-inch Teflon sample tube, between 5 m and 10 m long, running to the roof. Sample heights were nominally one meter above the roof level and three to five m above the ground level, with the exception of the Vernal site, which was 2 m above the roof and 15 m above the ground level. Fig. 3-1 shows an example of sample line and ozone monitor deployment.

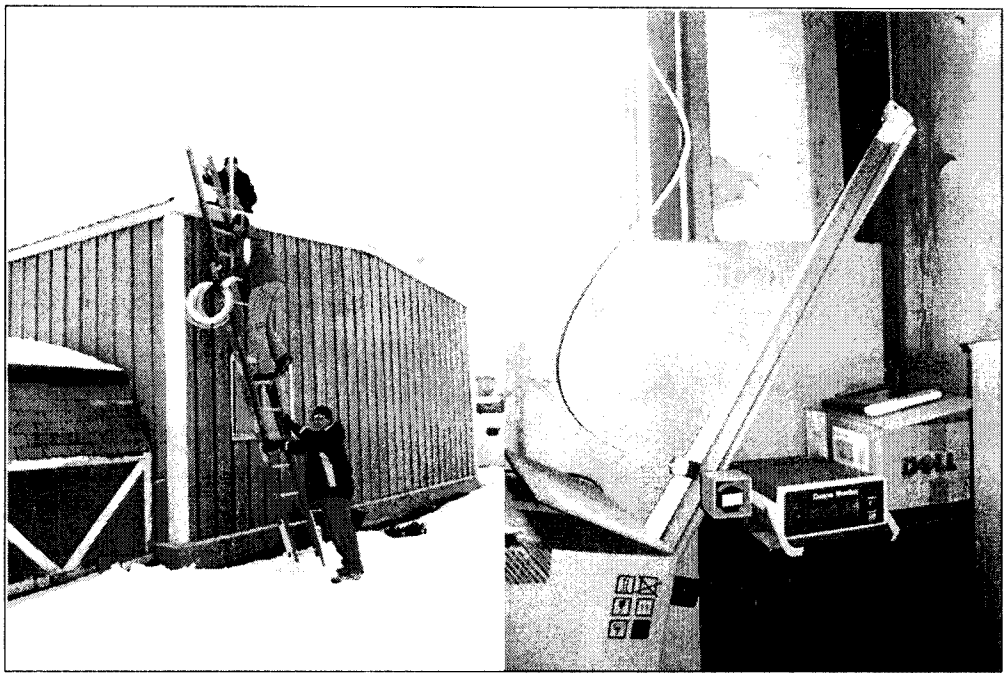

Figure 3-1. Installation of the sample line and 2B Ozone Monitor at the Roosevelt location.

A concern at some sites during this study was maintaining the temperature of the instruments within the manufacture-stated operating range of 0 to 50 °C while ambient temperatures dropped to less than -30 °C. Effective site-specific solutions were developed in each case. Temperature was also recorded at each site with HOBO temperature dataloggers (Onset Computer Corporation, Pocasset, MA) set to 5-min averaging periods.

Instrument locations were visited every two weeks to download data, perform a precision, zero and span (PZS) check, and, if necessary, recalibrate the ozone monitor. PZS checks were performed at 0, 90, and 200 ppb ozone levels during January, then changed to 0, 90, and 140 during February and March. The change was initiated in order to bring the highest PZS and calibration check level more in line with expected maximum ozone concentrations. Following manufacturer's recommendations, an instrument did not pass the PZS check if it reported a mean deviation (n = 10) of more than 7% at any level greater than zero or a mean absolute value greater than 5 ppb at the zero check. Calibrations were performed at five points linearly spaced between 0 and 200 for January, and 0 and 140 for February and March. The ozone calibration sources were Model 306 Ozone Calibration Source systems from 2B Technologies, which were calibrated against the UDAQ in-house standard ozone calibration instrument. These PZS check and calibration procedures are used by the UDAQ for their portable monitors and are modeled after manufacturer recommendations (2B Technology, 2010).

Monitor servicing and calibration at sites operated by external organizations were not under the direction of the USU/EDL team and were assumed to meet similar standards of quality control. In addition to ozone, meteorological parameters were recorded at most sites operated by external organizations. The Dinosaur National Monument, Fruitland, Ouray, Red Wash, and Rangely locations recorded hourly averaged wind speed, wind direction, temperature, relative humidity, and pressure. The Ouray and Red Wash sites also measured incoming solar radiation, vertical wind speed, and aspirated temperature at two heights (2 m and 10 m). The vertically spaced temperature measurements typically are used to examine vertical temperature profiles and estimate atmospheric stability.

3.2 DATA MAPPING ANALYSIS

Geospatial analyses and map production were performed using ArcMAP 10 (ESRI, Redlands, CA). Geographic Information System (GIS) data utilized in these operations were downloaded from the following sources: Utah GIS Portal, BLM Colorado, BLM Wyoming, Colorado Department of Transportation, Colorado Oil and Gas Conservation Commission, Colorado's Decision Support System, Idaho Department of Water Resources, and U.S. Geologic Survey National Elevation Dataset. The GIS data sources are shown below.

3.3 GIS DATA SOURCES

BLM Colorado. Available: http://www.blm.gov/co/st/en/BLM_Programs/geographical_sciences/gis.html. Last accessed: April 28, 2011.

BLM Wyoming. Available: http://www.blm.gov/wy/st/en/resources/public_room/gis/datagis.html. Last accessed: April 27, 2011.

Colorado Department of Transportation. Available: http://www.coloradodot.info/. Last accessed: April 27, 2011.

Colorado Oil and Gas Conservation Commission. Available: http://cogcc.state.co.us/. Accessed: March 24, 2011.

Colorado's Decision Support System. Available: http://cdss.state.co.us/DNN/default.aspx. Accessed: March 24, 2011.

Idaho Department of Water Resources. Available: http://www.idwr.idaho.gov/GeographicInfo/GISdata/gis_data.htm. Accessed: April 28, 2011.

U.S. Geologic Survey National Elevation Dataset. Available: http://ned.usgs.gov. Accessed: March 22, 2011. Last modified: August 2006.

Utah GIS Portal. 2011. Available: http://agrc.its.state.ut.us/. Last accessed: April 27, 2011. Last updated: April 9, 2011.

Ozone concentration distributions throughout the Basin were examined through interpolation of hourly averaged measured values for visualization. Interpolated surfaces from hourly averaged measurements were estimated using the Kriging interpolation tool in ArcMAP. The following default options were used in the interpolation: the ordinary Kriging method, a spherical semivariogram model, and a variable search radius to include 12 data points in the interpolation process. The quality of the fit of the interpolated surfaces to corresponding measured values was evaluated for a randomly selected 10% of analyzed hourly surfaces (n=17) and quantified using the root mean square error (RMSE). The calculated RMSEs ranged from 0.07 ppb to 16.4 ppb, with the values for the first, second, and third quartiles being 0.14 ppb, 1.2 ppb, and 5.8 ppb, respectively. Most RMSEs were within the error of the ozone instruments while high RMSEs (>7 ppb) were found for hours with low mean ozone concentrations (<60 ppb averaged across all sites). These results show the interpolated surfaces fit the data well, except during some hours with low spatially-averaged concentrations.

3.4 OXIDES OF NITROGEN (NO_X)

Ambient NO_X was measured by the USU/EDL team at the Vernal location only, pulling a sample directly from a teed branch of the same tube used to collect the ozone sample. The data were collected from the start of the intensive period (February 21, 2011) through the overall end of the Uinta Basin study (March 11, 2011). The instrument used was a USU-owned Thermo Environmental Model 42 Chemiluminescence NO_X analyzer, which uses a molybdenum converter of NO_2 reduction. The instrument was calibrated prior to deployment using certified calibration gas-phase NO standard with dilution provided by commercially purchased zero air. As with the 2B ozone monitors, the NO_X data collection was set for 5-minute averages and the data were post-processed into hourly averaged values. Additional ambient NO_X data, collected using similar analytical techniques and protocols, were also obtained from Golder Associates for the Red Wash and Ouray locations.

3.5 HYDROCARBONS (VOLATILE ORGANIC COMPOUNDS – VOCS)

Two paired VOC tubes were collected nominally at 7:00 and 15:00 at each of the two main field sites, additional paired samples were also collected at other periods throughout the daylight hours, as time allowed. Each of the paired tubes sampled approximately 1 liter (L) of ambient air. The flow rates through each of the tubes were determined at the start and end of each sample period with a calibrated mass flow meter (Red Wash) or rotameter (Vernal). The purpose of the paired tube collections was to allow dual GC/MS analysis at UWRL: one tube for light hydrocarbon (C2-C6) analysis and one tube for heavy hydrocarbon (C6-C10) analysis. Additionally, field blanks and laboratory-spiked transport samples were obtained.

A modified EPA TO-15 and TO-17 approach was selected to meet the VOC data requirement. In general, this modified method consisted of sample collection on Supelco Air Toxics 3-phase Sorbent Tubes, desorption of analytes onto a capillary gas chromatographic columns, followed by separation, identification and quantification of analytes based on retention time and presence of quantification ions. The following modifications were used:

1. TO-15 protocols suggest an internal standard be used for calibration and quantification; in this study, an external calibration curve was used.
2. BFB spectral check was not performed; however, the PFTBA spectrum was examined prior to analysis to ensure the m/z 69, 131, 219 and 505.2 ion ratios were normal.
3. TO-15 recommends the collection of pairs of samples at each point to compare results at a high and low flow rate to ensure sufficient sample collection. In this study, only one sample per carbon range (C2-C6 and C6-C12) per site, at the lower recommended flow rate, was collected.

The specific thermal desorption GC/MS system setup used for this project is described below. The generic TO-15 GC method assumes cryogenic capability for the GC oven. Since UWRL does not have that capability, it was necessary to run the method in two ways, each using a different column, to capture the desired C2-C12 analyte list. The methods are designated herein as the Light Hydrocarbon (LHC) and Heavy Hydrocarbon (HHC) methods. The fundamental difference in these methods was the analytical column used. The LHC method was used to quantitate analytes from ethane to benzene in volatility; while the HHC method captured analytes from n-hexane to n-dodecane. The specific GC configurations for the LHC and HHC analyses are described below.

3.6 THERMAL DESORPTION UNIT: PERKIN ELMER TURBOMATRIX ATD THERMAL DESORBER

- Sorbent Sample Tubes: Carbotrap 300, Supelco pn: 25085
- Secondary cryofocussing trap: Perkin Elmer Air Toxics Trap for Turbomatrix, PE pn: M0413628
- Dry gas purge time: 5 min
- Dry gas purge temperature: 25 C
- Tube desorb temperature: 300 C
- Primary desorb time: 20 min
- Secondary trap cryofocussing temperature: -40 C
- Secondary trap desorb temperature: 300 C
- Cryotrap ballistic heating rate: 40 C/s
- Injection mode:
  - LHC method: split, 10:1
  - HHC method: splitless

3.7 GC/MS SYSTEM CONFIGURATION: LHC METHOD

- Instrument: Agilent 6890 GC/5973 MS
- Column: Thermo Scientific TG-Bond Alumina Na2SO4 PLOT. 50m x 0.32 mm x 1 µm phase. Thermo pn: 26001-6050

- Carrier gas: helium, 12 psi constant head pressure.
- GC Oven parameters: 105°C for 5 min, ramp to 140°C @15°C/min, hold 6 min, ramp to 160°C @ 15°C/min, hold 5 minutes, ramp to 200°C at 20°C/min, hold 40 min.
- Mass Spectrometer: SIM mode, 2-6 ions per analyte, 80-100 ms dwell per ion.

The analysis of the lighter fraction of compounds on the Alumina PLOT column yielded baseline resolution of analytes in most cases. Using a split injection increased peak sharpness and aided in this separation. Because of the increased possibility of non-target analyte interference in SIM mode for hydrocarbons in the C6 to C12 range, the LHC method was run in Scan Mode to obtain definitive mass spectra. With the exception of using a splitless injection, the desorber parameters were the same.

3.8 GC/MS SYSTEM CONFIGURATION: HHC METHOD

- Instrument: Agilent 6890 GC/5973 MS
- Column: Restek Rxi-5ms, 60m x 0.25 mm x 1 μm phase. Restek pn: 13456
- Carrier gas: helium, 17 psi constant head pressure.
- GC Oven parameters: 40°C for 3 min, ramp to 260°C @8°C/min, hold 10 min
- Mass Spectrometer: Scan mode, scanning 35-260 amu, 3.25 scans/sec

All data processing was done on either Enhanced Chemstation G1701DA v. D.00.01.27 or MSD Chemstation version E.02.00.493.

A set of trip QC samples were prepared. These samples consisted of two 10 ppbv 0.5 L volume samples, two 100 ppbv 0.5 L samples, and two trip blanks. The 10 ppbv trip QC samples were prepared by adding 5 mL of a certified 1000 ppbv Ozone Precursor standard (Fisher part number 06-802-385) to 495 mL of air in a 1.0 L tedlar bag. This bag was then mixed, attached to a clean Carbopack sampling tube, and drawn through the tube at approximately 15 mL/minute until empty. The 100 ppbv samples were prepared similarly, with the exception that 50 mL of standard was added to 450 mL air.

The trip blanks, blank sample tubes and calibration standard tubes were prepared by conditioning the tubes at 300°C for 30 minutes, and then capping them hand-tight with brass Swagelok caps. Teflon ferrules were used in the caps.

The initial calibration curves for each analysis were prepared using standard concentrations of 2, 10, 20 and 55 ppbv per analyte. The samples were made up in 1 L total volumes, in tedlar bags, as described above. The lab temperature and time was recorded. The ambient pressure was later recovered from meteorological station data. Each calibration standard was then loaded on a blank carbopack tube using an SKC personal sampling pump with a flow restrictor, so that the measured loading rates varied from 15 to 18 mL/minute, nominally the same flow rate as the field samples. The flow rates were checked at the beginning and end of loading using an Alltech Digital Flow Check mass flow meter.

Despite its slow reactivity with most atmospheric oxidants and though it is not generally considered a significant contributor to tropospheric photochemistry, methane (CH_4) was collected at each field location by whole vial collection and analyzed at the UWRL via gas chromatography . When present in high enough concentrations, methane has been shown to be a significant player in ozone formation (e.g., Wyoming's Pinedale region). The CH_4 vials were

collected at the start and end of each sorption tube collection period and intermittently throughout the daily periods. Fig. 3-2 shows collection of a CH_4 vial at the roof top Vernal site. Furthermore, the ice chest in the lower left portion of fig. 3-2 houses the paired VOC sorption tubes.

Figure 3-2. Hand-held methane (CH_4) vial collection and paired VOC sorption tube collection (red ice chest) at the Vernal, Highway 40 sampling location.

3.9 PARTICULATE MATTER LESS THAN 2.5 µm ($PM_{2.5}$)

During the weeklong intensive study period at both the Vernal and Red Wash locations, five (5) collocated $PM_{2.5}$ samples were collected using AirMetrics MiniVol portable particulate samplers. The samplers nominally operated for 23 hours each, from 12:30 (pm) to 11:30 (am), leaving an hour to exchange filters between sample periods. The samplers operate at an average flow rate of 5 Lpm, provide particle fractionation via a specifically designed impactor/plate system, and collect the particulate matter on a 47 mm filter. Prior to the field test, each system's flow monitoring rotameter was calibrated using a certified transfer standard (orifice) and adjusted in the field to maintain the required flow rate at actual conditions. Fig. 3-3 shows the collocated $PM_{2.5}$ MiniVol on the roof of the former USU building, Vernal (Highway 40) location.

Figure 3-3. USU graduate student Wendy Merkley recovering flow data from the MiniVol $PM_{2.5}$ samplers at the Vernal, Highway 40 sampling location.

Through its Interagency Monitoring of Protected Visual Environments (IMPROVE) studies, the National Park Service has demonstrated that most fine particulate matter can be shown to be composed primarily of crustal (elemental) species, organic carbon, elemental carbon (black carbon or soot), ammonium sulfate, and ammonium nitrate (IMPROVE, 2011). Chemical speciation of the collected particulate matter is briefly described below.

Three MiniVol samplers were outfitted with pre-conditioned and pre-weighed 47 mm Teflon (TFE) membrane filters for gravimetric (total mass), ionic (soluble compounds), X-ray fluorescence (elemental composition) and Raman spectroscopic analysis (carbon and other chemical functional groups); one 47 mm pre-washed nylon filter as a duplicate method for examination of potential ionic particulate evaporation (especially nitrate); and one pre-conditioned 47 mm quartz filter for organic and elemental carbon analysis. The TFE filters were pre- and post-conditioned by storage at room temperature in a silica-gel desiccator for a minimum of 24 hours before weighing the filters on successive days until a consistency of ±2.5 µg was obtained on three consecutive weights. $PM_{2.5}$ concentrations were then determined by dividing the observed mass caught by the measured sample volume, with daily concentration at any particular site calculated as the average of the three TFE-filter based MiniVol samplers. Owing to post-test analytical requirements, no weights were determined for the collocated nylon and quartz filters; rather, it was assumed that their total captured mass would be similar to the mass captured with the TFE filter.

Ion chromatography (IC) analysis was used to quantify the soluble ionic species composition on the collected particulate matter. The analyses were performed at UWRL following standard protocols briefly described herein. All de-ionized water used in preparation, extraction, and IC analysis was purified using a Barnstead Nanopure Infinity water purification system and was

purified to 18.3 ΩM-cm resistance then filtered through a 0.2 μm-membrane filter. Prior to sample collection, nylon filters were rinsed three times in de-ionized water and allowed to air dry. For the extraction process, the collected Teflon and nylon filters were soaked in triplicate in 10 mL of de-ionized water, while being sonicated for 10 minutes. Following each individual extraction, the samples were combined for a total volume of 30 mL. Immediately following the final extraction, 15 mL were removed and spiked with 10 μl of 0.5 M HCl to fix the ammonium (NH_4^+), thus preventing it from evaporating as the gas-phase ammonia (NH_3) form. The remaining 15 mL was left untreated for anion analysis. Samples were stored in a refrigerator at ≤4°C until final IC analysis, which was within two to three weeks of original collection.

In order to remove any insoluble particulate matter, samples were filtered through a 0.2 μm nylon 13 mm Fisher syringe filter prior to being loaded on the IC for analysis. A Dionex ICS 3000 IC system (Dionex, Sunnyvale, CA) was used to determine cation and anion concentrations. The IC system consisted of a dual pump (DP1), eluent generator (EG2) and detector chromatography module (DC2). CSRS 300 4mm and ASRS 300 4mm suppressors were used as well as AS-11 HC and CS12A columns for the respective ionic species. A CRD 200 4mm carbonate removal device was used for the anion analysis. Anions were analyzed using 30 mM potassium hydroxide eluent produced in the eluent generator. Cations were analyzed using 0.3 N sulfuric acid eluent separately prepared in the laboratory, which was diluted to 10% by the IC pump, for a final concentration of 0.03 N sulfuric acid. A 283 μl sample loop was used for anions and cations. Chromeleon version 6.8 SR6 software was used to process the data.

Stock standards of 1000 mg/L were prepared using ACS reagent grade salts. Anion calibrations included fluoride, chloride, nitrate, nitrite, and sulfate with dilutions of 5, 2, 1, 0.5, 0.2 and 0.1 mg/L. A linear fit was used for chloride and nitrate calibrations, while a quadratic fit was used for the other anions. Cation calibrations included sodium, ammonium, potassium, magnesium and calcium with dilutions of 5, 2, 1, 0.5, 0.2 and 0.1 mg/L, except ammonium, magnesium and calcium which achieved a better fit with dilutions of 2, 1, 0.5, 0.2 and 0.1 mg/L. Ammonium, magnesium and calcium calibrations used a quadratic fit; while sodium and potassium used a linear fit. De-ionized water and quality control samples were checked prior to any analysis and rechecked approximately every ten samples. Field blanks of both filter types were collected and analyzed, as well as duplicate lab blanks, in both cases filters were treated as samples. Duplicate analyses were performed on no less than 10% of the samples.

One TFE filter from each run was analyzed for $PM_{2.5}$-bound elemental composition via X-ray fluorescence (XRF) as determined through a commercial laboratory (CHESTER LabNet, Tigard, OR) following EPA IO-3.3. Target elements included Na, Mg, Al, Si, P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Ge, As, Se, Br, Rb, Sr, Y, Zr, Mo, Pd, Ag, Cd, In, Sn, Sb, Ba, La, Hg, and Pb. It should be noted here that most of the target elements were observed, but not at levels statistically above the reported limits of detection. Only the most significant elements will be included in subsequent discussions.

Organic carbon (OC) and elemental carbon (EC) $PM_{2.5}$ content were similarly determined through the use of a commercial laboratory (Sunset Laboratory, Tigard, OR). Pre-conditioned 47 mm quartz filters were obtained from the vendor and stored refrigerated until used in the field. After exposure, the filters, along with unused blank filters, were returned to Sunset Laboratory for carbon determination. The protocol is more fully described by Birch and Cary (1996), but briefly the filter is exposed to an oxygen-free, helium atmosphere and heated through a stepped series to approximately 700°C which vaporizes any organic carbon. The gas-phase carbon is

transferred to an oxidizer oven where it is converted to carbon dioxide, followed by methanization, and quantified via flame ionization detection (FID). To account for non-carbon components of the organic compounds' mass, the OC concentrations reported were increased by the recommended multiplier of 1.7 (Malm and Hand, 2007). The remaining filter sample is then further heated to 850°C, vaporizing the remaining elemental carbon and quantifying the EC concentrations following the same procedure as the OC concentrations.

3.10 GROUND LEVEL METEOROLOGY

Ground level meteorology data were not directly collected at any of the monitoring locations by the USU/EDL sampling team. Any presented meteorology data were collected by external parties already mentioned (NPS, BLM, Golder Associates, etc.) and other resources, as available (e.g., MesoWest).

3.11 VERTICAL METEOROLOGY

Vertical profiling of meteorological parameters was carried out during daylight hours at the Red Wash and Jensen sites from about noon on February 21, 2011 until sunset on February 24, 2011. Ideally, closer proximity to the Vernal site would have been preferred; however, Federal Aviation Administration (FAA) requirements prohibited operating a tethered balloon within five miles (8 km) from the local airport. The nearby Jensen location, therefore, was used as a spatially and geographically similar surrogate. Measurements at both sites were accomplished using a tethered balloon carrying a meteorological tethersonde or on-board data collection package. Fig. 3-4 shows the tethersondes as deployed at the Jensen and Red Wash sites, respectively.

Figure 3-4. Meteorological tethersonde operations at Jensen (left) and Red Wash (right).

The instruments employed at the Red Wash site were the SmartTether Flight Module and the SmartTether Ground Station, both from Anasphere, Inc. The Flight Module relayed

instantaneous measurements of temperature, relative humidity, pressure, wind speed, and wind direction every three seconds to the Ground Station, which was connected to a computer running SmartTether, Ver. 3.1.1 communications and datalogging software provided with the tethersonde system. The meteorological package was suspended about 3 m below the balloon on the string attaching the balloon to the electronic winch and was free to spin about the string.

Ascent and descent of the balloon were manually controlled, with a standard initial height above ground level (agl) of the package set at 2.0 m. Final heights of the package, determined by the lifting capacity of the balloon, were between 250 and 350 m agl. The descent was usually initiated within three minutes once the maximum height was reached to reduce the time between the start of the ascent and end of the descent. A total time for the ascent and descent of 20-30 minutes was targeted. Vertical profile meteorological characterization was performed throughout the day, with special focus on the following time periods: shortly after sunrise, around sunset, at midday, and at mid-afternoon. Calibrations of the electronic compass in the Flight Module to true north were performed on February 22, 23, and 24, 2011. In addition, calibration checks were performed with the differences between reported and actual direction recorded for correction in post-processing.

Measurements collected at the Jensen site were made on the same days as those at the Red Wash site and during daylight hours only. Data collection at Jensen varied from that at Red Wash, however, since vertical soundings were generally made once every hour, with the total time for a descent and ascent being less than 20 minutes. The maximum height above ground level (agl), as measured by a handheld commercial laser range finder, was 290 m and a standard minimum height of 2.0 m was maintained.

Winds at the various elevations were monitored at the Jensen site using a custom wind speed and wind direction measurement system developed at EDL. This custom unit measures wind speed using a #40C cup anemometer from NRG (accuracy ±0.1 m/s, threshold speed 0.78 m/s) and wind direction by 3-axis electronic compass from Honeywell. Unfortunately, the wind direction sensor was not operating correctly and did not produce usable data. Wind data were transmitted wirelessly to a receiver at the ground and logged by a computer. In addition, a small pressure, temperature, and relative humidity sensor, model PRHTemp 101, from MadgeTech (Contoocook, NH) was attached underneath the custom wind measurement system in a small opaque enclosure with several perforations to allow for passive air exchange to separately characterize vertical profiles for temperature, pressure, and relative humidity. The PRHTemp 101 logged three-second averaged data throughout the day, and the data were downloaded each night. Due to abnormally high readings on February 22 and 23, 2011 of nearly 20°C, well above the actual ground conditions (<5°C), a radiation shield made of aluminum foil was placed around the enclosure for the February 24, 2011 sample times.

The recorded temperatures for February 24, 2011 were much lower throughout the day than for the previous days. Significant lag times found between changes in pressure and temperature on each day, however, suggest that the enclosure was not adequately ventilated by the passive air exchange, particularly during ascents, and likely did not represent actual temperature and relative humidity conditions during vertical movement. As a result, the data for these two parameters collected by the PRHTemp 101 did not pass QA/QC and were not used in any subsequent analysis.

The elevation of the tethersonde packages were calculated based on their pressure measurements. Heights agl at the Red Wash site were calculated using the integrated hydrostatic equation that relates changes in pressure to changes in elevation, (Cooper and Alley, 2005). The modified equation is

$$z = z_0 - \frac{R_d T_v}{g} \ln\left(\frac{P_z}{P_0}\right) \qquad \text{(Eq. 3-1)}$$

where z is the height of the tethersonde package in m, z_0 is the reference height (2.0 m), P_0 is the pressure in Pascals at z_0, P_z is the pressure measured at height z in Pa, g is the gravity constant of 9.81 m/s^2, R_d is the specific gas constant for dry air in J/kg-K, and T_v is virtual temperature in K. The virtual temperature of a moist parcel of air (i.e., with water vapor) is the temperature at which a theoretical parcel of dry air would have the same pressure and density as the moist parcel of air and is approximated using Eq. 3-2.

$$T_v \approx T_a(1 + 0.61q) \qquad \text{(Eq. 3-2)}$$

where T_a is the ambient temperature in K, and q is specific humidity in dimensionless units of kg of water vapor per kg of moist air. Specific humidity is related to saturation specific humidity (q_s) and relative humidity (RH) through Eq. 3-3.

$$q = q_s\left(\frac{RH}{100}\right) \qquad \text{(Eq. 3-3)}$$

Saturation specific humidity (q_s) is the maximum amount of water vapor that can exist at the current air temperature and occurs at RH = 100%.

The elevations for the measurements at the Jensen site were not calculated in this manner due to the problems with the temperature measurements. The relative pressure differences recorded between the z_0 and maximum heights were assumed, nevertheless, to be valid due to the faster response time and the holes within the instrument housing which permitted pressure equilibration between the enclosure and the ambient air. Instead, the pressure differences were used in combination with recorded maximum heights measured by the laser range finder. Assuming that the pressure change over the <300 m distance was linear, a relationship between the maximum elevation and the lowest measured pressure for each vertical profile was calculated and used to estimate the measurement height.

The height of the first boundary layer above the ground, referred to as the depth of the surface layer, was estimated through examination of graphs of the vertical profiles of temperature, potential temperature, dewpoint temperature, wind speed, and wind direction. Potential temperature represents the theoretical temperature of a parcel of air after being brought to a standard pressure adiabatically (i.e., without transferring heat or energy to/from the surrounding air) and is calculated for each measured height z according to Eq. 3-4.

$$\theta_z = T_z \left(\frac{1000}{P_z} \right)^{0.286}$$

(Eq. 3-4)

where T_z is the ambient temperature in K, P_z is the pressure in mb, the standard pressure is 1000 mb, and the units of θ are K. Calculating the potential temperature along a vertical profile allows comparison of air at all heights and is very useful in locating boundaries between different layers in the atmosphere. Dewpoint temperature is the temperature at which the air reaches water vapor saturation based on the amount of water vapor measured in the air. An example vertical profile from the Red Wash location is shown in Fig. 3-5 and shows actual ambient temperature, potential temperature, and dewpoint temperature in the same graph, with a dashed line marking the depth of the surface layer.

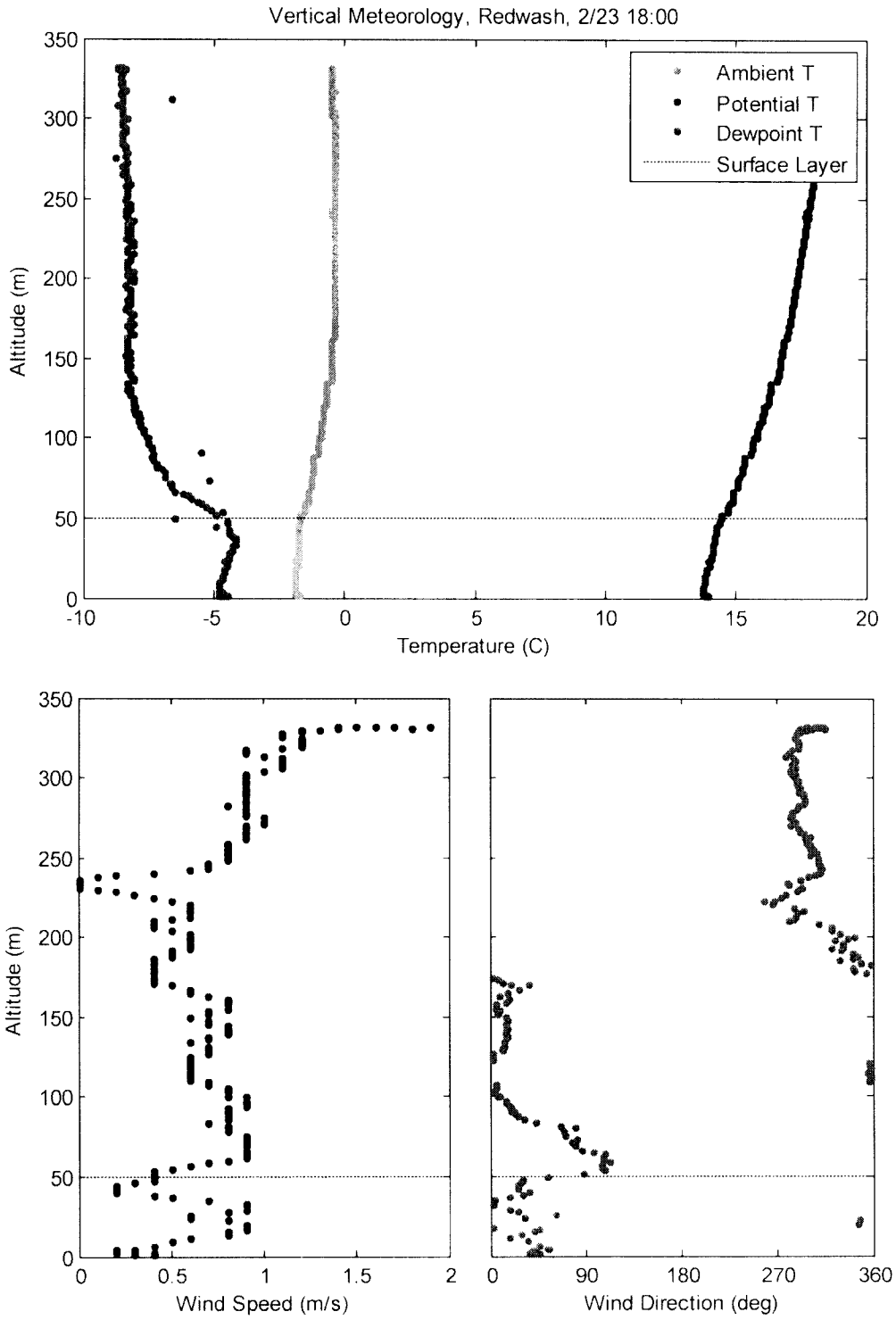

Figure 3-5. An example of vertical meteorology observed at the Red Wash site on Feb. 23, 2011, with a dashed line showing the approximate depth of the surface layer.

3.12 VERTICAL OZONE PROFILES

In order to measure vertical ozone profiles, a 2B Technologies Model 202 (single channel) Ozone Monitor was modified and used in conjunction with the previously discussed tethered balloon system. To use the 2B monitor for the purpose of collecting vertical ozone profiles, it was necessary to reduce the weight as much as possible. The monitor is originally built around a heavy aluminum plate and encased in an aluminum housing. To reduce weight, the housing was removed and the components of the monitor were remounted to a 6x9 inch copper/epoxy circuit board.

During balloon operation, a Thunder Power RC Li-Polymer 2100mAh 4S 14.8V 20C battery was used to supply power to the monitor. Due to the cold conditions of the winter time atmosphere, the battery was wrapped in a single layer of small bubble wrap and kept warm during flights by attaching a HotHandS HeatMax hand warmer to the outside of that bubble wrap. The entire unit was then encased in a single layer of small bubble wrap, followed by a double layer of large bubble wrap, a single layer of foam wrap and, finally, a layer of emergency blanket foil material. In order to protect the internal tubing and absorption cell from potential contamination due to particulate matter, a 2B technologies 2-mm PTFE particle filter in a PVDF 25-mm filter housing was attached to the inlet. External housing components were removed, and the Teflon tape was used to seal the housing. A 10-inch long, ¼-inch diameter sampling tube ran from the filter housing as the monitor inlet. All connectors and tubing were Teflon.

Prior to sampling, the monitor was allowed to warm up for thirty minutes on AC line power. After the initial warm up period, the monitor was quickly switched to battery power, the digital faceplate was removed, and the monitor was given a few minutes to equilibrate. Data averaging was set to 10-second intervals. The modified monitor and the in-field system can be seen in Fig. 3-6.

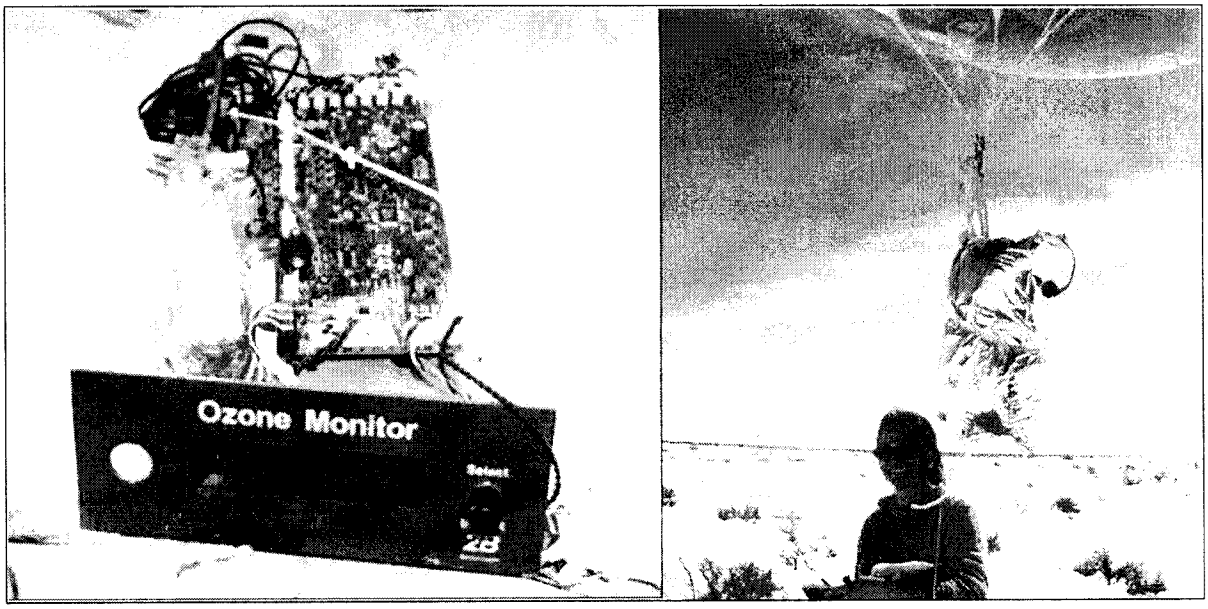

Figure 3-6. Modified 2B Technologies Model 202 ozone monitor remounted to circuit board and deployment at the Red Wash location.

Prior to field use, the ozone monitor was calibrated at the UWRL using a Thermo Environmental Instruments 49 C Ozone Calibrator. Ten data points were collected and averaged for a calibration curve of 0, 10, 20, 35, 40, 50, 70, 105, 120, and 140 ppb. The internal instrument offset (Z) and slope (S) were then adjusted as per manufacturer's protocol.

Vertical lift was achieved using an A.I.R. Inc. (Atmospheric Research Company) blimp-shaped, three cubic meter balloon, which was tethered to a TS-2AW A.I.R., Inc. electric winch. In order to assess mixing conditions, a HOBO temperature sensor was attached to the outside of the ozone monitor and sheltered from direct sunlight and set to collect data on three second intervals. During operation, the balloon was brought to the highest achievable point (determined using a range finder and estimated angle). That point was divided into nine segments, and the monitor was lowered to each target elevation, where it remained stationary for one and a half to two minutes. Time span, elevation and estimated elevation angle were recorded for each segment. Elevation for data points between stationary segments was then estimated using a linear relationship

4. RESULTS AND DISCUSSION

4.1 BASIN-WIDE OZONE

The main goal of this initial study was to identify the spatial extent and severity of the wintertime ground level ozone concentrations in the Uinta Basin. The compiled, summarized data will be presented first, with individual site-specific ozone profiles presented in subsequent sections. The compiled, hourly averaged ozone concentrations for all of the available sites can be obtained as described in the Appendix. Currently, ambient ozone is regulated on a running eight hour (8-hr) average value. In other words, the consecutive 8-hr period throughout a midnight-to-midnight day with the highest average value is deemed to represent the regulatory value for that given day. As of this writing, the U.S. 8-hr NAAQS for ozone is set at 75 ppb. Furthermore, the U.S. Code of Federal Regulations specifies that yearly ozone exceedance will be based on the fourth highest 8-hr value rather than on the highest recorded 8-hr value. This designation allows for theoretically anomalously high concentrations to be discounted. Finally, an area's official regulatory or "design" value actually is determined as the average fourth highest 8-hr values from three (3) consecutive years. It should also be noted, that the U.S. EPA gave official notice in December 2010 that owing to continually evolving health-based evidence, the 75 ppb standard would be revisited by mid-July of 2011, and the ozone NAAQS is expected to be lowered to between 60 and 70 ppb. As a point of comparison, prior to a 1997 NAAQS revision, ozone was regulated in the U.S. as a 1-hr standard at a maximum allowable concentration level of 120 ppb.

Ground level ambient concentrations in the Uinta Basin throughout the wintertime 2010-2011 study period seemed to be functions of regional weather patterns (frontal passage vs. stagnant inversion), local site elevation and adjacent topography, and relative proximity to likely ozone precursor sources. As was also previously discussed in the "Ozone Photochemistry" section of this report, the snow-reflected, augmented available solar radiation (insolation) likely is a significant contributor to enhanced winter time ozone formation in the area. Since the entire region was snow covered during the study duration, however, it is not expected to be a contributor to site-to-site ozone differences and will not be discussed further in this regard.

Figures 4-1(a) and 4-1(b) show fitted (kriging interpolation) 1-hr ozone concentration contours for the test region for a "clean" period (15:00 MST, Feb. 10, 2011) and a "dirty" period (15:00, February, Feb. 16, 2011). As can be seen during the clean period, Fig. 4-1(a), the observed afternoon ozone concentrations were uniformly around 50 ppb throughout the Basin. This time period was characterized by unsettled weather following a storm system that came through the area approximately three days earlier. In contrast, after a lengthy, six-day inversion episode, it can be seen from Fig. 4-1(b) that the highest ozone levels formed in a region centered along the Ouray/Pariette Draw locations and extended north to the Cedarview/Lapoint area, east to the Red Wash area, and west to Duchesne. Furthermore, it can be seen that even during this high-ozone period, upper elevation and "fringe" locations such as Fruitland, Altamont, Nine Mile Canyon, Rabbit Mountain, and Rangely (CO) remained essentially at clean or background concentrations.

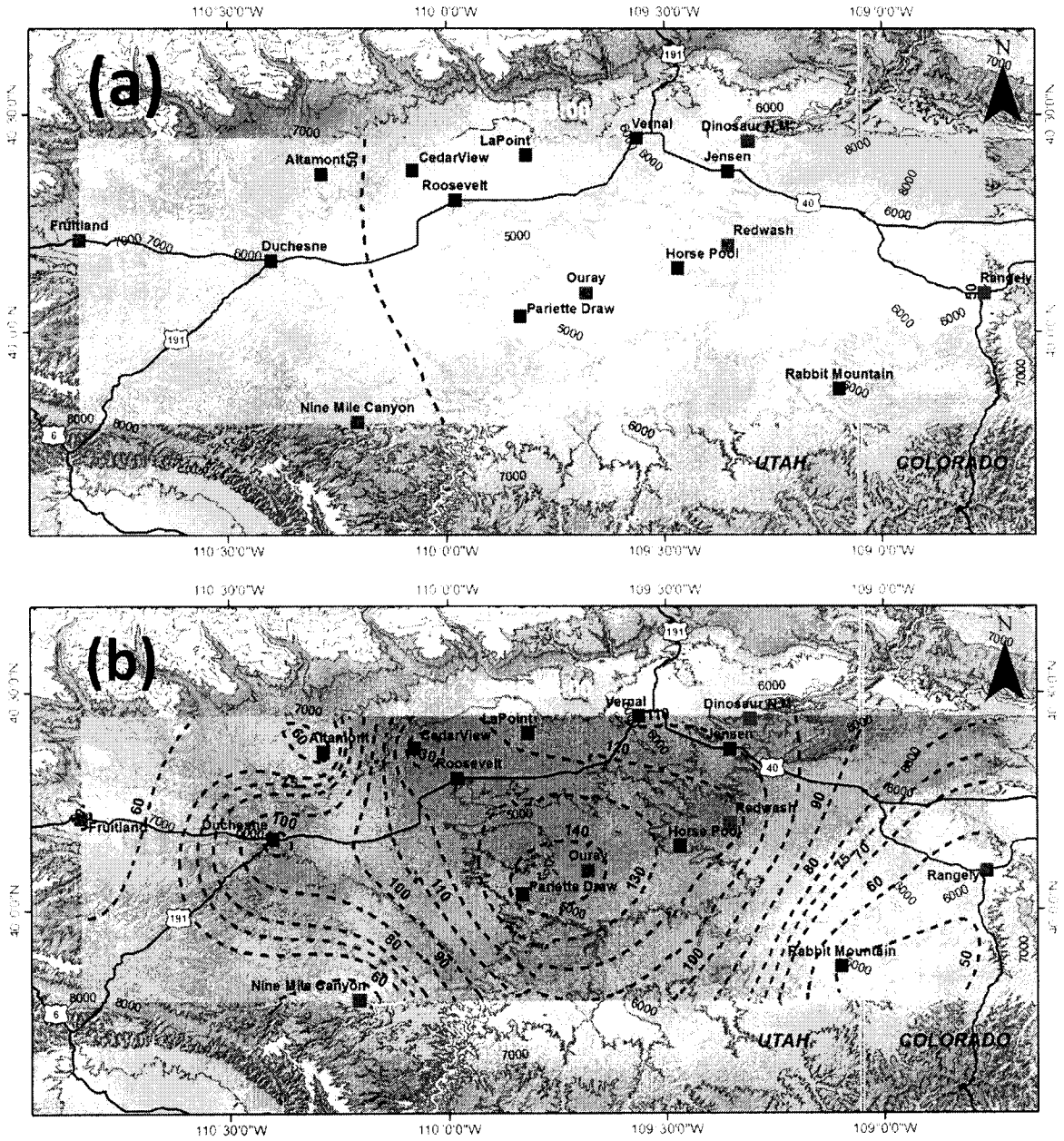

Figure 4-1. Uinta Basin 1-hr ozone concentrations during a clean period (a) 15:00 MST, Feb. 10, 2011 and a "dirty" period (b) 15:00 MST, Feb. 16, 2011. The dotted lines represent 10 ppb contour intervals.

The likely relationship between the abundance of precursor source emissions and the local ozone formation can be further inferred by examination of the ozone spatial concentrations and the suspected source locations. This is shown in Fig. 4-2 by combining the contour map shown in Fig. 4-1(b) and the active well map discussed in the "Ozone Monitor Placement" section.

Fig. 4-2 shows that the regions with the highest observed ozone concentrations tend to follow along the areas of greatest active well density. Furthermore, the fitted contour lines seem to

follow the well densities even in areas where in the sampler spacing was less than ideal (e.g., the area between Pariette Draw, Nine Mile Canyon, and Duchesne).

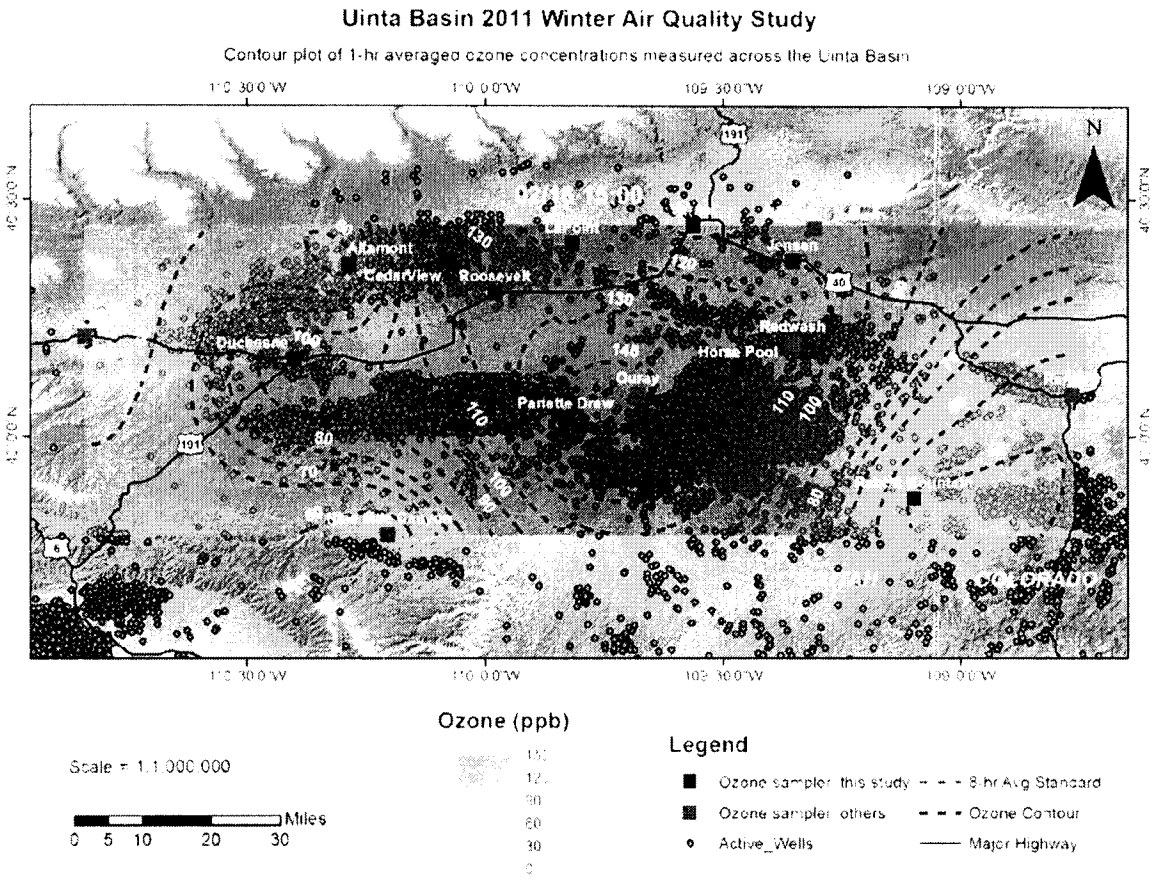

Figure 4-2. Observed 1-hr ozone concentrations within Utah's Uinta Basin (15:00, Feb. 16, 2011) in spatial relation to the region's active oil and gas wells.

Table 4-1 summarizes the available data from the Uinta Basin ozone sampling stations previously discussed. As can be seen, only two sites within the study region, Fruitland and Nine Mile Canyon, showed no exceedances of the 8-hr ozone standard with maximum 8-hr values of 48.6 and 55.6 ppb, respectively. From these data, it can be seen that these locations, at a minimum, represent the outer boundaries of the ozone-impacted areas of the Uinta Basin. Additionally, three other sites, Altamont, Rabbit Mountain, and Rangely (CO), had fewer than four 8-hr exceedances and would not be consider nonattainment with fourth highest 8-hr concentrations of 68.5, 73.4 and 73.4 ppb, respectively, for this winter measurement period. The data from these "fringe" sites suggest that the ozone concentrations observed during the wintertime inversion periods are a function of local topography, meteorology, and ozone precursor abundance rather than any exterior mid- or long-range transport.

Table 4-1. Compiled ozone concentration data from the Uinta Basin 2010–2011 wintertime ozone study.

Site ID	Highest 1-Hr (ppb)	Highest 8-Hr (ppb)	4th Highest 8-Hr (ppb)	# of 8-hr Exceedances
Altamont	91.1	79.8	68.5	1
Cedarview	137.5	122.7	101.0	18
Dinosaur N.M. (NPS)	112.1	106.8	91.0	9
Duchesne	127.0	105.7	81.5	6
Fruitland (UDAQ/BLM)	55.4	48.6	45.9	0
Horse Pool	136.5	129.3	117.1	25
Jensen	110.4	102.2	81.6	9
Lapoint	125.9	118.7	101.3	20
Nine Mile Canyon (BLM)	68.3	55.6	50.2	0
Ouray (Golder)	149.0	139.1	116.4	25
Pariette Draw	144.5	134.6	121.6	19
Rabbit Mountain	102.0	91.5	73.4	3
Rangely, CO (BLM/NPS)	93.6	88.6	73.4	3
Red Wash (Golder)	140.0	125.1	100.6	22
Roosevelt	123.7	116.3	103.6	19
Vernal	107.0	95.1	84.9	7

Table 4.1 also shows that all of the other sites exceeded the 8-hr standard four or more times. The fewest exceedances of these nonattainment sites were observed at Duchesne (six exceedances, fourth highest 8-hr ozone = 81.5 ppb). Two sites, Ouray and Horse Pool, tied with the greatest number of exceedances (25) with fourth highest concentrations of 116.4 and 117.1 ppb, respectively. The Pariette Draw location recorded the highest 8-hr value at 121.6 ppb.

The data tabulated in Table 4.1 are also shown graphically in Fig. 4-3. The contour lines represent an interpolated fit (Kriging method) to the observed number of 8-hr exceedances as a function of the site location; the red line represents the approximate, fitted boundary of the area that could potentially be perceived to be nonattainment relative to the current ozone NAAQS (75 ppb, 8-hr). The shaded region represents a color-graded exceedance scale (the darker the color the more 8-hr exceedances) bounded by the locational coordinates of the observed region. Fig. 4-3 shows that the greatest number of exceedances occurred in the central region of the Basin near Ouray, Horse Pool, and Pariette Draw.

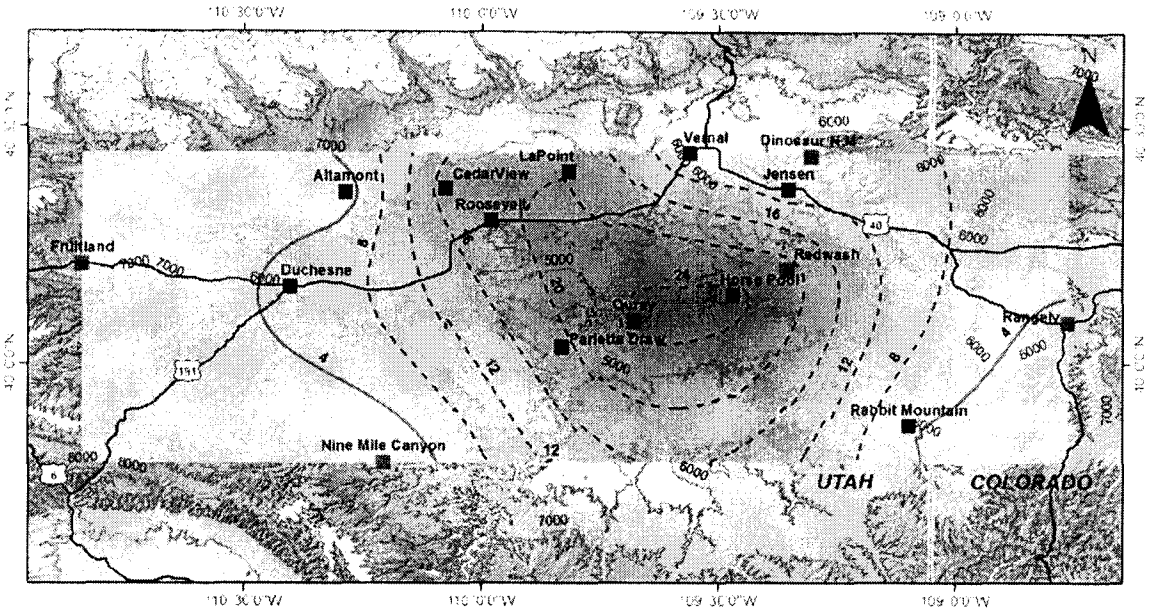

Figure 4-3. An isoplethic representation of the number of 8-hr ozone NAAQS exceedances observed during the 2010-11 winter study period. The red contour line approximately bounds the region observed to be nonattainment based on the fourth highest 8-hr average.

It has been speculated that the Uinta Basin ozone concentrations may also be partially a function of local elevation, with the hypothesis that ozone, or perhaps even the precursor species, tend to concentrate in lower regions due to drainage air flows. In other words, even under the apparent light winds within an inversion event, the air parcels would tend to concentrate ozone and precursor species following the general topography of the region's broad river valleys. This process is often referred to as orographic flow. The potential for this phenomenon is examined in Fig. 4-4. As can be seen, there is a moderate linear relationship (R^2 = 0.7218) between some of the sites and the local elevation, but seven of the locations (Cedarview, Lapoint, Red Wash, Roosevelt, Horse Pool, Pariette Draw, and Ouray) displayed no obvious relationship between elevation and number of exceedances. These sites essentially represent the core of the oil and gas field source areas where the ozone concentration is high enough to exceed the NAAQS regardless of the elevation of this region. Additionally, Fig. 4-4 indicates that the average Basin-wide inversion elevation can be estimated somewhere between 5500 and 6000 ft asl (1676-1829 m agl), and sites located above the inversion do not experience levels of ozone that exceed the NAAQS. The argument could be made that Rangely, CO, and Nine Mile Canyon should also be listed as "out of the Basin inversion area" based on number of exceedances, but these sites may also represent fairly isolated locations on the edge of the Basin's topographical boundaries.

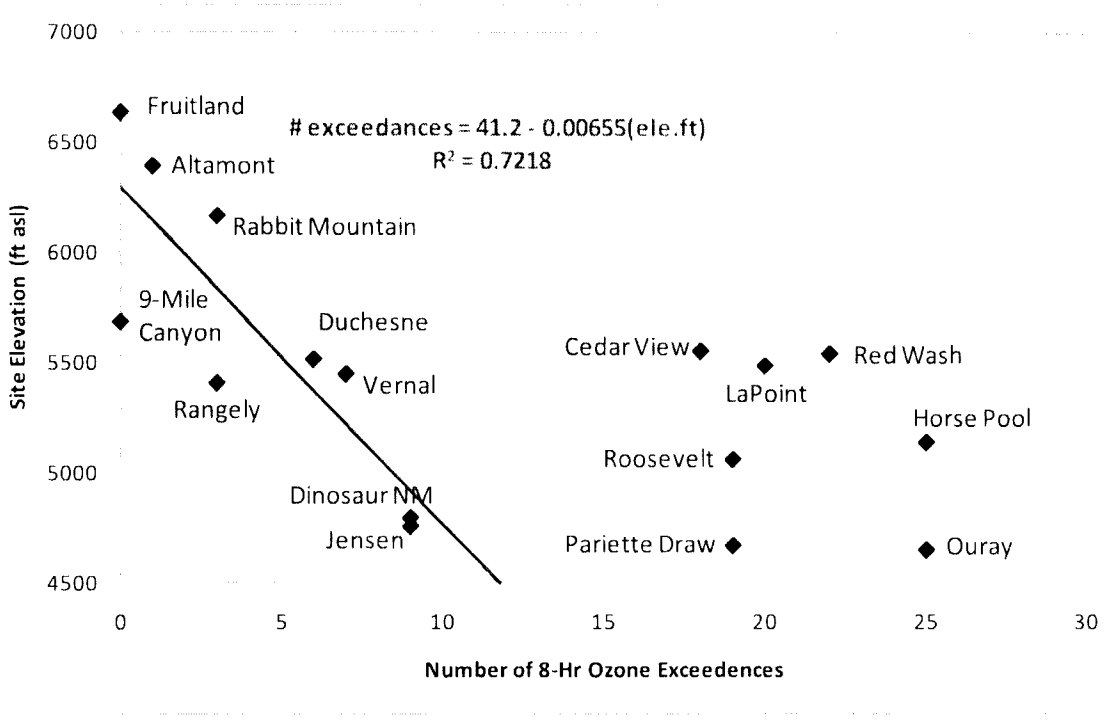

Figure 4-4. Number of 8-hr exceedances at each sampling site as a function of site elevation.

It could also be speculated that the concentration of ozone precursors was related to the proximity of the monitoring site to oil and gas wells. Table 4-2 summarizes available information on the number of wells within 5 km and 10 km radii of each of the sample locations. As can be seen, the monitoring locations with the greatest number of nearby wells also tended to have the highest ozone concentrations (1-hr and 8-hr) and the greatest number of NAAQS exceedances. Curiously, a few of the locations with a significant number of nearby wells (Altamont, Nine Mile Canyon, and Rangely, CO) were shown to have relatively few exceedances. These seeming exceptions may be a function of the previously discussed topographic "fringe" locations or of elevation above the Basin-wide inversion layer (approximately 5500-6000 ft asl).

Table 4-2. Available number of active wells within 5 and 10 km radii of each ozone monitoring site.

Site	# of wells (5 km radius)	# of wells (10 km radius)
Altamont	46	176
Cedarview	62	204
Dinosaur	1	37
Duchesne	26	91
Fruitland	1	8
Horse Pool	397	1083
Jensen	27	90
Lapoint	14	70
Nine-mile	68	152
Ouray	46	412
Pariette Draw	135	492
Rabbit Mtn.	9	75
Rangely, CO	112	295
Red Wash	155	442
Roosevelt	34	109
Vernal	8	55

4.2 SITE SPECIFIC OZONE PROFILES

For each sampling location, the following subsections show the overall winter-long ozone (1-hr average) time series as well as average 1-hr diurnal patterns for two specific time periods: (1) a basin-wide clean, low-ozone period from February 2 through February 6, 2011; and (2) an inversion, high-ozone period from February 10 through February 16, 2011. These specific periods were selected to show the average diurnal behavior for a time period dominated by dynamic meteorology (frontal/storm passages) and a time period typified by a sustained inversion event. The graphs for these time series plots are shown alphabetically in Fig. 4-5 through Fig. 4-36. The error bars included on the diurnal figures represent the 95% confidence intervals about each of the hourly averaged data points. The following discussion is limited to examples of ambient ozone behavior at a few representative sites; however, data from all of the sites collected by the USU/EDL sample team or external partners are included.

Table 4-1 showed that the site with the consistently lowest ambient ozone concentrations was the Fruitland location. The Fruitland ozone concentration time series for the sample period is shown in Fig. 4-13. Throughout the observed period, the ozone measured at the Fruitland sampling site remained relatively low, without significant diurnal changes or inversion-related buildups. This is consistent with sites believed to represent free tropospheric background air masses. This assumption is further supported by the fact that, at the 95% confidence interval, the average diurnal profiles for a "clean" (Feb. 2-6) period and a "dirty" period (Feb. 12-16) were statistically indistinct, as shown in Fig. 4-14. Furthermore, in neither the time series chart nor the average diurnal behaviors graph did the daily ozone concentrations change by more the 20-30 ppb between the daylight and nighttime hours, indicating very little local photochemical ozone formation. The consistently low ozone concentrations at the Fruitland site also suggest that neither ozone nor its precursor species are transported into the Uinta Basin from the Wasatch Front area (i.e., Salt Lake City), which generally lies upwind from the Basin.

The observed Duchesne ozone concentration time series for the winter sample period is shown in Fig. 4-11. In contrast to the Fruitland observations, the recorded ozone concentrations for the same period varied considerably. Unlike the previously described Fruitland time series, the Duchesne data showed obvious diurnal behavior, indicating direct influence of local or regional area ozone formation and destruction reactions, as well as systematic buildup and removal of inversion-driven ozone episodes. The average diurnal profiles for a "clean" (Feb. 2-6) period and a "dirty" period (Feb. 12-16) show (Fig. 4-12) statistically different behavior, particularly during the daylight and early evening hours. During the clean period, as was also observed at the Fruitland location, the day/night differences in ozone concentrations were on the order of 20-30 ppb. During the inverted period, however, the concentrations varied by around 80 ppb throughout the day. Once again, this latter behavior is indicative of significant local/regional photochemical ozone reactions. These concentration levels and diurnal behaviors were also similar to those observed at Dinosaur National Monument (Figures 4-9 and 4-10), Jensen (Figures 4-17 and 4-18), and Vernal (Figures 4-35 and 4-36).

The observed Altamont ozone concentration time series and average diurnal patterns are shown in Figures 4-5 and 4-6, respectively. As can be seen, the behaviors are similar to the Duchesne observations, but generally at lower concentrations and more consistent with those observed at Fruitland. As previously discussed, although near a relatively large number of active wells, the ozone concentrations remained relatively low; however, there were statistically different afternoon/evening hourly values between the low and high ozone periods. The higher, above inversion, elevation of Altamont likely contributed to greater levels of advective (wind-driven) mixing, even during regionally stagnant periods, and, therefore, resulted in lower average ozone concentrations. Similar concentrations and behaviors were also observed at Nine Mile Canyon (Figures 4-21 and 4-22), Rabbit Mountain (Figures 4-27 and 4-28), and Rangely, CO. (Figures 4-29 and 4-30).

As was previously shown in Table 4-1 and Figure 4-1(b), the highest 1-hr and 8-hr ozone concentrations, as well as the greatest number of NAAQS exceedances, were typically observed in a core area centered in the Horse Pool/Ouray/Pariette Draw region. The ozone time series and clean and dirty diurnal behaviors for the Horse Pool site are shown in Figures 4-15 and 4-16, respectively. The ozone time series and diurnal behaviors for Ouray are shown in Figures 4-23 and 4-24, respectively. The ozone time series and diurnal behaviors for the Pariette Draw sampling location are shown in Figures 4-25 and 4-26, respectively. High ozone concentrations and similar differences in diurnal ozone behaviors were noted at Cedarview (Figures 4-7 and 4-8), Lapoint (Figures 4-19 and 4-20), Red Wash (Figures 4-31 and 4-32), and Roosevelt (Figures 4-33 and 4-34).

4.2.1 Altamont

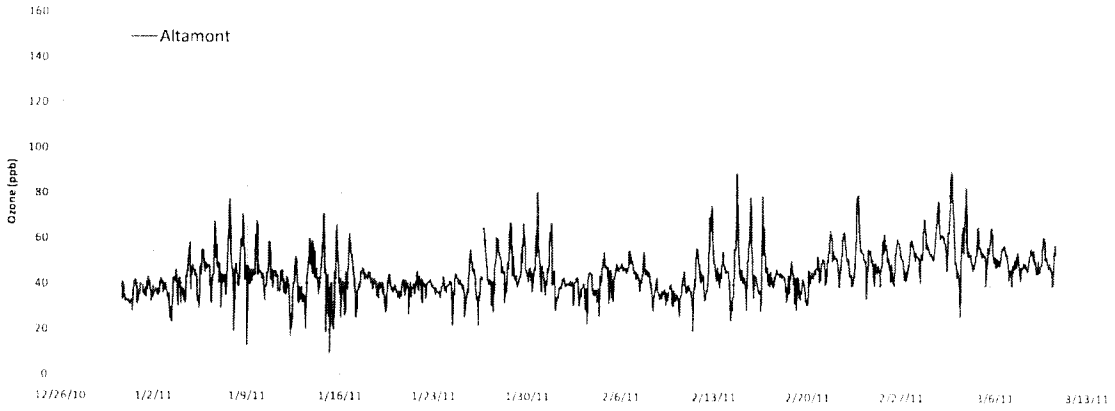

Figure 4-5. Winter 2010–11 Altamont 1-hr average ozone time series observations.

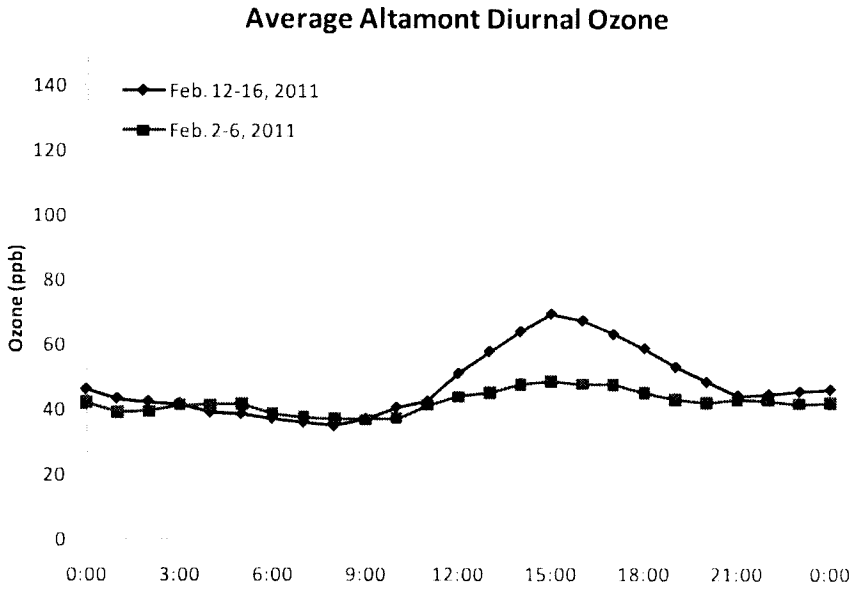

Figure 4-6.Av erage diurnal ozone measured at the Altamont location for Feb. 2–6 and Feb. 12–16, 2011.

4.2.2 Cedarview

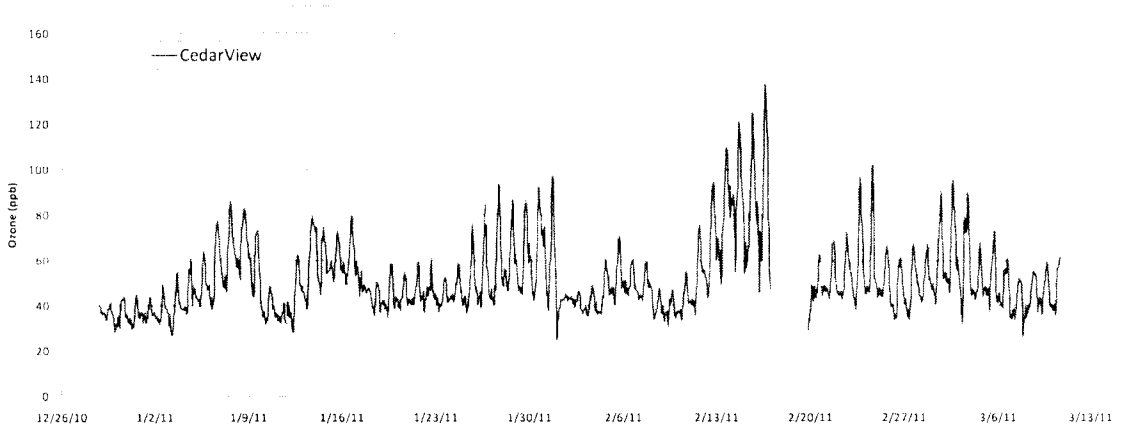

Figure 4-7. Winter 2010–11 Cedar View 1-hr average ozone time series observations. The data gap represents a period when the sample line became blocked by water and ice.

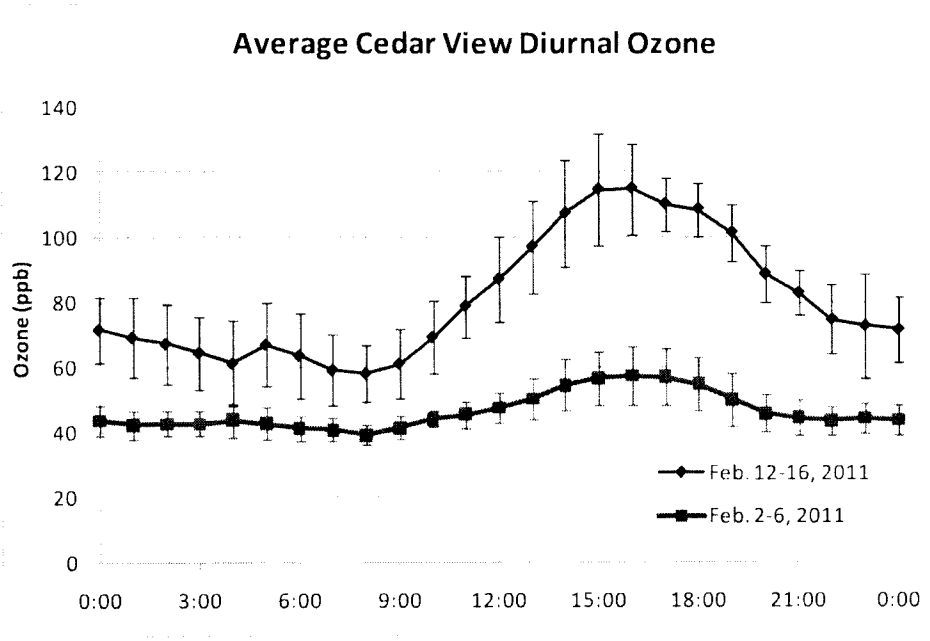

Figure 4-8. Average diurnal ozone measured at the Cedar View location for Feb. 2–6 and Feb. 12–16, 2011.

4.2.3 Dinosaur National Monument

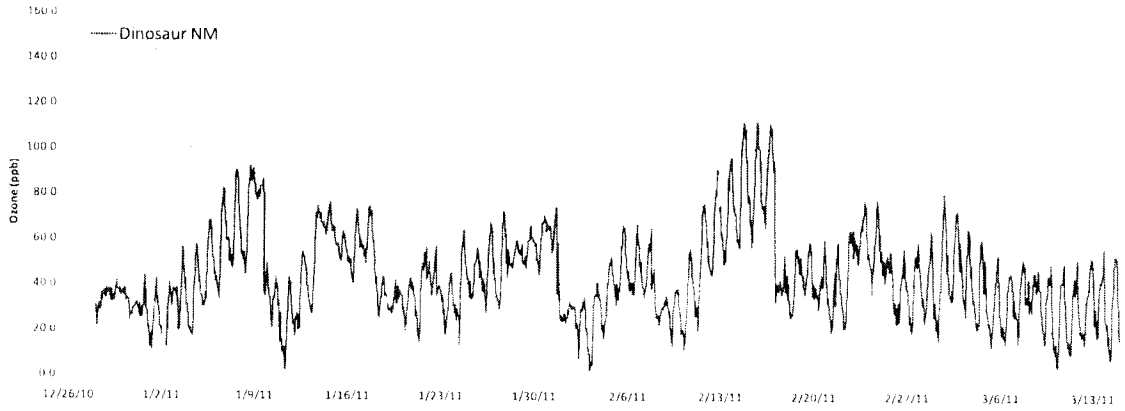

Figure 4-9. Winter 2010–11 Dinosaur National Monument 1-hr average ozone time series observations.

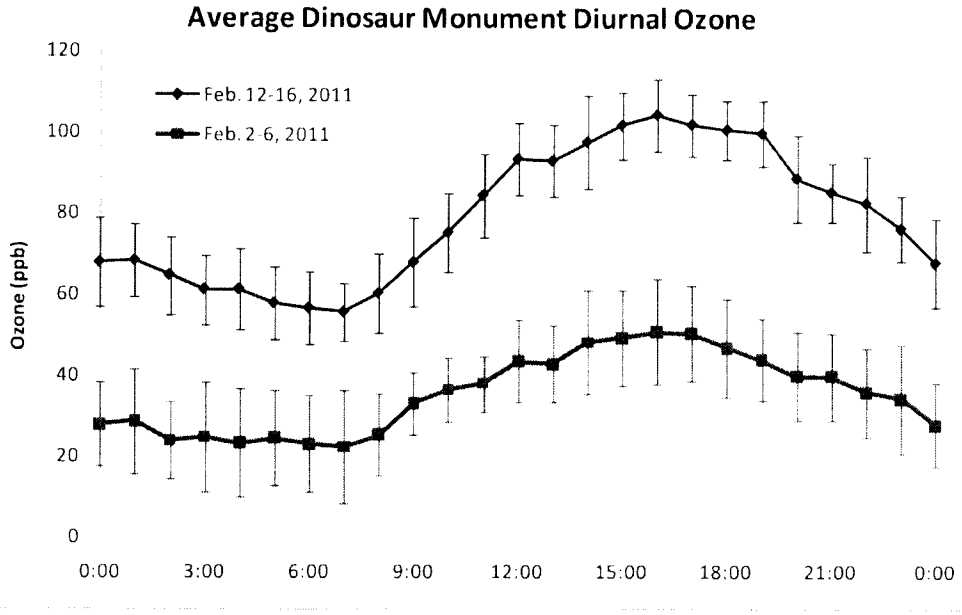

Figure 4-10. Average diurnal ozone measured at the Dinosaur National Monument location for Feb. 2–6 and Feb. 12–16, 2011.

4.2.4 Duchesne

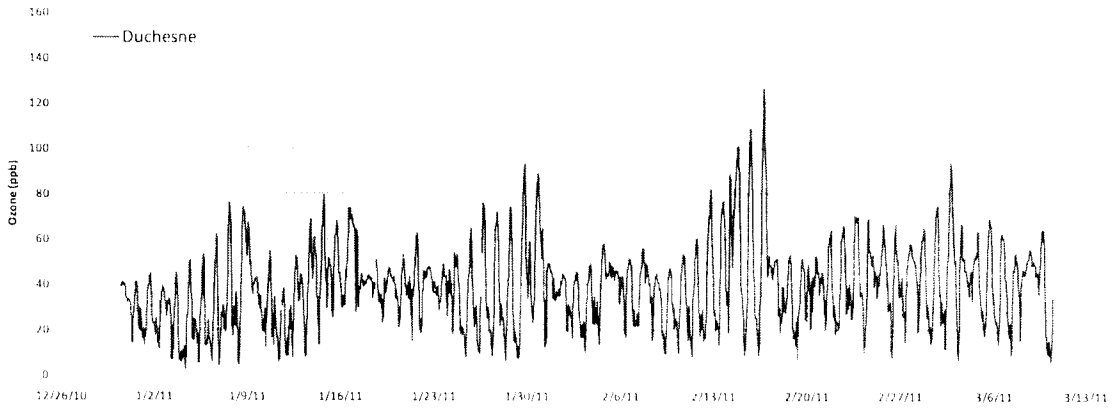

Figure 4-11. Winter 2010–11 Duchesne 1-hr average ozone time series observations.

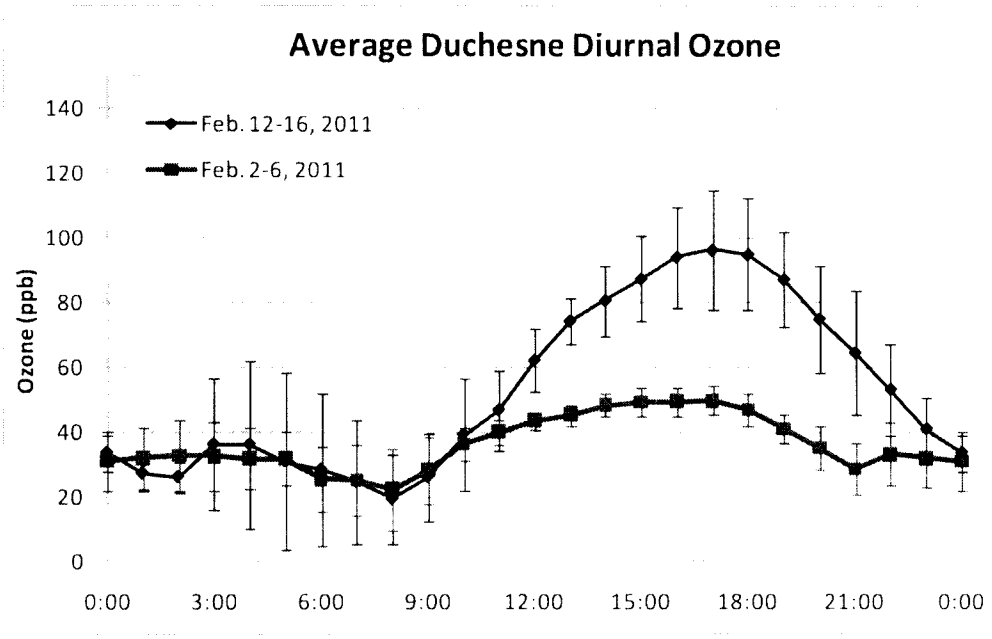

Figure 4-12. Average diurnal ozone measured at the Duchesne location for Feb. 2–6 and Feb. 12–16, 2011.

4.2.5 Fruitland

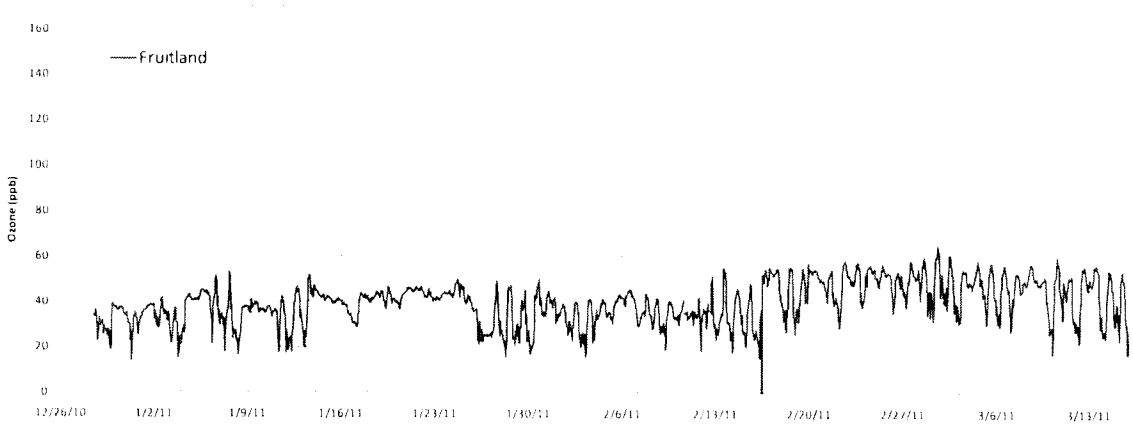

Figure 4-13. Winter 2010–11 Fruitland 1-hr average ozone time series observations.

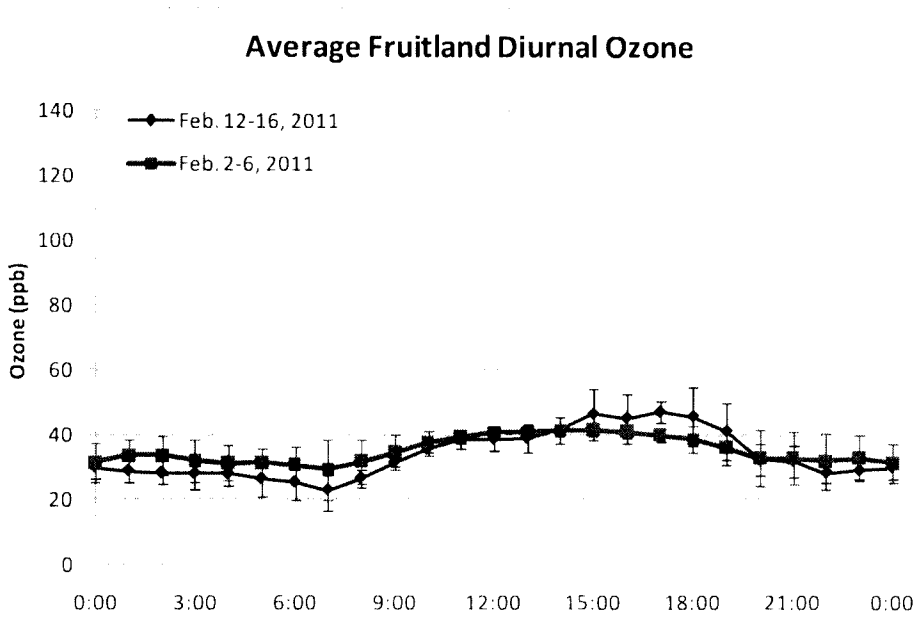

Figure 4-14. Average diurnal ozone measured at the Fruitland location for Feb. 2–6 and Feb. 12–16, 2011.

4.2.6 Horse Pool

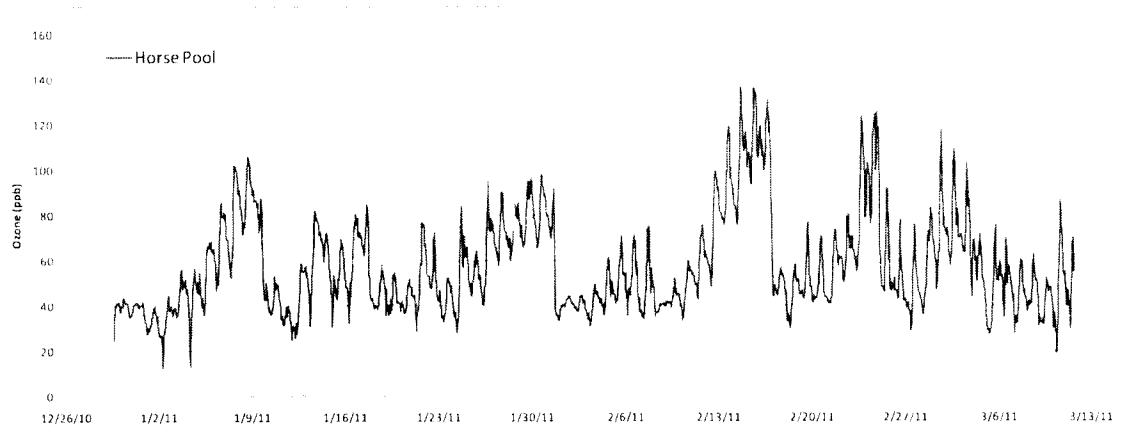

Figure 4-15. Winter 2010–11 Horse Pool 1-hr average ozone time series observations.

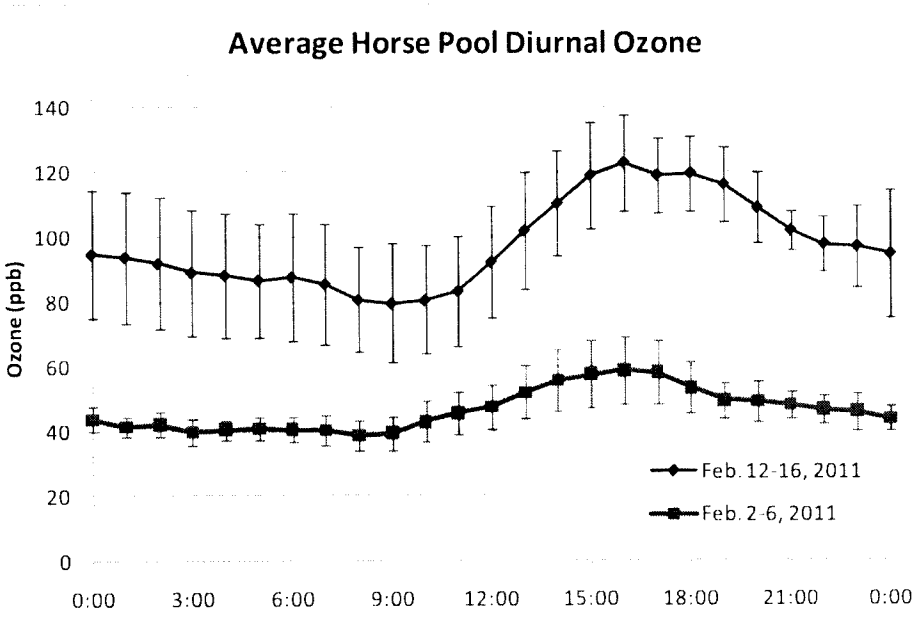

Figure 4-16. Average diurnal ozone measured at the Horse Pool location for Feb. 2–6 and Feb. 12–16, 2011.

4.2.7 Jensen

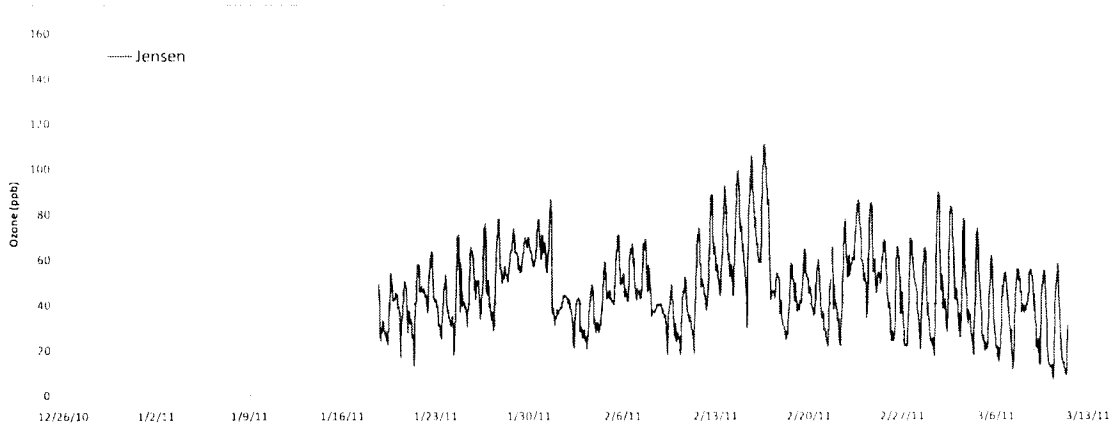

Figure 4-17. Winter 2010–11 Jensen 1-hr average ozone time series observations.

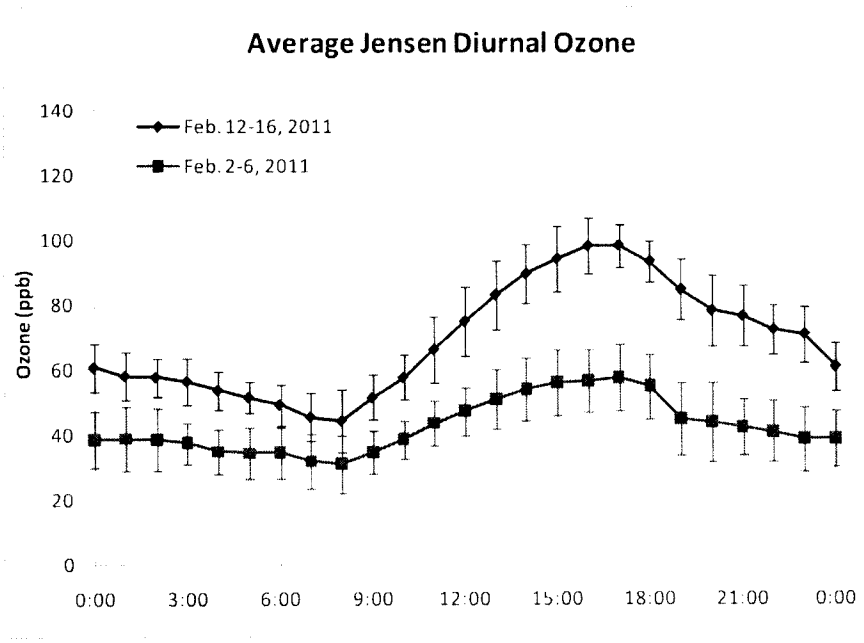

Figure 4-18. Average diurnal ozone measured at the Jensen location for Feb. 2–6 and Feb. 12–16, 2011.

4.2.8 Lapoint

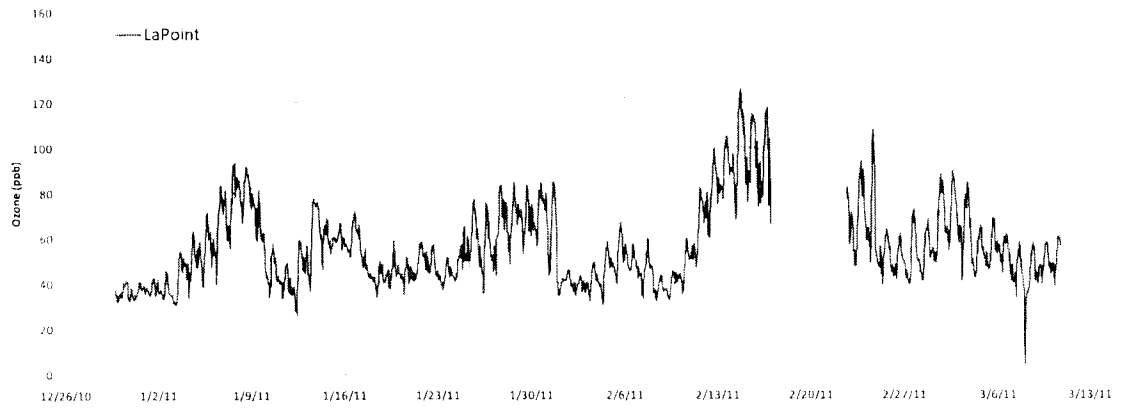

Figure 4-19. Winter 2010–11 Lapoint 1-hr average ozone time series observations. The data gap represents a period when the sample line became blocked by water and ice.

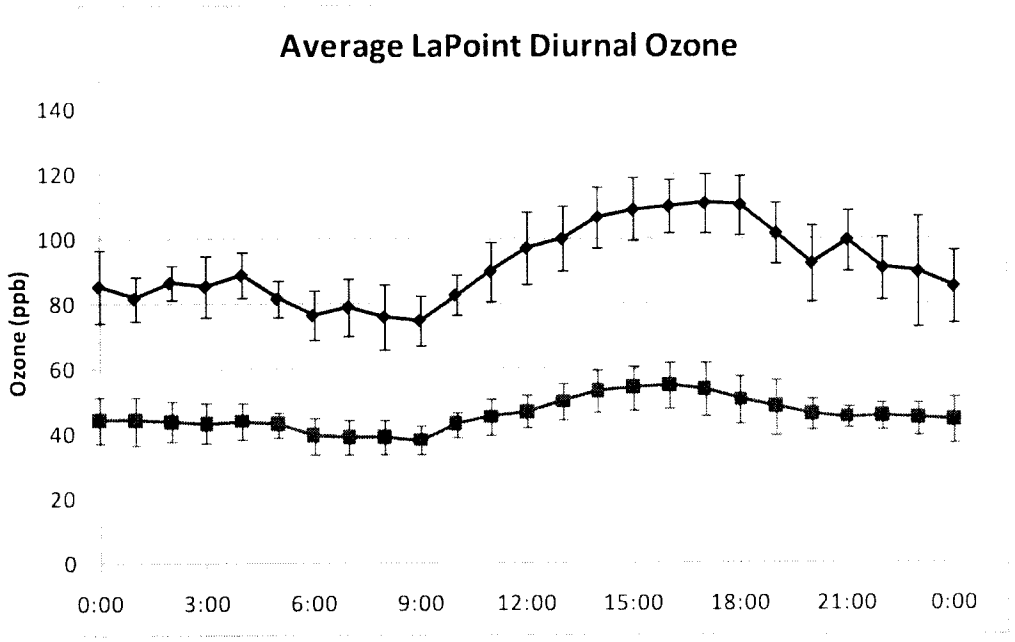

Figure 4-20. Average diurnal ozone measured at the Lapoint location for Feb. 2–6 and Feb. 12–16, 2011.

4.2.9 Nine Mile Canyon

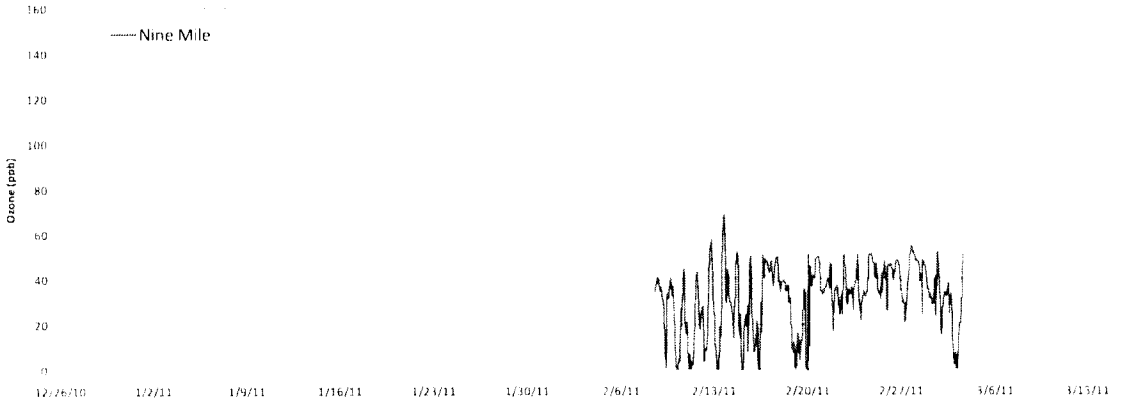

Figure 4-21. Winter 2010–11 Nine Mile Canyon 1-hr average ozone time series observations. Owing to solar power limitations, ozone sampling was not initiated until early Feb. 2011.

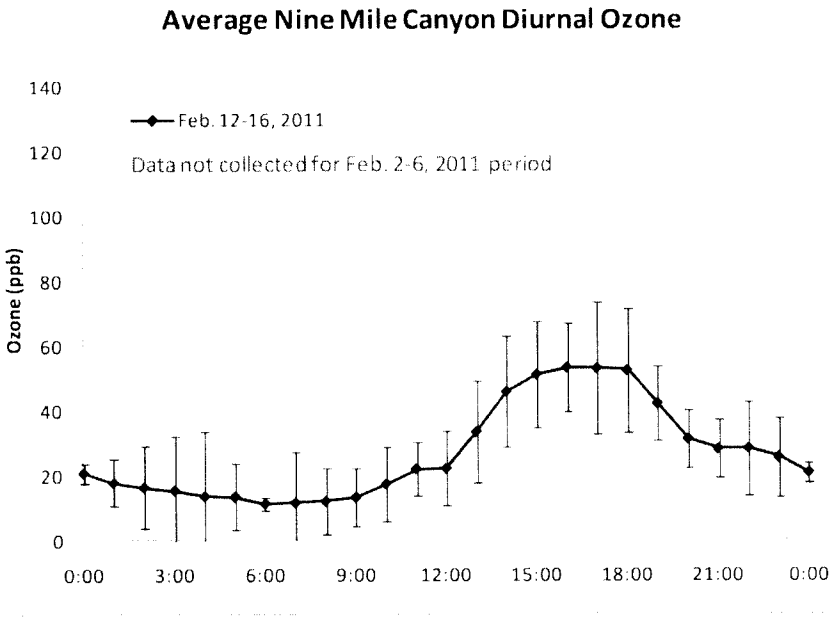

Figure 4-22. Average diurnal ozone measured at the Nine Mile Canyon location for Feb. 12–16, 2011.

4.2.10 Ouray

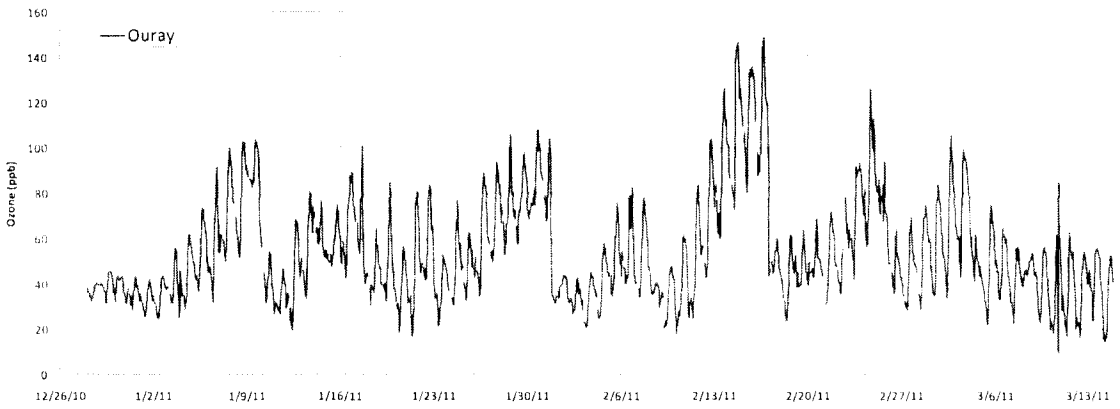

Figure 4-23. Winter 2010–11 Ouray 1-hr average ozone time series observations.

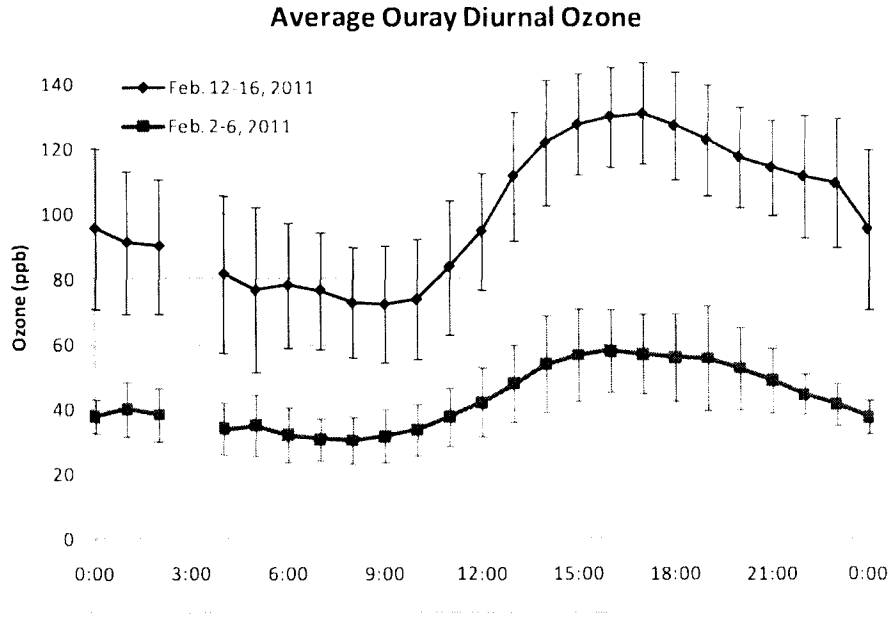

Figure 4-24. Average diurnal ozone measured at the Ouray location for Feb. 2–6 and Feb. 12–16, 2011. The gap in the data at 3:00 represents the automated QA/QC time period.

4.2.11 Pariette Draw

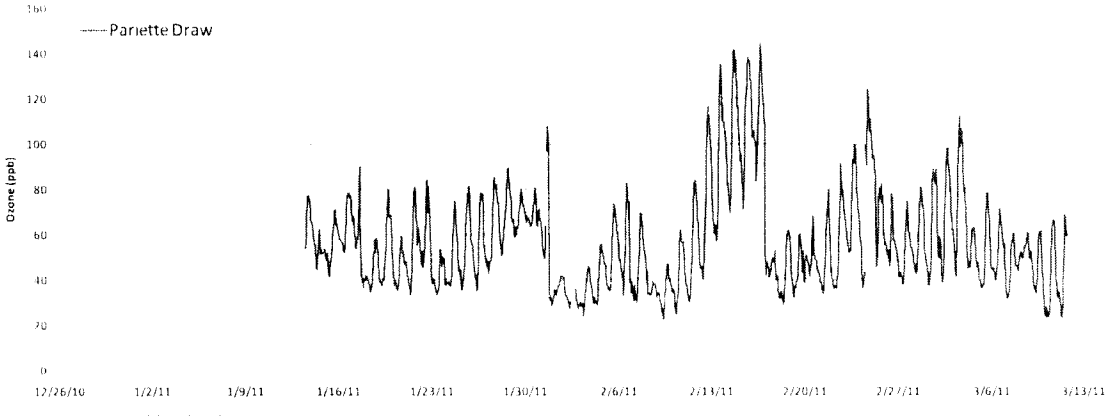

Figure 4-25. Winter 2010–11 Pariette Draw 1-hr average ozone time series observations.

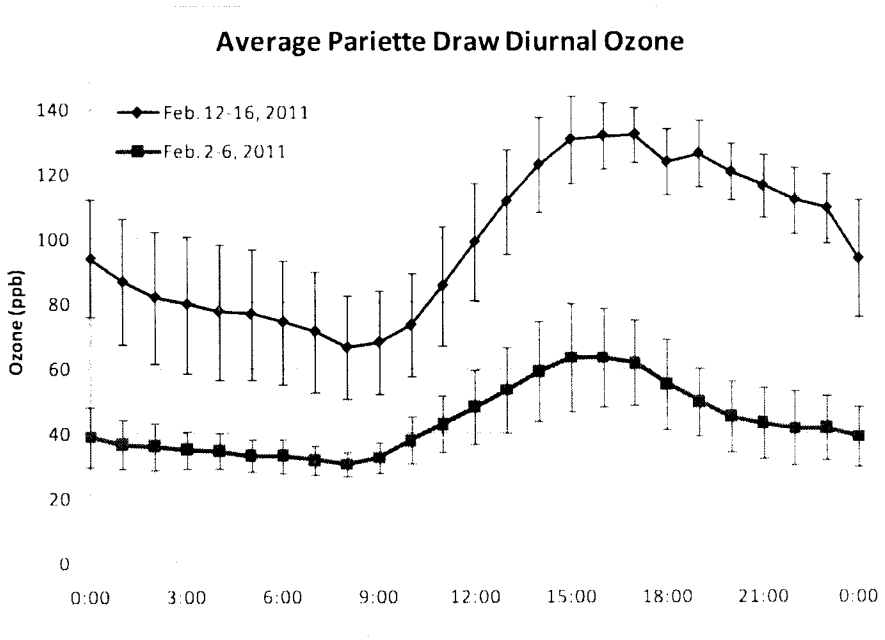

Figure 4-26. Average diurnal ozone measured at the Pariette Draw location for Feb. 2–6 and Feb. 12–16, 2011.

4.2.12 Rabbit Mountain

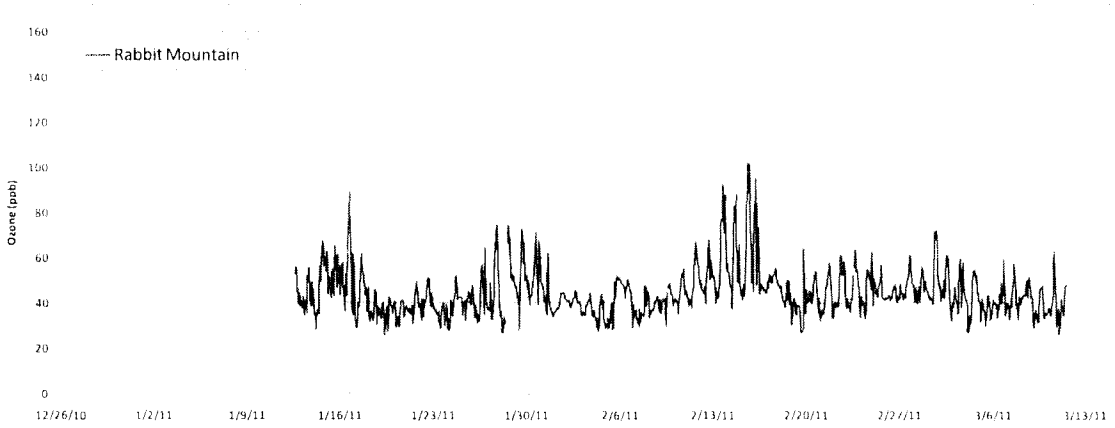

Figure 4-27. Winter 2010–11 Rabbit Mountain 1-hr average ozone time series observations.

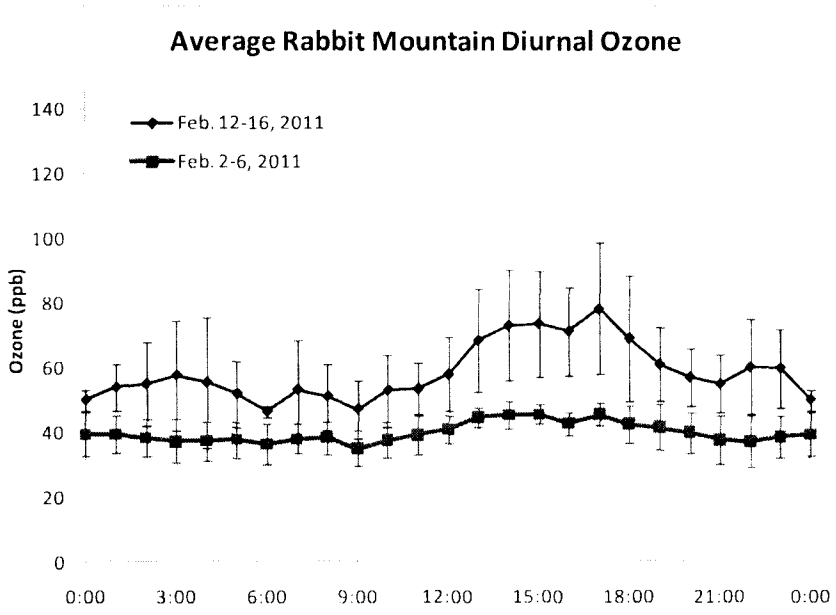

Figure 4-28. Average diurnal ozone measured at the Rabbit Mountain location for Feb. 2-6 and Feb. 12-16, 2011.

4.2.13 Rangely, CO.

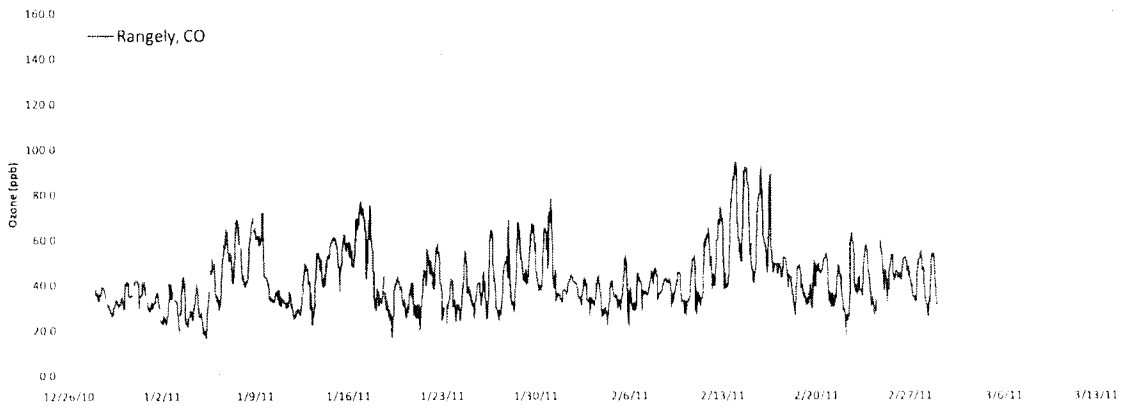

Figure 4-29. Winter 2010–11 Rangely, CO, 1-hr average ozone time series observations.

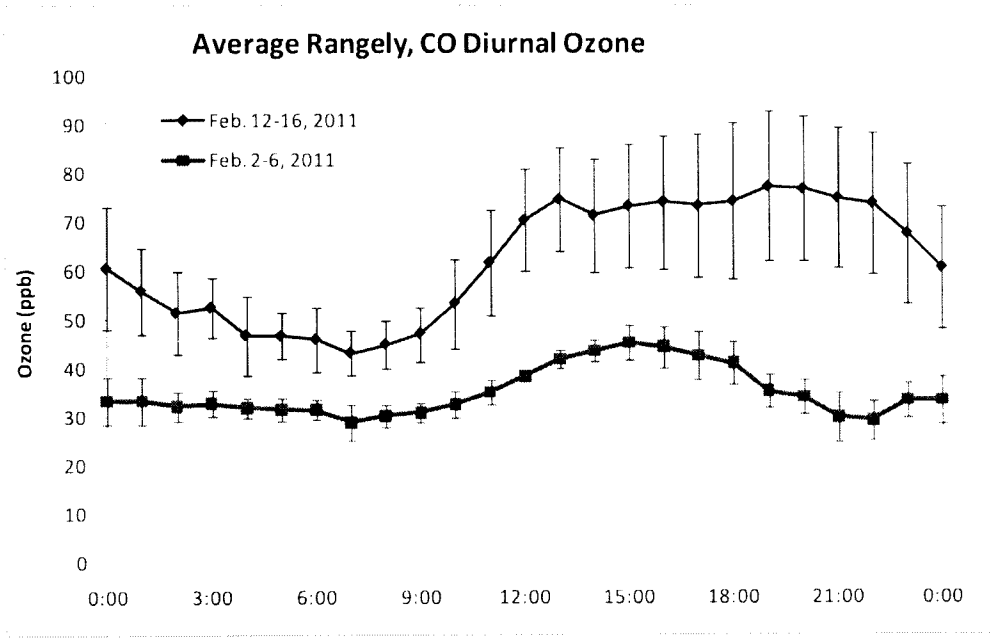

Figure 4-30. Average diurnal ozone measured at the Rangely, CO, location for Feb. 2–6 and Feb. 12–16, 2011.

4.2.14 Red Wash

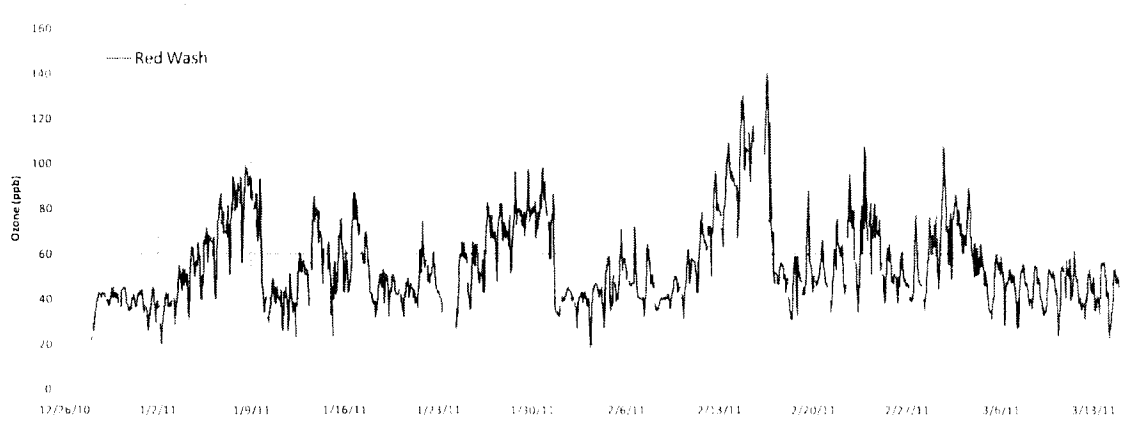

Figure 4-31. Winter 2010–11 Red Wash 1-hr average ozone time series observations.

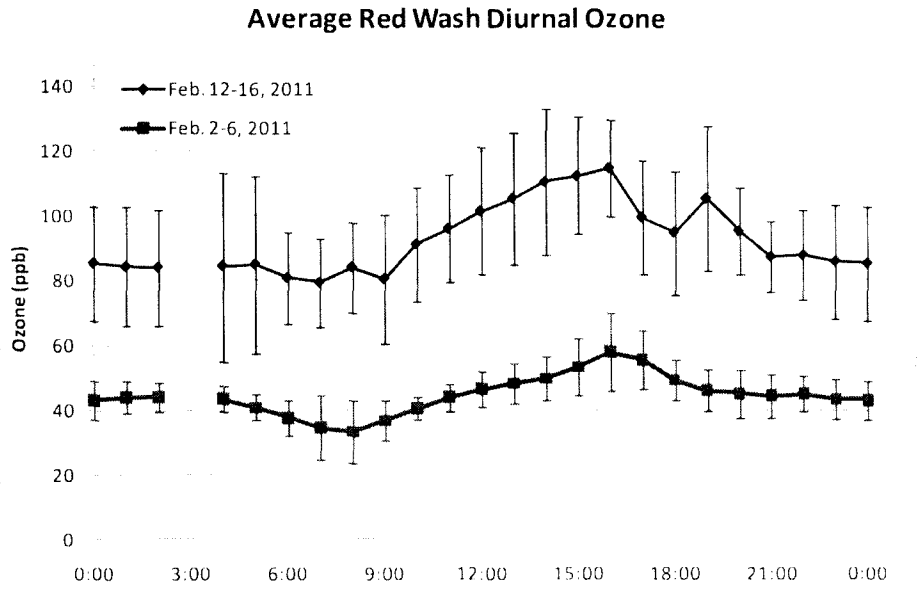

Figure 4-32. Average diurnal ozone measured at the Red Wash location for Feb. 2–6 and Feb. 12–16, 2011. The gap in the data at 3:00 represents the automated QA/QC time period.

4.2.15 Roosevelt

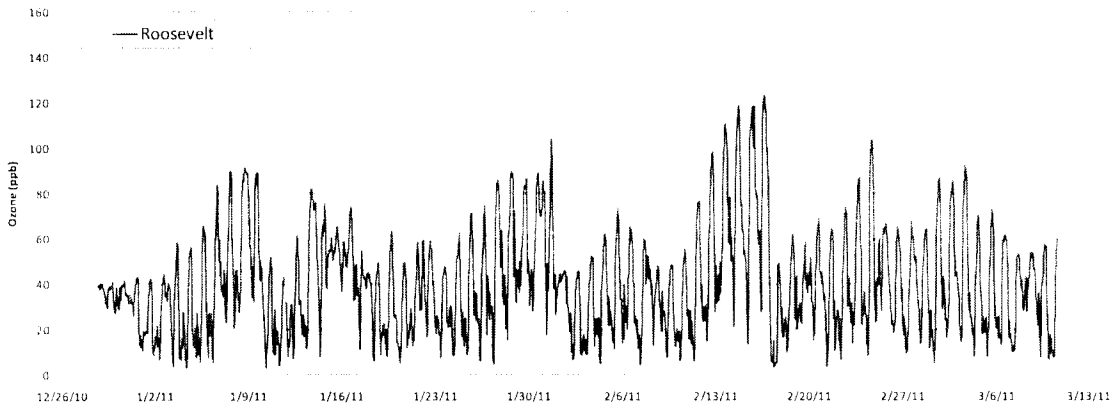

Figure 4-33. Winter 2010–11 Roosevelt 1-hr average ozone time series observations.

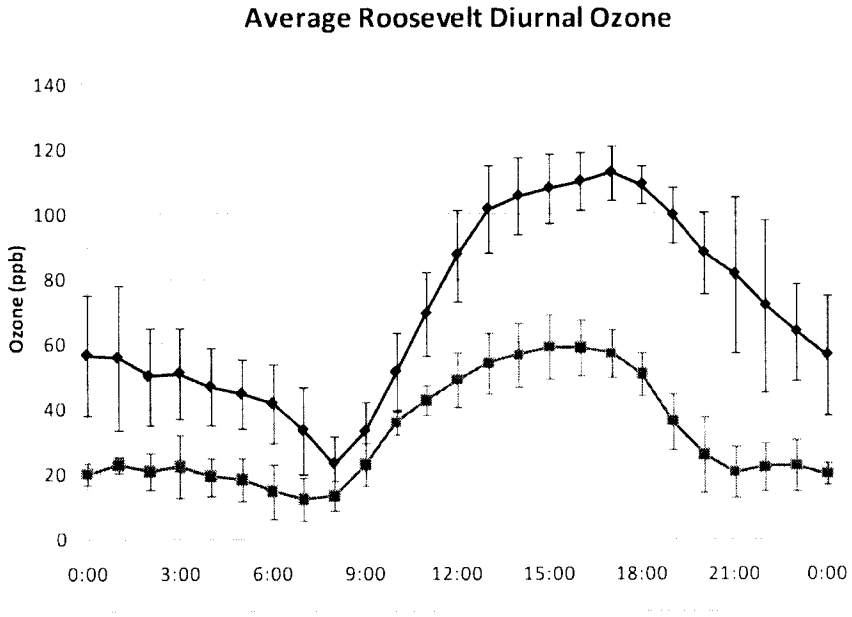

Figure 4-34. Average diurnal ozone measured at the Roosevelt location for Feb. 2–6 and Feb. 12–16, 2011.

4.2.16 Vernal

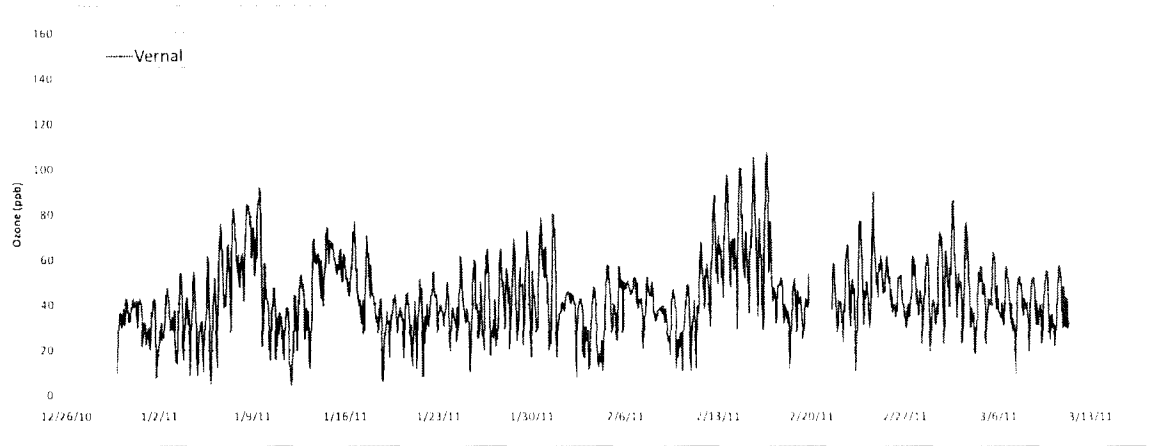

Figure 4-35. Winter 2010–11 Vernal 1-hr average ozone time series observations. The data gap represents a period when the sample line became blocked by water and ice.

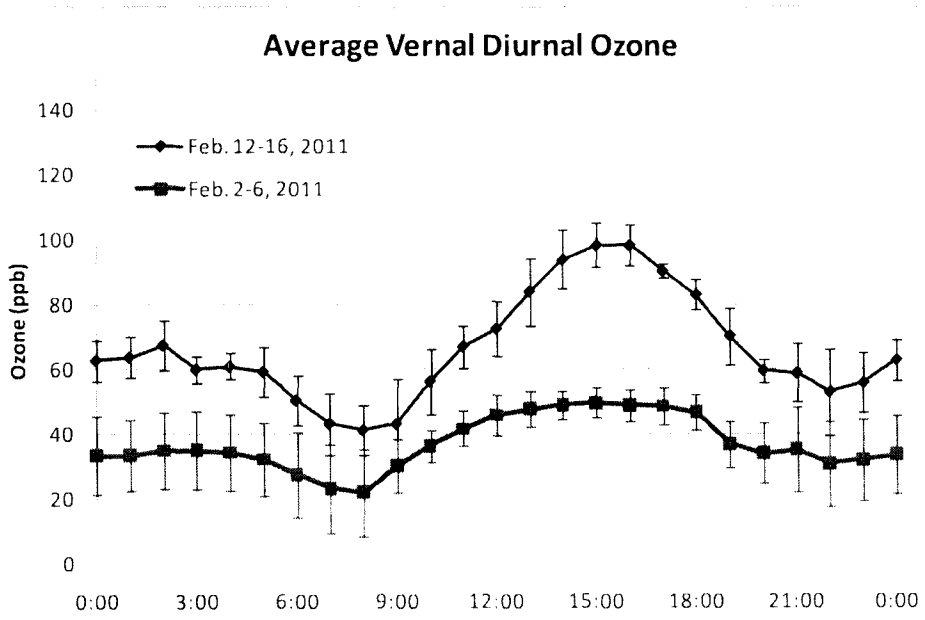

Figure 4-36. Average diurnal ozone measured at the Vernal location for Feb. 2–6 and Feb. 12–16, 2011.

4.3 VERTICAL OZONE PROFILE

Though not part of the original project plan, a tethered balloon-borne modified 2B Technologies ozone monitor was used to examine the vertical ozone profile on a single day at the Red Wash sampling location. Fig. 4-37 shows the four vertical ozone profiles measured on February 24, 2011 at 8:00 MST, 9:00 MST, 13:00 MST and 16:00 MST. As can be seen, the ground level ozone concentrations were greater than the ozone concentrations at higher elevations at all observed time periods throughout the day. Furthermore, it can be seen that the thickness of the zone of higher ozone concentrations seemed to grow throughout the day. In addition, the balloon-borne ground level ozone values were very similar to the values provided by the collocated Golder Associates Red Wash ozone monitor.

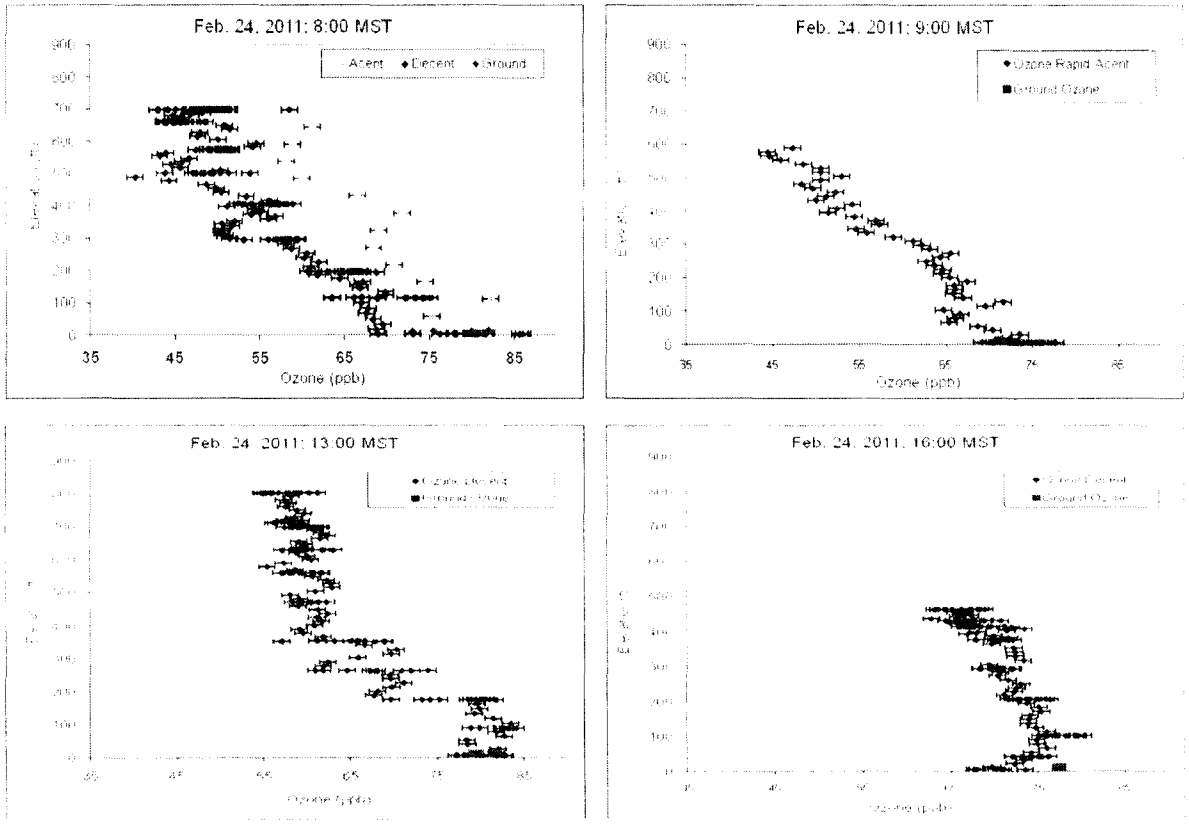

Figure 4-37. Red Wash tethered balloon vertical ozone profiles from Feb. 24, 2011.

The higher ozone concentrations observed at the surface are suggestive of local or near-area precursor emissions and ozone generation, as opposed to long-range transportation. Additionally, the higher elevation (> 500 ft agl) ozone concentrations tended to equilibrate around 45-50 ppb. These concentrations are approximately equivalent to the average values observed at the Fruitland location, which was hypothesized to essentially represent free tropospheric (background) ozone concentrations. Fig. 4-38 compares one of the Red Wash site's ozone profiles to a similar measurement in Utah's Cache Valley one week later, but under similar meteorological conditions. As is shown, the higher ozone values for the Cache Valley were observed at the upper elevations, basically opposite of the situation observed at the Red

Wash site. It should be noted that the Cache Valley has not observed any wintertime ozone exceedances, but the area is an officially declared nonattainment area for another secondary pollutant, $PM_{2.5}$, partially driven by reaction with ozone and other photochemical oxidants.

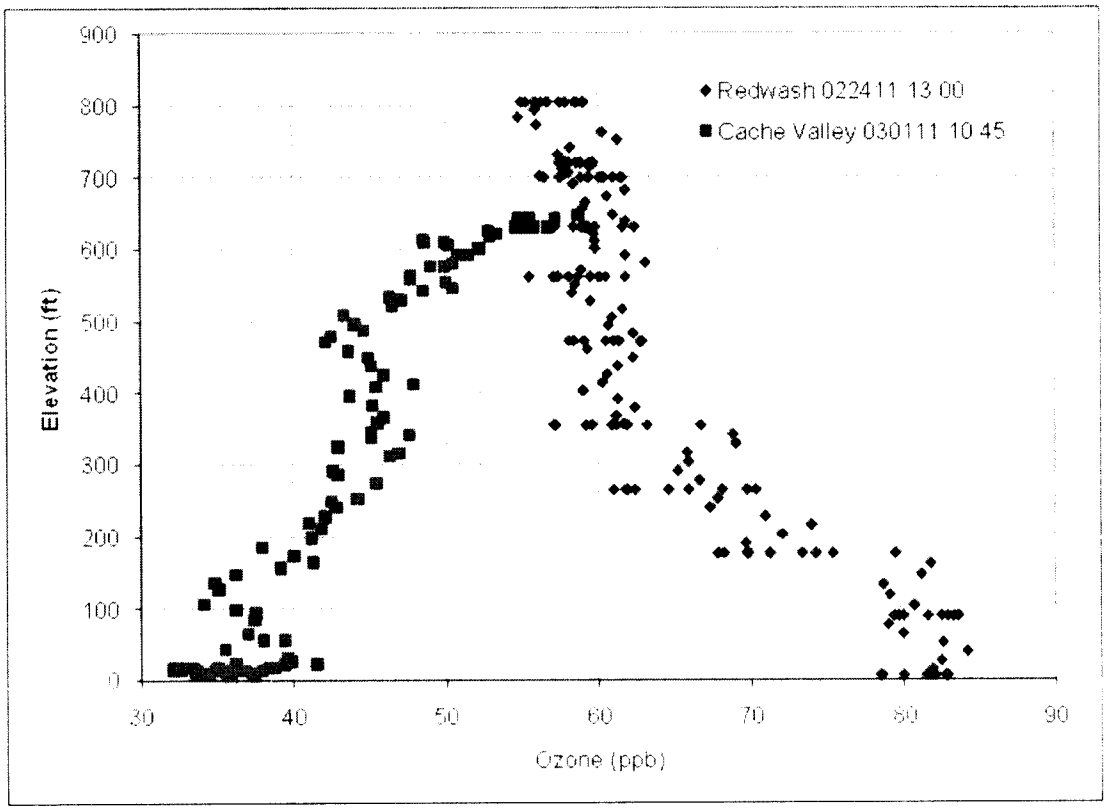

Figure 4-38. Comparison of wintertime vertical ozone profiles for Uinta Basin (Red Wash) and Cache Valley.

4.4 OXIDES OF NITROGEN

Ambient oxides of nitrogen (NO_X) are generally presumed to be the sum of gas-phase nitric oxide (NO) and nitrogen dioxide (NO_2). In anthropogenically impacted areas, NO is typically produced as an unwanted by-product of combustion and often is, therefore, a convenient marker compound for automotive and other combustion exhausts. Once emitted into the atmosphere, NO may be converted to NO_2 by oxidants such as ozone. Air masses dominated by NO (relative to NO_2) are usually considered to be a "fresh" plume, while those dominated more by NO_2 (relative to NO) are considered to be more "aged," or in the presence of a more oxidizing atmosphere (i.e., plentiful in oxidizing compounds). Additionally, NO_2 is a key component in the formation of ozone. It also undergoes photolysis to produce free atomic oxygen, which then readily combines with diatomic oxygen to form ozone.

The observed ambient concentrations of NO_X were typical of semi-urban and rural areas. The time series for NO_X at the Vernal and Red Wash sites, as well as additional data for the Ouray location, are shown in Figures 4-39, 4-40, and 4-41, respectively. Data from the latter two sites were supplied by Golder Associates. The NO_X concentrations originally were planned to be

monitored only during the intensive study period (Feb. 21-25, 2011); however, additional data were also collected through the middle of Mar. 2011.

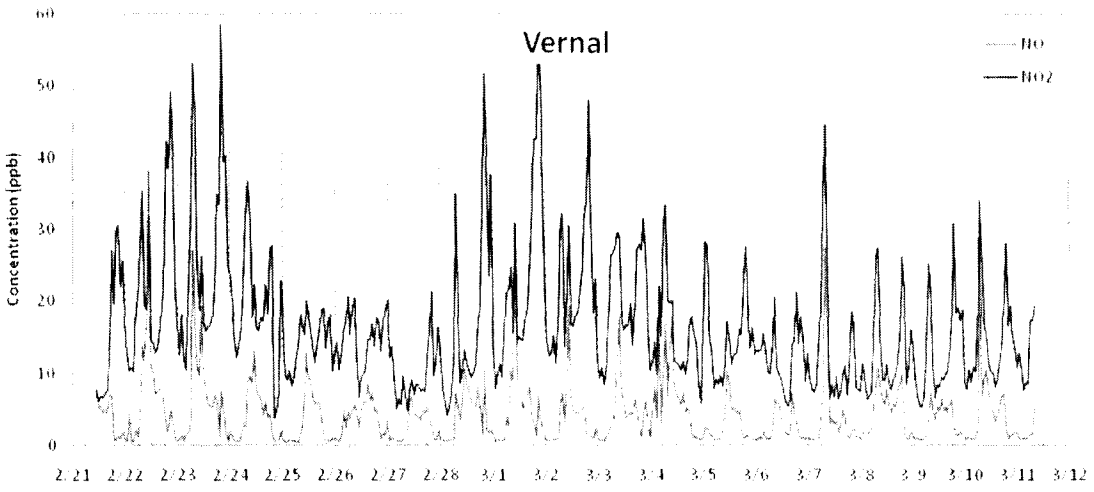

Figure 4-39. Time series of ambient NO and NO_2 as measured at the Vernal sample site from Feb. 21 to Mar. 11, 2011.

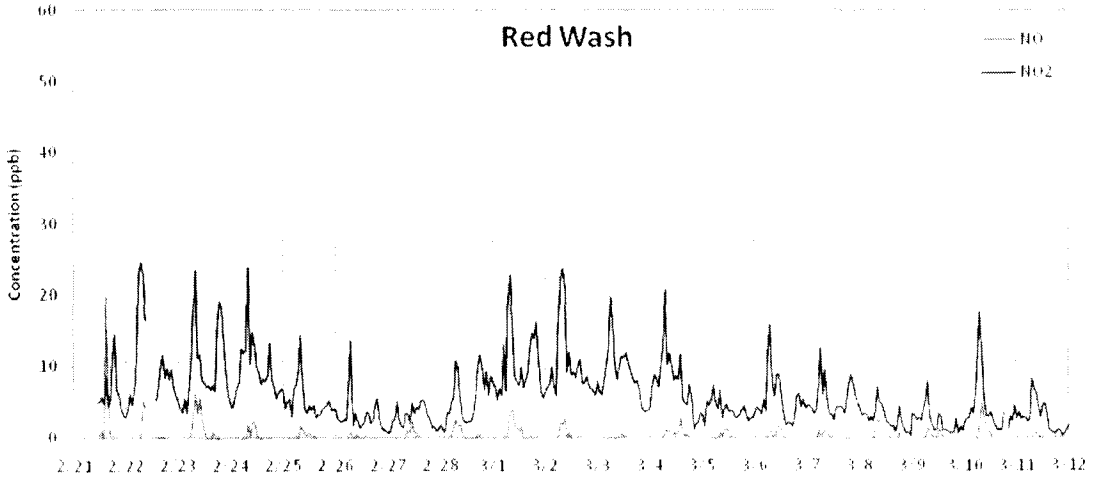

Figure 4-40. Time series of ambient NO and NO_2 as measured at the Red Wash sample site from Feb. 21 to Mar. 11, 2011. Data supplied by Golder Associates.

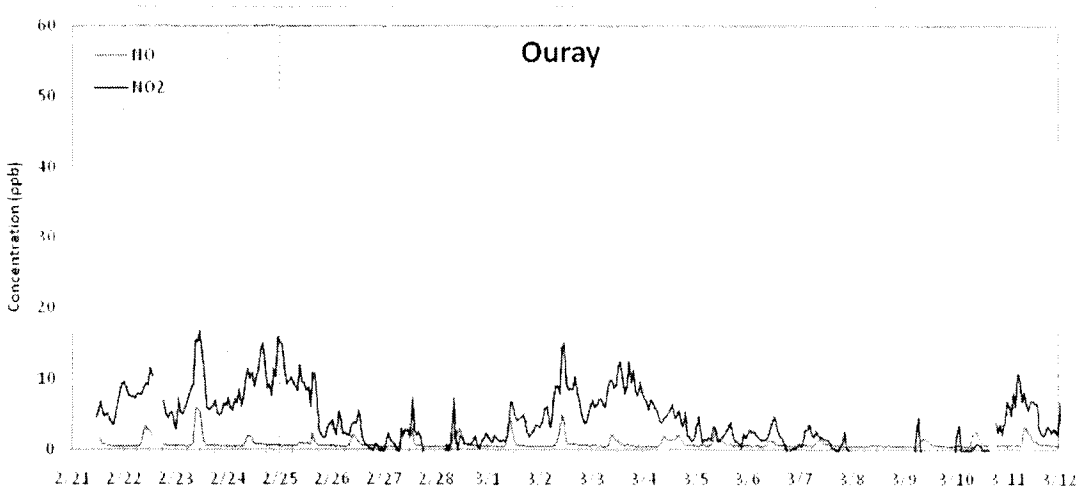

Figure 4-41. Time series of ambient NO and NO_2 as measured at the Ouray sample site from Feb. 21 to Mar. 11, 2011. Data supplied by Golder Associates.

As shown in Figures 4-39, 4-40, and 4-41, during the observed period, the Vernal location was found to have the highest concentrations of both NO and NO_2 among the observed locations. Vernal's hourly averaged concentrations of NO_2 approached as much as 60 ppb on several occasions which were coincident with elevated ozone and observed inversion conditions (see Fig. 4-39). For comparison, oxides of nitrogen, which are regulated as only NO_2, has a NAAQS hourly standard of 100 ppb, regulated at the 98th percentile. All observed NO_2 concentrations were well below the allowable standard. The NO concentrations observed at Vernal were approximately half of those of NO_2, suggesting the observed air mass was an aged plume or in the presence of abundant oxidizing species (i.e., ozone). Maximum NO_2 concentrations measured at the Red Wash and Ouray locations approached 25 and 15 ppb, respectively (see Figures 4-40 and 4-41).

Close examination of Fig. 4-39 through Fig. 4-41 shows various concentration spikes in the NO_2 and NO at different times on a given day. Calculating the hourly average NO_2 and NO concentrations for the February 21-25, 2011 period resulted in the diurnal curves shown in Fig. 4-42 through Fig. 4-44. As can be seen, the Vernal concentration spikes are much more pronounced and demonstrate chronological patterns expected when urban traffic is the assumed dominant source of NO_x compounds. As the monitoring distance from potential immediate sources of NO_x was increased, the observed concentrations and diurnal magnitude changes decreased. For example, NO_x concentrations at the Red Wash site, which is adjacent to Utah State Highway 45, still displayed morning and evening traffic-related NO_x spikes. On the other hand, measurements from the Ouray site, centrally located in the oil and gas fields, reveal much more damped diurnal NO_x.

It is also worth noting that comparison of the average NO_x diurnal profiles shown in Figures 4-39, 4-40, and 4-41 with the previously discussed corresponding ozone diurnal profiles, shows that when the NO begins to increase in the early morning hours, the background ozone is quickly titrated (decreased), converting the NO into NO_2. Furthermore, as the daily sunlight increases,

NO_2 and VOCs are photolyzed to form ozone and other products; later, the evening NO_x peaks are paralleled by an ozone decrease.

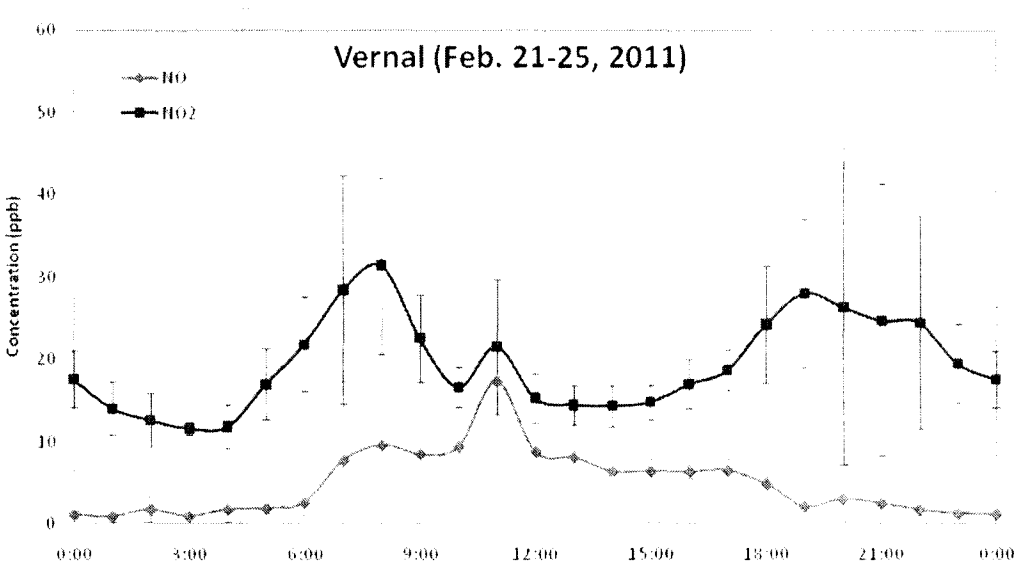

Figure 4-42. Vernal average diurnal NO_2 and NO for Feb. 21-25, 2011.

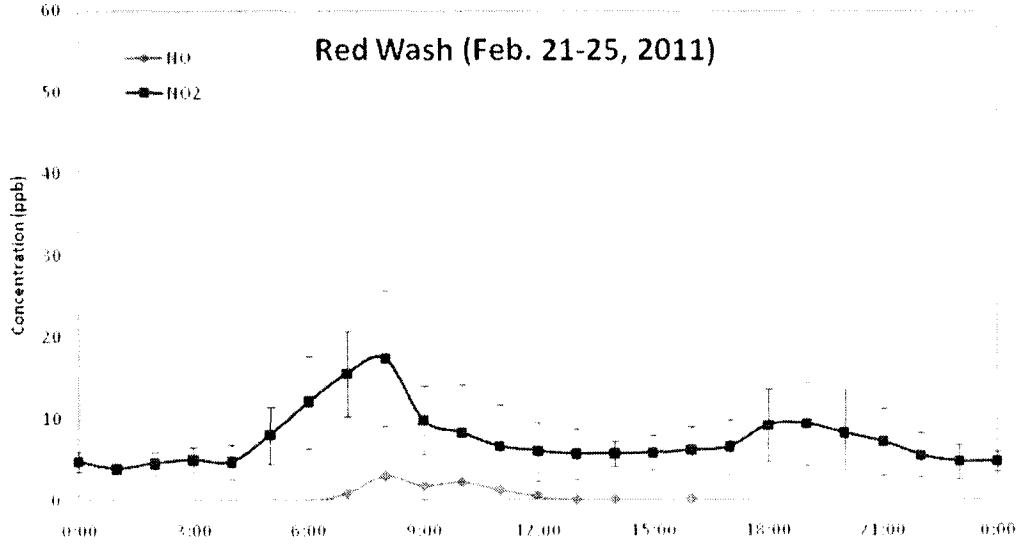

Figure 4-43. Red Wash average diurnal NO_2 and NO for Feb. 21–25, 2011.

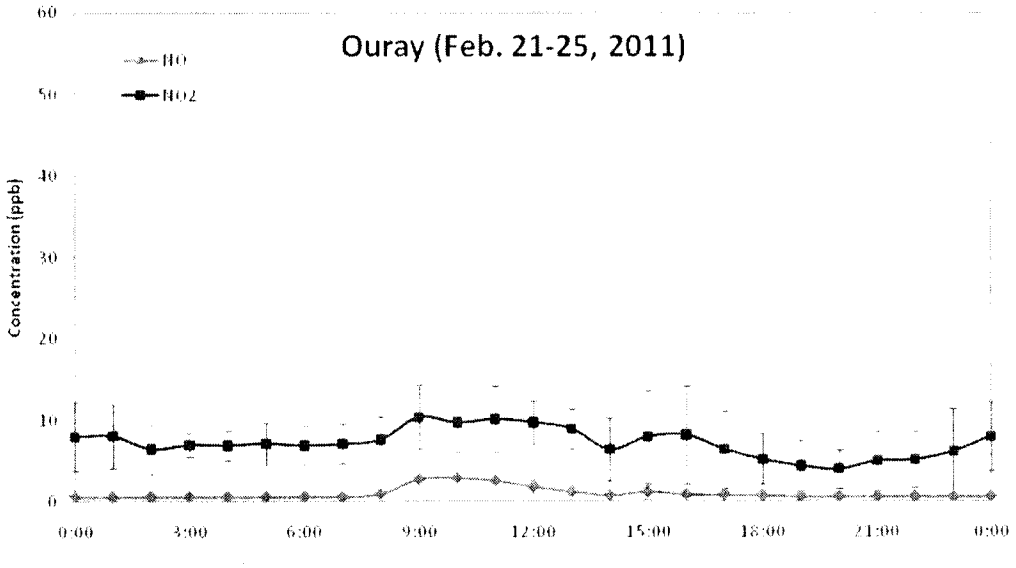

Figure 4-44. Ouray average diurnal NO_2 and NO for February 21-25, 2011.

4.5 HYDROCARBONS (INCLUDING CH_4)

Ambient methane (CH_4) and speciated non-methane hydrocarbons (NMHCs) were characterized at various daytime periods throughout the intensive sampling period of February 21-25, 2011. Methane is not normally considered a tropospherically-reactive hydrocarbon; however, CH_4 was added to the sampling scheme in response to research conducted in Pinedale, Wyoming, that revealed CH_4 to exist in concentrations where its reactivity became important. The NMHCs were collected over an integrated time period of approximately one hour, and grab samples were collected for CH_4 at the start and end of each NMHC sample period.

The average CH_4 concentrations, along with the 95% confidence intervals are shown in Fig. 4-45. As can be seen, the Vernal site CH_4 averaged 1.76 ± 0.24 ppm and the Red Wash site CH_4 averaged 2.78 ± 0.64 ppm. The 95% confidence intervals suggest statistically different concentrations at the two locations. Furthermore, it should be noted that the CH_4 concentrations ranged from 0.5 to 2.3 ppm at Vernal and 1.7 to 5.5 ppm at the Red Wash site. Oil and gas well exploration and production is a well-known source for potential CH_4 emissions during various process activities. This was consistent with the observed ambient concentrations that were significantly higher in the oil/gas field (Red Wash) than in the semi-urban (Vernal) area. For comparison, background northern hemispheric CH_4 is usually taken to be 1.6 – 1.7 ppm. Personal discussions with the other investigators suggest that the Red Wash site values are on the same level as those reported in Wyoming's Pinedale area.

As described in the "Methodologies" section, the analyses for the non-methane hydrocarbons was performed from collocated parallel sorption tubes: one nominally collected for light NMHC analysis (approximately C2 to C6) and the other for heavy NMHC analysis (C6 to C12). In the few cases where the GC analysis overlapped (e.g., benzene and a few other similar chain NMHCs), the analyses were averaged.

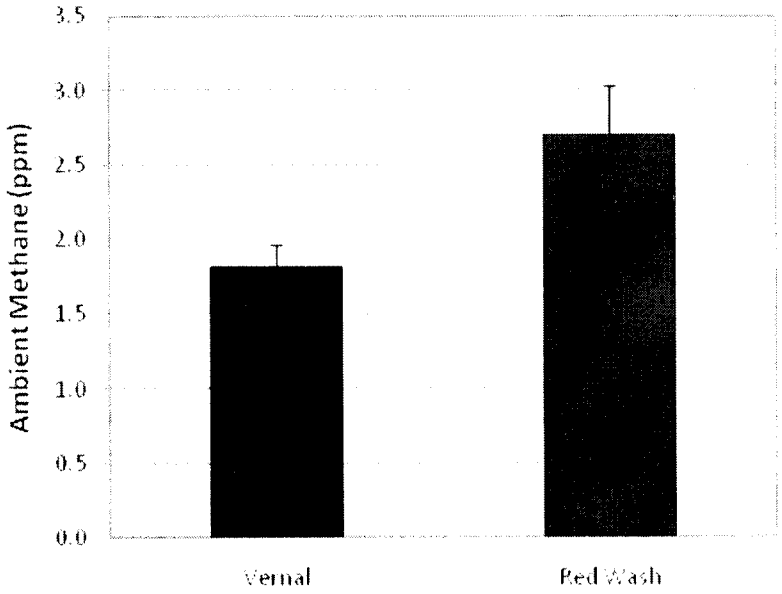

Figure 4-45. Average ambient methane for Vernal and Red Wash observed from instantaneous grab samples on February 21 through February 25, 2011. The error bars represent the 95% confidence interval about the average.

Between the light and heavy VOC gas chromatography analyses, attempts were made to quantify the 56 different compounds which are typically believed to be representative of ozone precursor species. The compiled averaged NMHC concentrations are shown in Table 4-3. It should also be noted that CH_4 has also been included, and its concentrations have been converted to parts per billion (from parts per million) for direct comparison with the other hydrocarbon compounds.

Initial examination of the species in Table 4-3 shows most of the targeted compounds were observed at sub-ppb concentrations. Furthermore, it can be seen that the concentrations of the identified VOC concentrations were greater at the Red Wash site by more than a factor of two for most of the observed compounds.

Table 4-3. Average reactive hydrocarbons measured at the Red Wash and Vernal sampling locations, February 21-25, 2011. The uncertainty represents the 95% confidence interval about the mean.

Compound	Red Wash (ppb)	Vernal (ppb)	Compound	Red Wash (ppb)	Vernal (ppb)
Methane	2780 ± 679	1764 ± 244	**2,3-dimethyl pentane**	0.09 ± 0.05	0.29 ± 0.13
Ethane	125 ± 35	119 ± 30	**3-methyl hexane**	0.26 ± 0.15	0.28 ± 0.19
Ethene	51.1 ± 93.0	6.1 ± 2.7	**2-methyl hexane**	0.15 ± 0.11	0.24 ± 0.11
Propane	20.9 ± 10.9	11.5 ± 8.0	**n-heptane**	0.51 ± 0.31	0.87 ± 0.49
Propene	0.78 ± 0.34	0.76 ± 0.24	**Benzene**	0.62 ± 0.22	0.32 ± 0.14
isobutane	5.23 ± 2.95	1.68 ± 2.17	**2,2,4-trimethyl pentane**	0.03 ± 0.04	0.02 ± 0.02
Acetylene	57.7 ± 111.0	2.07 ± 1.21	**2-methyl heptane**	0.39 ± 0.17	0.01 ± 0.02
Butane	8.74 ± 4.82	2.21 ± 3.86	**3-methyl heptane**	0.27 ± 0.14	n.d
trans-2-butene	0.09 ± 0.04	0.05 ± 0.03	**Toluene**	1.49 ± 0.70	0.05 ± 0.02
1-butene	0.18 ± 0.04	0.16 ± 0.03	**n-Octane**	0.81 ± 0.41	n.d
cis-2-butene	0.07 ± 0.03	0.04 ± 0.03	**Ethylbenzene**	0.11 ± 0.07	n.d
cyclopentane	0.28 ± 0.16	0.07 ± 0.10	**m,p-xylene**	0.33 ± 0.19	n.d
2-methylbutane	4.33 ± 2.60	0.97 ± 1.41	**Nonane**	0.35 ± 0.13	n.d
Pentane	4.34 ± 2.57	0.91 ± 1.70	**Styrene**	0.08 ± 0.12	0.07 ± 0.06
trans-2-pentene	0.01 ± 0.02	0.01 ± 0.02	**o-xylene**	0.15 ± 0.10	n.d
1-pentene	0.02 ± 0.02	0.01 ± 0.02	**isopropyl benzene**	0.02 ± 0.02	n.d
cis-2-pentene	n.d.	n.d.	**n-propyl benzene**	0.08 ± 0.04	n.d
methyl cyclopentane	0.54 ± 0.32	0.45 ± 0.23	**m-ethyl toluene**	0.09 ± 0.10	0.01 ± 0.02
2,2-dimethyl butane	0.16 ± 0.10	0.09 ± 0.05	**p-ethyl toluene**	0.05 ± 0.05	0.01 ± 0.01
cyclohexane	0.52 ± 0.33	0.48 ± 0.24	**1,3,5-trimethyl benzene**	0.05 ± 0.04	n.d
2,3-dimethyl butane	0.17 ± 0.12	0.03 ± 0.06	**n-decane**	0.22 ± 0.11	0.02 ± 0.04
2-methyl pentane	1.69 ± 1.02	0.34 ± 0.67	**o-ethyl toluene**	0.06 ± 0.04	n.d
3-methyl pentane	0.82 ± 0.50	0.16 ± 0.31	**1,2,4-trimethyl benzene**	0.18 ± 0.16	n.d
isoprene	2.91 ± 1.10	0.46 ± 0.90	**1,2,3-trimethyl benzene**	0.08 ± 0.05	0.01 ± 0.01
n-hexane	0.07 ± 0.03	1.13 ± 0.65	**m-diethyl benzene**	0.04 ± 0.04	n.d
1-hexene	0.03 ± 0.03	0.02 ± 0.02	**p-diethyl benzene**	0.07 ± 0.06	0.01 ± 0.01
2,4-dimethyl pentane	0.06 ± 0.05	0.05 ± 0.03	**n-undecane**	0.42 ± 0.19	0.71 ± 1.02
methyl cyclohexane	0.65 ± 0.43	0.39 ± 0.27	**n-dodecane**	0.61 ± 0.38	0.84 ± 0.81

n.d. = non-detect

Besides methane, the final report "Oil and Gas Emission Inventories for the Western States" (WRAP, 2005) states that benzene, toluene, and the combined xylene compounds are all key VOC's associated with oil and gas exploration and production operations. As can be seen in Table 4-3, at the Red Wash location the average concentrations for benzene, toluene, and m,p-xylene were 0.62 ± 0.22 ppb, 1.49 ± 0.70 ppb, and 0.33 ± 0.19 ppb, respectively. The concentrations observed at the Vernal location for the same compounds were 0.32 ± 0.14 ppb, 0.05 ± 0.02 ppb, and non-detectable, respectively. It should also be pointed out that these same species are also representative of automotive emissions, and the ratio of benzene-to-toluene (B/T) is often used as an indicator of the age of the air mass. As listed in many atmospheric chemistry reference texts, a B/T ratio≈0.4 is usually considered to be evident of fresh vehicular emissions. Benzene-to-toluene ratios >0.4 are presumed to represent an aged air mass, since toluene has a much higher atmospheric reactivity rate than does benzene. The observed B/T ratios from this study were 0.43 and 6.03 for Red Wash and Vernal locations, respectively. The Vernal B/T ratio may be somewhat anomalous due to the very low average concentration observed for toluene (0.05 ppb).

However, the 2005 WRAP document suggests the B/T ratio from oil and gas field operations should range between 0.43 and much greater than one, depending on the process examined. For

example, dehydration/evaporation, storage tanks, and general well operations are estimated to show B/T ratios of 0.433, 0.77, and 31.5-39.5, respectively. In summary, it is reasonable to assume that the abundance of CH_4 and NMHCs observed at the Red Wash site, located on the edge of a dense well field, is a result of the oil and gas exploration and production activities

4.6 PARTICULATE MATTER LESS THAN 2.5 µm ($PM_{2.5}$)

During the intensive sampling period (Feb. 21-25, 2011), four 23-hr $PM_{2.5}$ daily composite samples were collected at the Vernal and Red Wash locations (see Fig. 4-46). The error bars shown represent the 95% confidence interval about the mean of three collocated TFE-filter based MiniVol $PM_{2.5}$ measurements (refer to "Methodologies" discussion). Historical $PM_{2.5}$ measurements in the Vernal area by the Utah Division of Air Quality (UDAQ) have shown some exceedances of the current $PM_{2.5}$ national standard (>35 µg/m^3). The concentrations during this study period were well below the allowable limits. Furthermore, Fig. 4-46 shows that a collocated, continuous, near real-time (E-BAM) $PM_{2.5}$ analyzer operated by an external operator (Golder Associates) found very similar concentrations at the Red Wash site

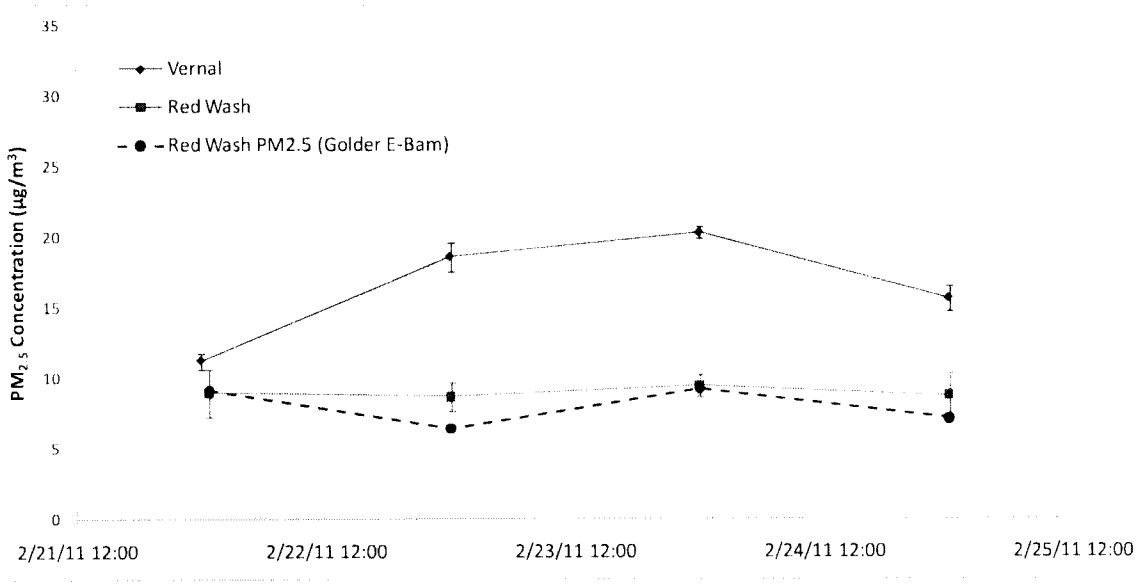

Figure 4-46. Average daily $PM_{2.5}$ at the Vernal and Red Wash sites during late Feb. 2011. The dashed line and associated symbols represent the average values reported by a collocated E-Bam operated by Golder Associates.

Chemical speciation of the collected $PM_{2.5}$ was also determined via multiple methodologies, and these composite analyses are shown in Fig. 4-47. Both sites were dominated by particle-bound carbon, accounting for around 80% of the $PM_{2.5}$ mass. This contrasts with what is observed in other areas of Utah, especially the Wasatch Front and Cache Valley, where the ionic components, most notably ammonium (NH_4^+) and nitrate (NO_3^-), often account for mass percentages similar to that of the carbon component in the Uinta Basin $PM_{2.5}$. The abundance of carbon material suggests either strong local or regional direct sources of primary carbonaceous particles or local/regional formation of photochemical secondary organic aerosols (SOAs). Either scenario adds weight to the likelihood of strong regional contributions of the oil and gas industry to the atmospheric hydrocarbon (VOC) burden of the Uinta Basin's airshed.

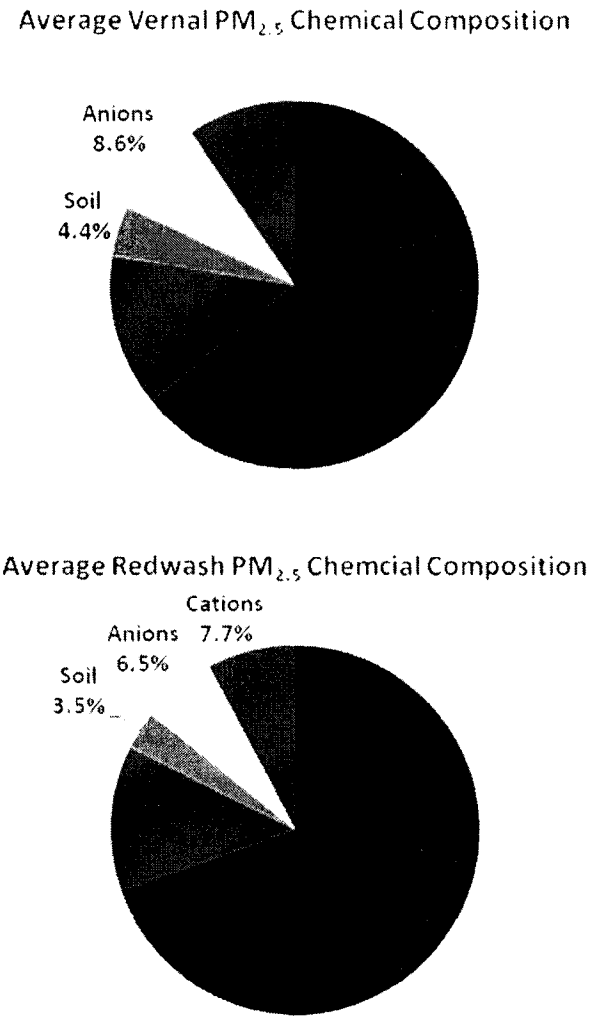

Figure 4-47. Average composite chemical composition of the collected PM2.5 for the Vernal and Red Wash sites during the Feb. 21-25, 2011 sampling period.

4.7 METEOROLOGY (INCLUDING VERTICAL PROFILES)

4.7.1 Vertical Meteorology

Vertical meteorological parameters were successfully characterized at the Red Wash site during four days in late February 2011: a low pressure system with accompanying clouds and precipitation prevented further tethersonde data collection at the end of the test period. Post analyses of the data were performed to determine the above ground level height of the tethersonde package, the stability of the atmosphere, and the depth of the surface layer, all based on measured ambient temperature, pressure, humidity, wind speed, and wind direction. Examples of the collected and calculated data used to determine both the stability of the atmosphere and the depth of the surface layer are shown in Figures 4-48 and 4-49. These figures are from an early

morning and a mid-afternoon profile, the times of day when the surface layer is usually at its lowest and highest levels, respectively.

The potential temperature profiles, calculated from actual temperature profiles with nearly identical trends, show warming temperatures with increasing altitude (i.e., a temperature inversion). Strong temperature inversions were detected during each profile measurement and extended from the ground to beyond the 250-350 m reach of the tethersonde system. Temperature inversions prohibit vertical mixing in the atmosphere, resulting in very stable conditions wherein emitted pollutants remain near the same level as their source. Measured wind speeds throughout the experiment were generally light (< 2 m/s) from the surface up to more than 200 meters. The observed calm/low wind conditions, combined with the strong, persistent temperature inversion, suggest that very little vertical mixing occurred and horizontal movement was limited within the Basin during this measurement period. This combination of surface and vertical meteorology measured during elevated ozone concentrations supports the hypothesis that local sources and their strengths are more influential in determining ozone concentrations than long distance sources or other influences from external airsheds.

The mean value of the surface layer depths estimated during both the ascent and descent of the tethersonde balloon is shown by the dotted lines in Figures 4-48 and 4-49. Note that while the surface layer in the afternoon is higher than in the morning, the level of the surface layer is still below 100 meters. This pattern was seen throughout the experiment, as shown in Fig. 4-50, with extremely shallow surface layer depths at 20-80 m. Such shallow surface layers during the afternoon are indicative of a stable atmosphere with very limited vertical mixing. Vertical wind speed measurements made at the permanent monitoring station at Red Wash (Golder Associates) indicate very little vertical movement from Feb. 21-24, 2011. It should be noted that the Red Wash site was located near the top of a ridge, which may have been near the top or above the winter-time inversion depth in the Uinta and Ashley river valleys, which is supported by personnel observations throughout each day.

Technical and instrumentation problems at the Jensen site prevented the calculation of surface layer depths and, for the most part, the extraction of useful data. However, collected wind speed data throughout the deployment were considered valid. A representative example of the wind speed profiles seen at the Jensen site is shown in Fig. 4-51 for the morning and late afternoon/evening period on Feb. 22, 2011. Wind speeds throughout the measurement period were below 3 m/s at all times. A diurnal pattern was found where calm conditions existed throughout the profile during the mornings and evenings, with low winds present at most altitudes during midday and in the afternoon.

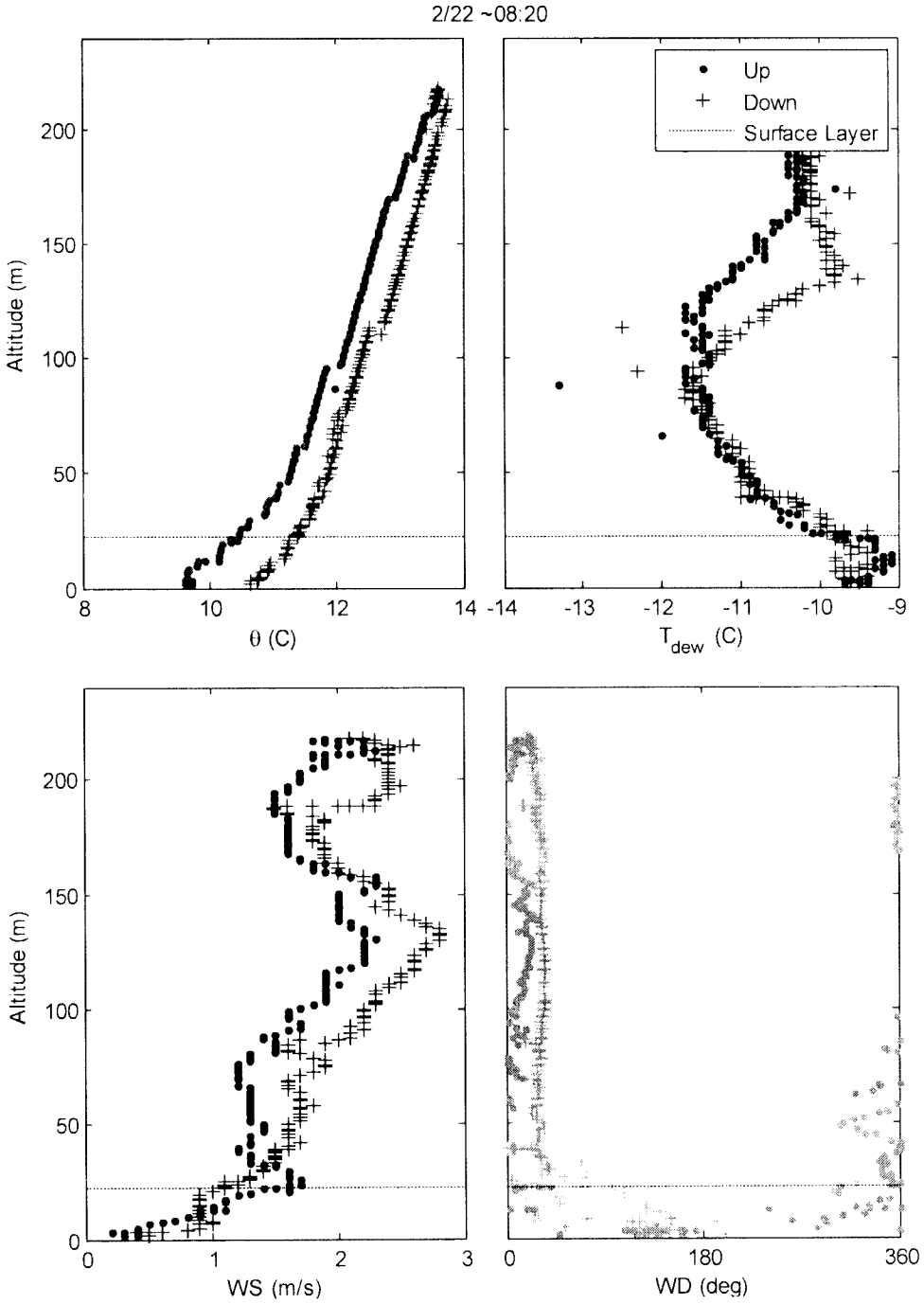

Figure 4-48. Vertical profiles of potential temperature (θ), dewpoint temperature (Tdew), wind speed (WS), and wind direction (WD) for February 22, 2011 around 08:00 hours.

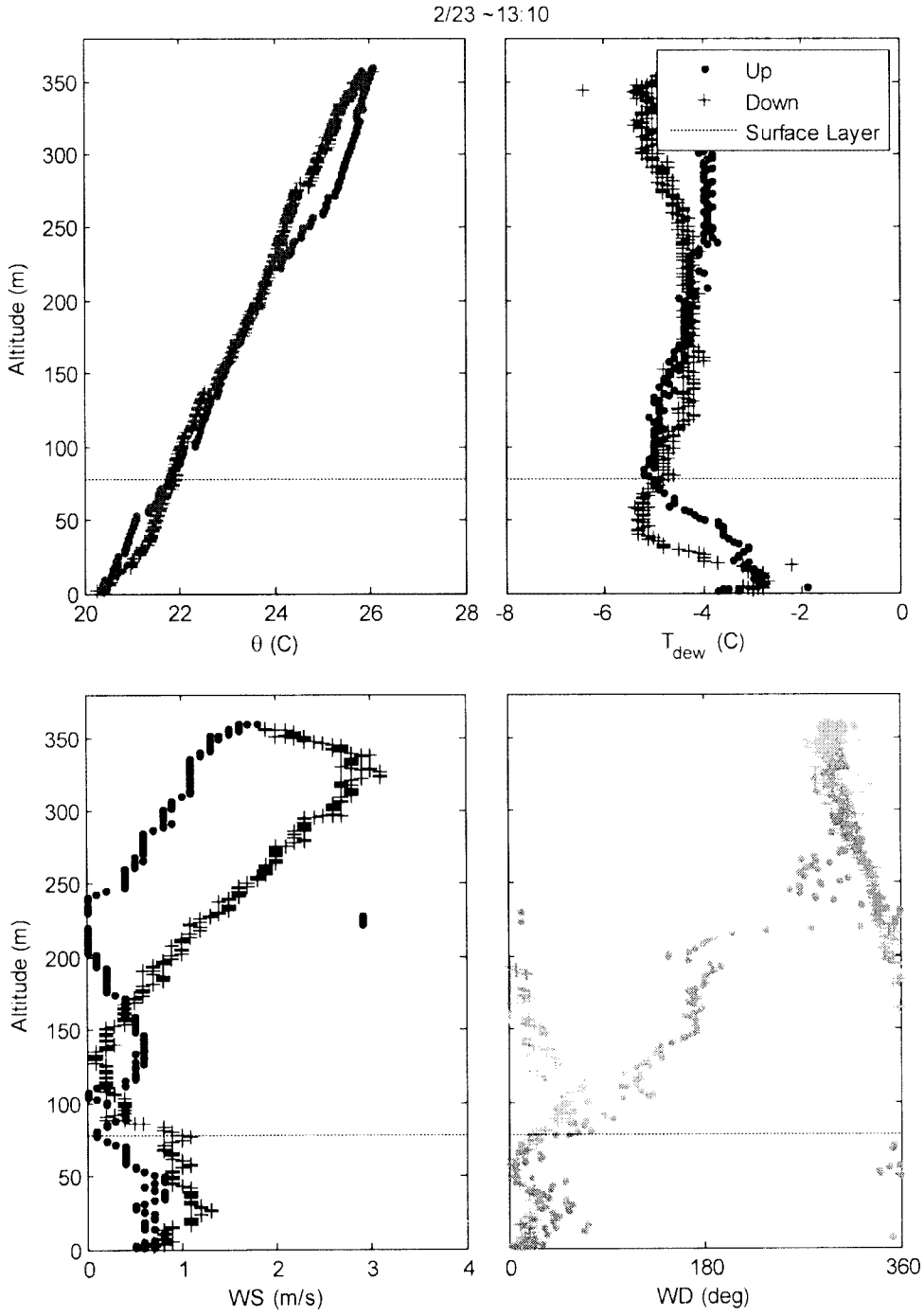

Figure 4-49. Vertical profiles of potential temperature (θ), dewpoint temperature (T_{dew}), wind speed (WS), and wind direction (WD) for February 23, 2011 around 13:00 hours.

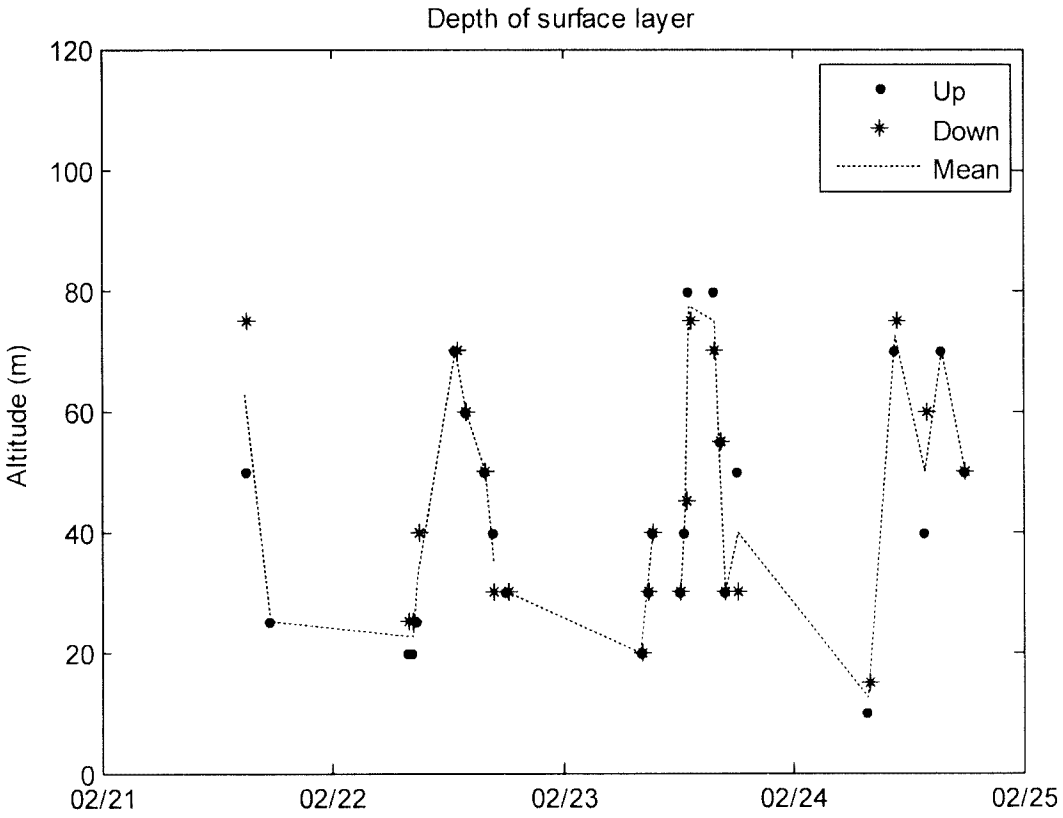

Fig. 4-50. Graphical representation of the depth of the surface layer determined for each vertical profile through examination of the collected and calculated data at the Red Wash location.

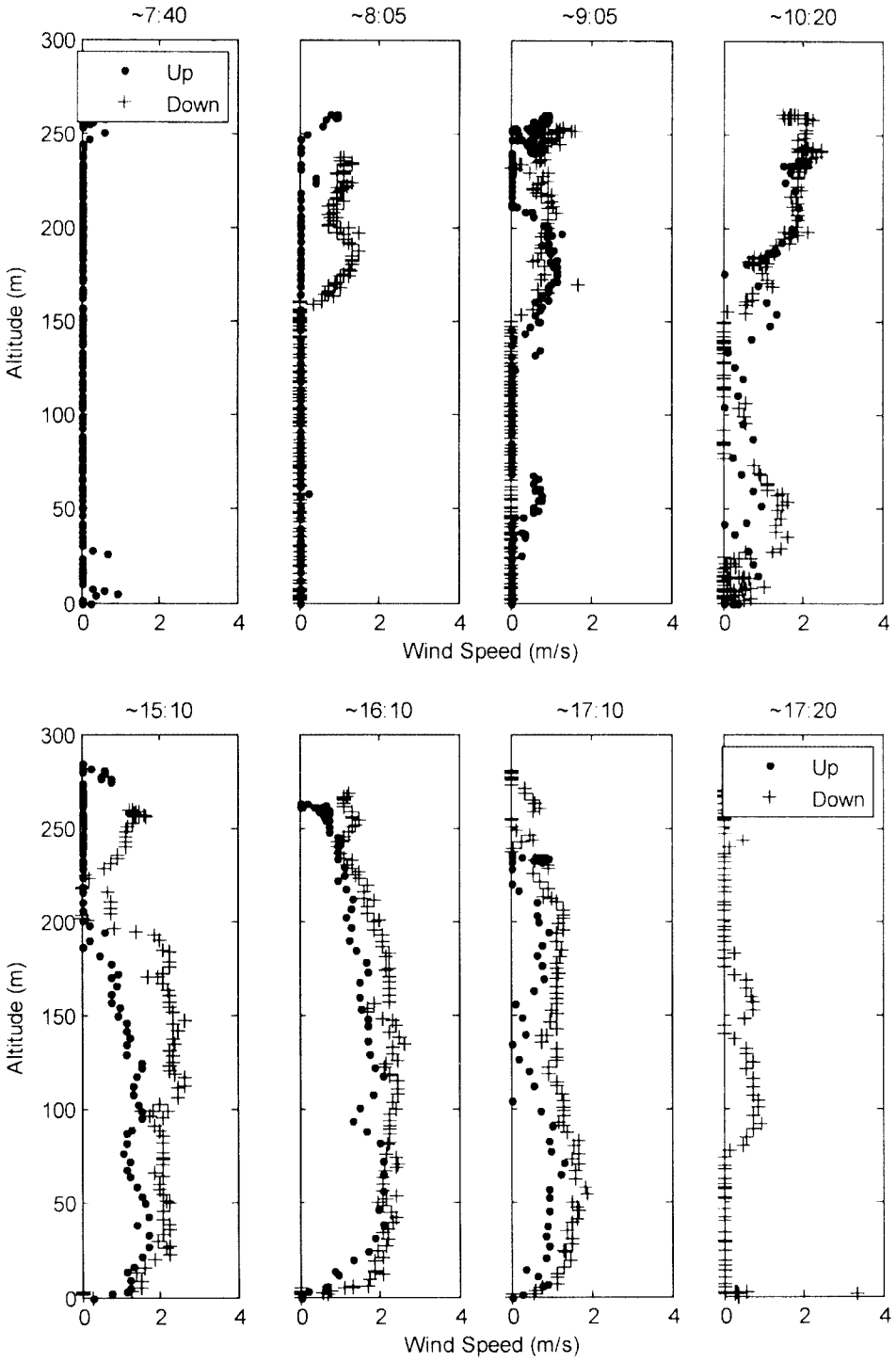

Figure 4-51.Wind sp eed versus altitude as measured during the morning and late afternoon at the Jensen site on Feb. 22, 2011.

4.8 HORIZONTAL METEOROLOGY

Meteorological stations spread throughout the Uinta Basin that measure, at a minimum, temperature, wind speed, and wind direction, were identified and data were gathered for the December 15, 2010 to March 15, 2011 time period. Data sources include Golder Associates, NPS, UDAQ/BLM, and Mesowest. Wind data were compiled and used to create windroses for periods of interest, as shown in Fig. 4-52, for the months of January and February 2011 for the (a) Fruitland, (b) Rangely, (c) Ouray, and (d) Dinosaur National Monument monitoring sites. Windroses are useful graphical representations of wind data because they can show the relative amount of time the wind *comes from* a given direction and the wind speed values measured from that direction.

In Fig. 4-52, the Fruitland data show that winds almost exclusively come from the west or northwest directions and tend to have wind speeds greater than 2 m/s. The Rangely data show that winds usually originate from the east and west with most winds less than 2 m/s. The winds at Ouray are more evenly spread from all directions and almost always have low speeds. Winds measured at Dinosaur National Monument are dominantly from the southwest direction and exclusively have wind speeds below 2 m/s. One parameter that is not represented in the graph is the number of calm hours, or hours with an average wind speed below 0.5 m/s. Calm hours accounted for 48.6% of the total hours at Dinosaur National Monument, 13.4% at Ouray, 3.9% at Rangely, and 0.2% at Fruitland.

A collection of spatially separated windroses, such as that shown in in Fig. 4-52, can be more easily understood when overlaid onto a surface map of the area of interest. Figures 4-53 and 4-54 show windroses for wind measurements from several meteorological stations located throughout the Basin for the February 2-6, 2011 and February 12-16, 2011 periods. The February 12-16, 2011 period was chosen as representative of stagnant meteorology and high pollution episodes, while the February 2-6, 2011 period was a period of dynamic meteorology and low ozone levels between strong storms. The compass grids were removed to allow map details to be seen, but all windroses used equal scales with the maximum percentage of a single bar being about 25% at the Diamond Rim and Five Mile stations on the February 12-16, 2011 map in Fig. 4-54. As can be seen from these figures, the stations at higher elevations surrounding the Basin, such as Dragon Road, Diamond Rim, Five Mile, and Upper Sand Wash recorded similar wind patterns that are very different from those measured within the valley regions of the Basin. The strong differences for both periods in the winds measured within the valley regions and at higher elevations on the edges of the Basin show that the valley is isolated from the regional air mass movement. The low wind speed dominance within the valley demonstrates the stagnant nature in the surface layer under the strong temperature inversions.

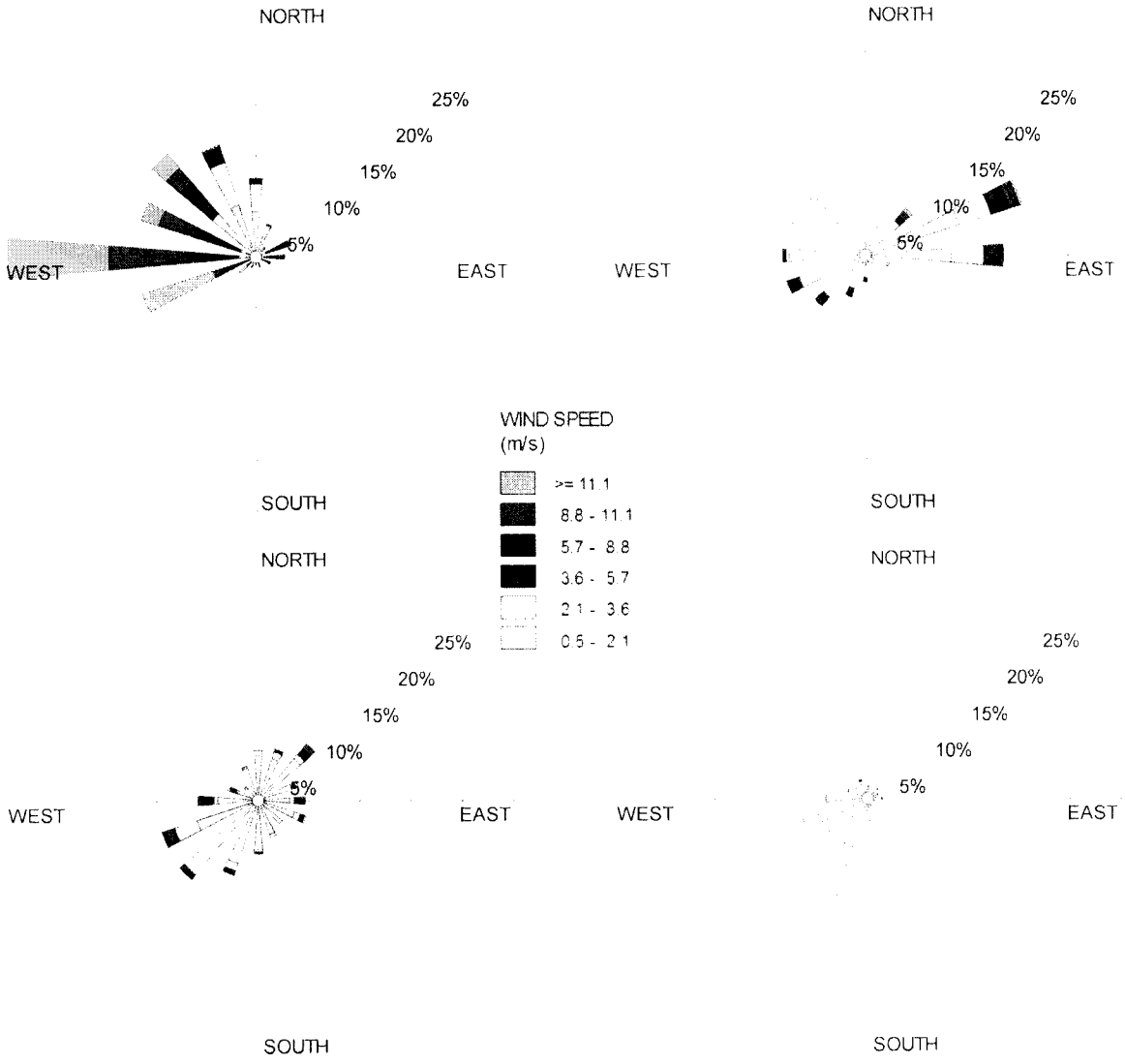

Figure 4-52.Windro ses created for (a) Fruitland, (b) Rangely, (c) Ouray, and (d) Dinosaur National Monument monitoring locations for the Jan. 1 - Feb. 28, 2011 period. Calm hours were 0.2% for Fruitland, 3.9% for Rangely, 13.4% for Ouray, and 48.6% for Dinosaur National Monument.

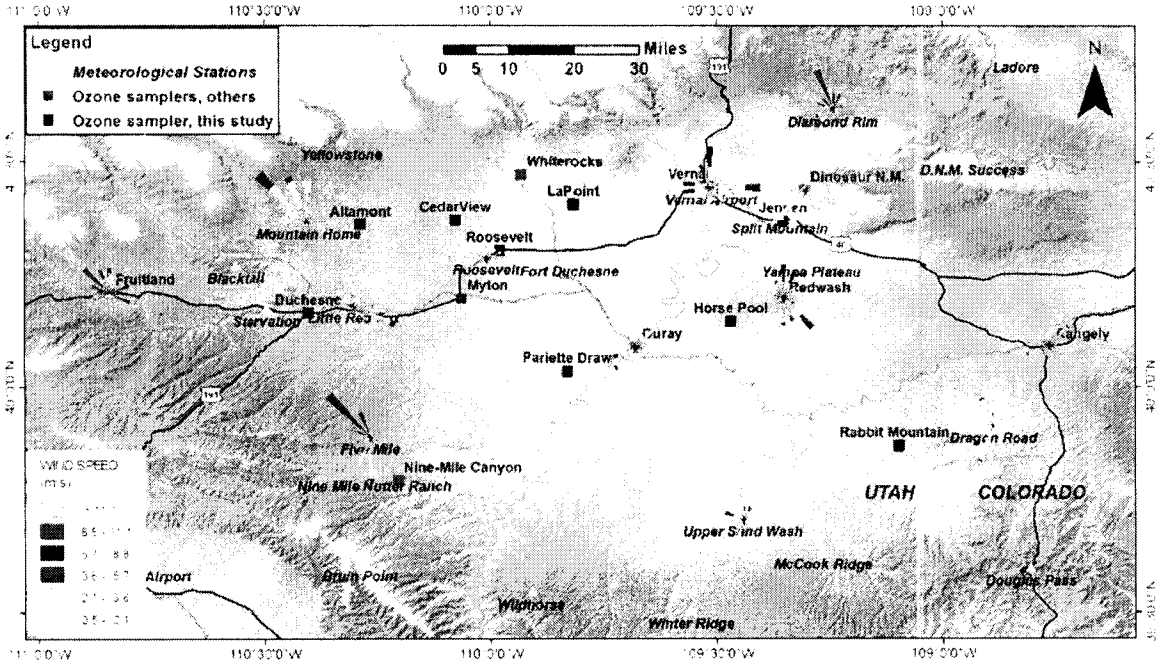

Figure 4-53. Spatially located windroses for the Feb. 2-6, 2011 period overlaid on a map of the Basin. For scale, Five Mile winds came from the northwest approximately 15% of the time.

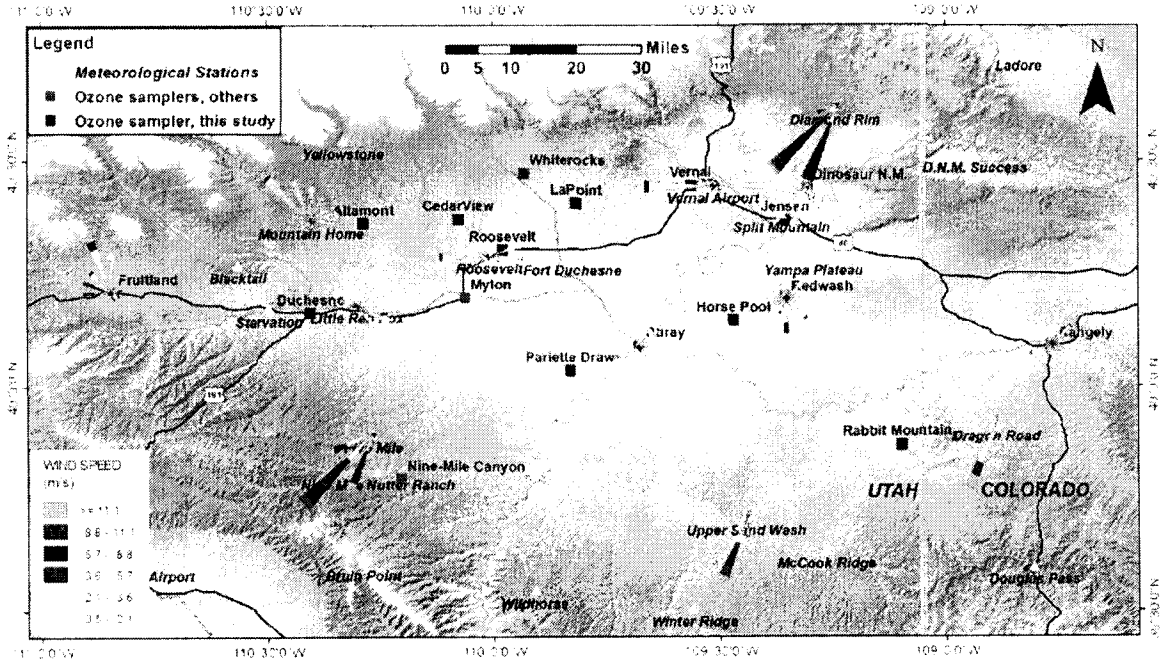

Fig. 4-54. Spatially located windroses for the Feb. 12-16, 2011 period overlaid on a map of the Basin. For scale, Diamond Rim winds came from the southwest approximately 25% of the time.

5. OZONE MODELING

5.1 INTRODUCTION

Computer models of atmospheric ozone require two interacting components: airflow and chemistry. The airflow component is required to predict how a pollutant moves about and is dispersed. The chemistry component is necessary because concentrations rise and fall as ozone is generated and consumed by chemical reactions. There are, however, some models that neglect airflow and focus on chemistry. These "box models" examine the chemical reactions occurring in a column, or "box," of air, and may also include provisions for chemical constituents entering and leaving the box through its boundaries. Box models are directly applicable to laboratory smog chamber experiments, and they can also be used to model processes in flowing air, under the assumption that the box represents a column of air moving with the ambient flow. Furthermore, box models are applicable to most ozone events, including those in the Uinta Basin, because such events occur during thermal inversions when the air is stagnant and the constituents are relatively homogeneous within the inverted layer. Given the preliminary, short-term nature of the present study, it was decided to focus on box modeling, and, in particular, on ozone chemistry at lower, wintertime temperatures. Most of our studies employed OZIPR, the EPA-approved box-model system.

Because of its low stability and high reactivity (it reacts with practically any other molecule), ozone is considered "promiscuous," and since it is hazardous at low concentrations, effective chemical modeling requires that we consider ozone's reactions even with trace gases in the atmosphere. Needless to say, atmospheric ozone chemistry is extremely complex. At the core of any chemical model of ozone production is the "mechanism," which, in the present context, consists of three components: (1) the chemical species considered by the model, (2) the chemical reactions by which the chemical species interact, and (3) a specification of the kinetic rate laws or mathematical formulas required for calculating the rate of each reaction. The rate of a given reaction depends on the concentrations of reacting species, temperature, pressure, and, for photochemical reactions, on the actinic flux (total available solar radiation). All of these dependencies are included in the reaction rate expression. There are several different "state-of-the-art" mechanisms employed in contemporary ozone models, including CB05, SAPRC, RADM, and Morphecule (Gery et al., 1989; Dodge 2000; Yarwood et al., 2005; Sarwar et al. 2008; Carter 2010). CB05 incorporates about 50 chemical species and 160 reactions, and many of these are "lumped" species or reactions, meaning that similar compounds have been grouped together to simplify the mechanism. SAPRC defines over 100 species and over 250 reactions, again with lumping (Carter 2010). According to one estimate, a mechanism that did not resort to lumping would require several thousand species and around 20,000 reactions (Dodge 2000).

Reaction rate expressions must be determined empirically, and extensive measurements are required to completely specify dependence on concentration, temperature, pressure, and actinic flux. Needless to say, it is doubtful that measurements have been performed to determine the reaction rate expressions for all the 20,000 reactions mentioned above at the sub-zero temperatures at issue in the present study. It is likely that most measurements were performed near room temperature since no motive existed to consider ozone reactions at lower temperatures when convention viewed tropospheric ozone as a summertime problem.

Three concerns about CB05 or similar mechanisms at low temperatures will be listed in the following paragraphs. Our best estimate is that current predictions of winter ozone are probably about 10 ppb too high, but with an uncertainty (one standard deviation) of about 11 ppb. Mollner et al. (2010) discussed the significance of a 10 ppb modeling mistake. The motivation of this section is not to indict the researchers who studied these reactions or who assembled CB05 or any other mechanism. The reactions are complex, their rates are difficult to measure, and for obvious reasons such measurements have focused on summertime temperatures. Rather, our motivation is, first, to indicate the limitations of applying the current mechanisms to predictions of winter ozone; and, second, to specify areas for possible future research to improve predictive capabilities at low temperatures.

5.1.1 Concern I: Temperature dependence of photolytic reactions.

The CB05 mechanism neglects the temperature dependence of the more than 20 photolytic reactions in that mechanism (Tonnesen 2011). Based on explicit calculations for five different photolytic reactions, the rate of a photolytic reaction decreases by roughly 1% for every 5 K drop in temperature. This effect leads to a decrease of 5-10 ppb in the predicted ozone concentration at temperatures near -10°C.

5.1.2 Concern II: Negative empirical activation energies.

The empirical activation energies of about 45 reactions in CB05 are negative. The most likely explanation (Tonnesen, 2011) is that the true activation energy is positive but small in magnitude. A negative activation energy reflects temperature dependence of the pre-exponential factor. There is nothing inherently wrong with a negative activation energy if it provides a reasonable empirical fit to the data; however, an extrapolation to temperatures beyond the temperature range of the data used to develop the rate expression is suspicious. In "Reactions with Negative Activation Energies" below, a comparison is shown of a "power-Arrhenius" rate law (an Arrhenius form with a pre-exponential factor that is a power function of temperature with negative exponent) with a positive activation energy against an ordinary Arrhenius form with a negative activation energy. The two equations are respectively concave up and concave down, which means that they have fundamentally different extrapolation properties. Making this change with low temperature extrapolations leads to a decrease of about 0.5 to 1 ppb in the predicted ozone concentration near -10°C.

5.1.3 Concern III: Other reactions appearing without temperature dependence.

Apart from the photolytic reactions mentioned above, about 40 reactions appearing in CB05 are displayed without any temperature dependence. This *may* indicate that the reaction is independent of temperature; however, the more likely explanation is that the rate of the reaction has only been measured at one temperature. Monte Carlo calculations shown below in "Sensitivity of the Base Model to Adjustments in Reaction Rates" are based on the premise that any reaction appearing in CB05 without temperature dependence will actually follow an Arrhenius law whose activation energy is selected randomly from a spectrum representative of all tabulated activation energies in CB05. These calculations indicate that the most-probable value of predicted ozone drops by approximately 3 ppb, but there is an uncertainty on the order of about 11 ppb.

Of the 160 reactions occurring in CB05, about 110 fit into one of the three categories of concern discussed above. Of the remaining reactions, one ($OH + NO_2 + M \rightarrow HNO_3 + M$, where M represents a generic air molecule) is particularly noteworthy. As a result of new, precise measurements, the rate of this reaction has recently been revised. The predicted ozone maximum turns out to be very sensitive to the rate of this reaction (see below), and the revision leads to an increase of 5-10 ppb in the predicted summertime ozone concentrations (Mollner et al., 2010). Unfortunately for our purposes, these new measurements were performed near room temperature, providing little guidance for adjusting the rate at low temperatures.

Fortunately, it is common practice to validate mechanisms against both field data and smog chamber measurements, and the results of such validations indicate that well-designed and properly-executed computer models are very useful tools (Dodge 2000). Low-temperature validations, however, are not available at present.

Two important caveats exist concerning computer modeling of winter ozone events. The first relates to the above discussion regarding deficiencies in applying the mechanisms at low-temperature: *None of the mechanisms has been adequately validated at low temperatures.* The second caveat relates to the fact that although VOCs in general play a role in ozone chemistry, each compound has its own reactivity: *Modeling results will be tentative until VOC speciation has been measured.* Because of several years' lead-time, VOC speciation in the Upper Green River Basin is better understood than in the Uinta Basin.

Dr. Gail Tonnesen, EPA District 8, supplied us with the computer code for OZIPR, a standard EPA-approved box-model software platform for modeling ozone events. This implementation of OZIPR utilizes the CB05 mechanism. Dr. Tonnesen also supplied a test case, including VOC speciation data, representing a typical late-winter ozone event (Feb. 20, 2008) in the UGRB (Tonnesen, 2011). The average temperature for this test case is −9°C = 264 K, and the ozone concentration rises from 24 ppb at dawn to a maximum of 122.5 ppb in the afternoon. It is noteworthy that the CB05 mechanism predicts a significant winter ozone event, but as already mentioned, we believe that the mechanism has not been adequately validated at low temperatures. The UGRB test case was used as a base model to investigate the applicability of CB05 to low temperatures (see below). Although we believe it is advisable to revise CB05 to reflect recent findings relative to the $OH + NO_2 + M$ reaction (Mollner et al., 2010), such a revision was not done in the current study; rather, CB05 was used as it was delivered to us for the calculations discussed in this report.

An important consideration when adjusting reaction rates in a mechanism is the sensitivity of the base model to a change in any given reaction. A formal definition and discussion is given in the following section. In subsequent sections, we present calculations that estimate the effects of each of the three concerns mentioned above.

In the following sections, we define two scenario temperatures: T_h = 300 K = 27°C = 80.6°F (the "hot" temperature), typical of the temperatures for which CB05 was developed, and T_c = 264 K = −9°C = 15.8°F (the "cold" temperature), typical of the temperatures occurring during the winter ozone phenomenon. We also use a '*P*' (with assorted subscripts and qualifiers to designate adjustments to the mechanism) to indicate the predicted ozone peak, or predicted daily maximum ozone concentration.

5.2 SENSITIVITY OF THE BASE MODEL TO ADJUSTMENTS IN REACTION RATES

For each one of the 160 reactions in the CB05 mechanism, simulations were performed in which individual reactions were artificially accelerated and decelerated, and the change in the predicted maximum ozone concentration was monitored. The simulations quantified the sensitivity, S_i, of the base model to the rate of reaction i. The 22 reactions with the highest sensitivities are shown in the Table 5-1. Each S_i has the units of concentration and is given in Table 5-1 in ppb units. The technical definition of S_i is given at the end of this section, but a simple example will illustrate its role: For every 1% increase in the rate of reaction i, the maximum ozone peak increases by 1% of S_i. A negative sensitivity designates that the ozone peak decreases rather than increases. The highest sensitivities are approximately ±60 ppb. There are many reactions for which the sensitivity is near 0. The column headed "Suspicious?" indicates whether the reaction belongs to one of the three categories mentioned above: P indicates a photolytic reaction, N indicates an Arrhenius law with negative activation energy, and C denotes a reaction appearing without temperature-dependence.

Table 5-1. The 22 reactions in CB05 with high sensitivities relative to the base model. See Sarwar, et al. (2008) for definitions of species' names.

Reaction	Suspicious?	Si, ppb
[1] $NO_2 + h\nu \rightarrow NO + O$	P	+60
[3] $O_3 + NO \rightarrow NO_2 + O_2$		-60
[28] $NO_2 + OH \rightarrow HNO_3$		-58
[138] $OH + XYL \rightarrow 0.7\ HO_2 + 0.5\ XO_2 + 0.2\ CRES + 0.8\ MGLY + 1.1\ PAR + 0.3\ TO_2$	N	+39
[74] $FORM + h\nu \rightarrow 2\ HO_2 + CO$	P	+31
[88] $C_2O_3 + NO_2 \rightarrow PAN$		-16
[31] $HO_2 + NO_2 \rightarrow PNA$		-15
[30] $HO_2 + NO \rightarrow OH + NO_2$	N	+14
[32] $PNA \rightarrow HO_2 + NO_2$		+14
[87] $C_2O_3 + NO \rightarrow MEO_2 + NO_2$	N	+14
[140] $MGLY + h\nu \rightarrow C_2O_3 + HO_2 + CO$	P	+14
[75] $FORM + h\nu \rightarrow CO$	P	+12
[101] $ALDX + h\nu \rightarrow MEO_2 + CO + HO_2$	P	+12
[128] $TOL + OH \rightarrow 0.44\ HO_2 + 0.08\ XO_2 + 0.36\ CRES + 0.56\ TO_2$	N	+11
[9] $O_3 \rightarrow O_2 + O(^1D)$	P	+9
[10] $O(^1D) + M \rightarrow O + M$	N	9
[11] $O(^1D) + H_2O \rightarrow 2\ OH$	C	+9
[129] $TO_2 + NO \rightarrow 0.9\ NO_2 + 0.9\ HO_2 + 0.9\ OPEN + 0.1\ NTR$	C	+9
[130] $TO_2 \rightarrow CRES + HO_2$	C	-8
[86] $ALD2 \rightarrow MeO_2 + CO + HO_2$	P	+5
[159] $NO_2 \rightarrow NO_2S$	P	+5
[160] $NO_2S + H_2O \rightarrow OH + HONO$	C	+5

Obviously, if a reaction has either a large positive or negative sensitivity, then it is important to have an accurate determination of its reaction rate. With smaller sensitivities, accurate determination of the reaction rate is perhaps less critical. For example, reaction [28], OH + NO_2

+ M → HNO_3 + M, is the reaction whose rate was recently modified by Mollner, et al., and with a sensitivity of –58 ppb, it is among the most sensitive reactions in the model. The room-temperature revision of its rate constant constitutes a decrease of approximately 15% in the reaction rate. If we can expect a similar decrease at lower temperatures, then we would expect this revision to generate a change of ln(0.85) × (–58 ppb) = +9 ppb in the predicted ozone peak. As already mentioned, the new measurements were only done at 298 K, and the precise extent to which the low-temperature rate should be modified is not clear.

These sensitivities can also be used to indicate useful mitigation strategies. For example, reactions 128 and 138 are the only reactions in the mechanism that involve toluene and xylene respectively, and their respective sensitivities are +39 and +11 ppb. Because both reactions are first-order in toluene and xylene, respectively, then a 10% reduction in the concentration of both is predicted to change the ozone concentration by ln(0.9) × (39 + 11) ppb = –5 ppb.

The formal definition of S_i is shown in Eq. 5-1, where $P(0)$ represents the ozone peak concentration of the base model, $P_i(+)$ and $P_i(-)$ represent the ozone peak concentrations of the models for which reaction i has been accelerated or decelerated by the factors $e^{+0.15} = 1.162$ and $e^{-0.15} = 0.861$.

$$S_i = \frac{1}{2}\left(\frac{P_i(+) - P(0)}{0.15} + \frac{P(0) - P_i(-)}{0.15} \right) = \frac{P_i(+) - P_i(-)}{0.3} \qquad \text{(Eq. 5-1)}$$

Eq. 5-1 is equivalent to the numerical estimation of a derivative, so an alternative definition is

$$S_i = \frac{\partial P}{\partial (\ln z_i)} \qquad \text{(Eq. 5-2)}$$

where z_i represents the speed of reaction i. In practice, the rate of the reaction can be accelerated by multiplying the acceleration factor $e^{+0.15}$ by all of the coefficients in the rate expression that contain units of time^{-1}. Because the MS-DOS implementation of OZIPR rounds off all P values to the nearest 0.1 ppb, the detection level of S_i by this formula is about ±1 ppb.

5.3 TEMPERATURE DEPENDENCE OF PHOTOLYTIC REACTIONS

CB05 and other standard mechanisms neglect the temperature dependence of photolytic reactions. This is not a problem for summer ozone but does affect the prediction of winter ozone as discussed below. The rate of any photolytic reaction, $j(T)$, is given by Eq. 5-3 (Finlayson-Pitts & Pitts, 2000, p. 76):

$$j(T) = \int_{\lambda_{min}}^{\lambda_{max}} d\lambda \, F(\lambda)\sigma(\lambda, T)\Phi(\lambda, T) \qquad \text{(Eq. 5-3)}$$

where $F(\lambda)$ is the actinic flux, $\sigma(\lambda,T)$ is the absorption cross-section, and $\Phi(\lambda,T)$ is the quantum yield (Note: the temperature dependence of each term is explicitly shown). The noontime value of $j(T)$ was calculated for several reactions at different temperatures. Actinic flux values in every case were taken from the 80%-albedo tabulation of Finlayson-Pitts & Pitts (2000, p.71) using the minimum solar zenith angle for the UGRB on Jan. 31, which was 59.8°. Absorption cross-sections and quantum yields are available from two sources, either a pdf document (Sander et al., 2006) or as downloadable text files (Keller-Rudek and Moortgat). The following paragraphs summarize these calculations. The integration resolution was 1 nm, using linear interpolation whenever the tabulated values were not available at that resolution.

Fig. 5-1 displays each integrand of Eq. 5-3, i.e., the product $F\sigma\Phi$, as a function of wavelength for each of the integrations. The final value of each rate constant is equal to the area under the corresponding curve in Fig. 5-1, and is reported in Table 5-2.

- Reaction: $O_3 \rightarrow O_2 + O$ at $T = 218$ K. The integration range is $\lambda \in [290\text{ nm}, 340\text{ nm}]$; σ data are available in the interval $\lambda \in [196\text{ nm}, 342\text{ nm}]$ from Table 4-5 of Sander et al. (2006), as downloaded directly from Keller-Rudek & Moortgat. The quantum yield splits into two channels: Φ_1 and Φ_2, corresponding to the production of $O(^1D)$ and O, respectively; hence, Φ_2 applies to this reaction. (As a point of clarity, $O(^1D)$ refers to the higher energy "singlet" state of the oxygen atom, and O represents the more common "triplet" state.) An empirical formula is given (Sander et al., 2006, pp. 4-16, 4-17) for Φ_1 in the interval $\lambda \in [306\text{ nm}, 328\text{ nm}]$ and over the temperature range $T \in [200\text{ K}, 300\text{ K}]$; outside that interval, the recommendations are $\Phi_1 \approx 0.08$ for $\lambda \in [329\text{ nm}, 340\text{ nm}]$ and $\Phi_1 \approx 0.90$ for $\lambda < 360$ nm, both recommendations being independent of temperature. No recommendation is given above 340 nm, except for a warning that Φ_1 might be non-zero. The upper bound for the integration was, therefore, set at 340 nm. Then Φ_2 was calculated as $1 - \Phi_1$.
- Reaction: $O_3 \rightarrow O_2 + O$ at $T = 295$ K. The integration range is $\lambda \in [329\text{ nm}, 340\text{ nm}]$; σ data are available in the interval $\lambda \in [185\text{ nm}, 825\text{ nm}]$ from Table 4-5 of Sander et al. (2006), and downloaded directly from Keller-Rudek & Moortgat. The source for Φ is the same as at $T = 218$ K.
- Reaction: $O_3 \rightarrow O_2 + O(^1D)$ at both $T = 218$ K and 295 K. Sources for σ and Φ are the same as for the $O_3 \rightarrow O_2 + O$ reaction, except that now the quantum yield corresponds to the Φ_1 channel.
- Reaction: $NO_2 \rightarrow NO + O$, lower T. Absorption cross-sections are available at 220 K, and quantum yields at 248 K. For this calculation, therefore, the temperature will be reported as 234 K. The integration range is $\lambda \in [290\text{ nm}, 422\text{ nm}]$. σ-data are from Table 4-12 of Sander et al. (2006), and downloaded directly from Keller-Rudek and Moortgat in the interval $\lambda \in [241\text{ nm}, 662\text{ nm}]$. Φ-data in the interval $\lambda \in [300\text{ nm}, 422\text{ nm}]$ are obtained from Table 4-13 of Sander et al. (2006) and downloaded directly from Keller-Rudek and Moortgat, and extrapolated to 290 nm.
- Reaction: $NO_2 \rightarrow NO + O$, higher T. Absorption cross-sections are available at 294 K, and quantum yields at 298 K. The temperature will be reported as 296 K for this integral.

The integration range is $\lambda \in$ [290 nm, 422 nm]. Sources for σ and Φ are the same as this reaction at lower temperatures.

- Reaction: $H_2O_2 \rightarrow OH + OH$. No σ data are available above 350 nm, while Fig. 5-1 indicates that absorption above 350 nm is significant. Consequently, an extrapolation was applied equivalent to a 15% augmentation of the integral truncated at 350 nm. The integration range is $\lambda \in$ [290 nm, 350 nm]. Two different sources for σ are provided by Sander et al.: a tabulation, Table 4-9, downloadable from Keller-Rudek and Moortgat, and an empirical formula, Table 4-10; both were employed in separate integrations. The source for Φ is Sander, et al. (2006, p. 4-19): "At and above 248 nm the quantum yield for OH production is 2." The relevant yield for the current calculation is production of a pair of OH radicals; therefore, $\Phi = 1$ was employed. All results appearing in Table 5-2 include the 15% correction.
- Reaction: $MeOOH + O_2 \rightarrow HCHO + HO_2 + OH$. No σ data are available above 365 nm, while it appears that absorption still occurs at higher wavelengths; therefore, just as with the hydrogen peroxide reaction, the final integral is augmented by 7%. A temperature is not given; hence, $T \approx 300$ K is assumed. The integration range was set at $\lambda \in$ [290 nm, 365 nm]. σ was obtained from Sander et al., Table 4-37, downloadable from Keller-Rudek and Moortgat. Sander et al., p. 4-53 report that the quantum yield is unity. The result appearing in Table 5-2 includes the 7% correction.
- Reaction: $HCHO + 2O_2 \rightarrow 2HO_2 + CO$. The quantum yield for photodissociation of formaldehyde involves three separate channels, designated channels 1 through 3 by Sander et al. (Channel 2 is considered below; channel 3 will not be considered here.) The current reaction corresponds to channel 1, whose quantum yield is reported to be independent of T and P, and given by an empirical formula (Sander et al., p. 4-44). Cross-section data are available at two temperatures. The integration range is taken to be $\lambda \in$ [290 nm, 365 nm]. σ came from Sander et al., Table 4-30 and 4-31, downloaded from Keller-Rudek and Moortgat.
- Reaction: $HCHO \rightarrow H_2 + CO$. Sander et al. (2006) report that three channels are involved in the photodissociation of formaldehyde, with the current reaction corresponding to channel 2. It is found in Sander et al., Table 4-32, but only tabulated at 298 K, and reported to have a complex temperature dependence. Only a single temperature, therefore, was considered for this reaction. The integration range was set at $\lambda \in$ [290 nm, 361 nm]. σ was obtained from Sander et al., Table 4-30, downloaded from Keller-Rudek and Moortgat.

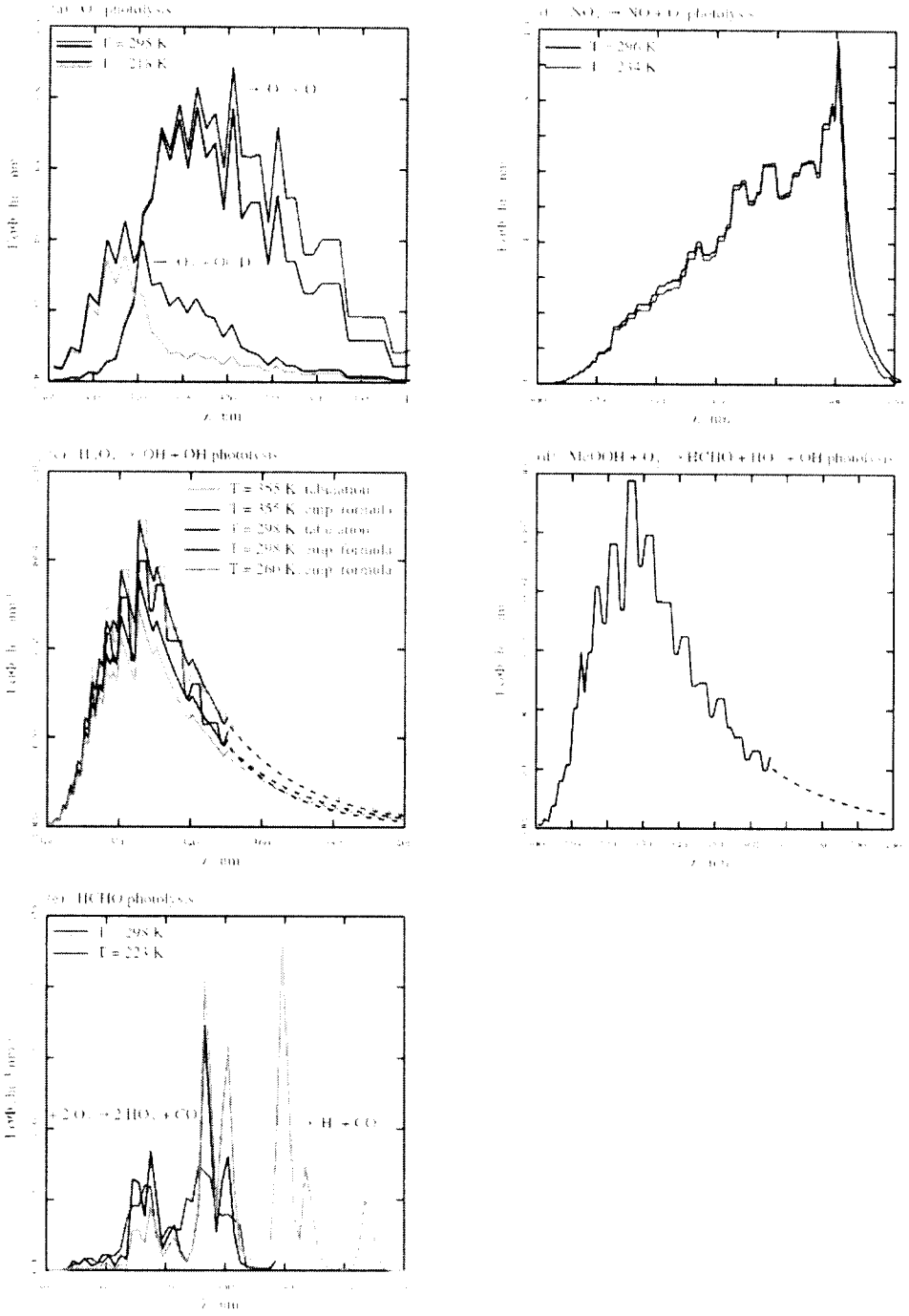

Figure 5-1. The products $F\sigma\Phi$ (F = actinic flux, σ = absorption cross-section, Φ = quantum yield) for the indicated reactions at the indicated temperatures. In panels (c) and (d), dashed curves represent extrapolations explained in the text.

With results at two temperatures, a linear interpolation can be applied to estimate temperature-dependence. Three temperatures are available for the hydrogen peroxide reaction, but in this case there is sufficient scatter that a linear regression is most appropriate. Therefore, we will represent the temperature dependence of photolytic reactions with the following linear formula:

$$j = j_h + \Gamma\left(T - T_h\right) \qquad \text{(Eq. 5-4)}$$

j_h is the rate constant at $T = T_h$, while Γ is the slope. Values of j_h and Γ, obtained by linear interpolation or linear regression, are collected in Table 5-2. For comparison, we also display j_{CB05}, or the value of the rate constant as assigned in CB05. There is generally good agreement between j_h and j_{CB05} values; the variation can probably be attributed to use of different data sets for σ and Φ, different assumptions about actinic flux and albedo, or to different conventions in performing the numerical integrations. The one exception to this is the reaction $O_3 \rightarrow O_2 + O$, for which the rate employed in CB05 is about 10 times larger than the rate we calculate. The sensitivity value for this reaction, however, is undetectably low, and a direct modification of the rate by one order of magnitude changes P by only 0.1 ppb.

Table 5-2. Results of computations of photolytic rate constants.

Reaction	j, current result,[a] min^{-1}	j_{CB05}, min^{-1}	j_h,[d] min^{-1}	Γ, $min^{-1}\,K^{-1}$	Γ/j_h, $10^{-3}\,K^{-1}$
$O_3 \rightarrow O_2 + O$	2.60×10^{-3} (218) 3.15×10^{-3} (295)	3.56×10^{-2}	3.18×10^{-3} (0.09)	7.2×10^{-6}	2.3
$O_3 \rightarrow O_2 + O(^1D)$	7.43×10^{-4} (218) 1.19×10^{-3} (295)	1.14×10^{-3}	1.22×10^{-3} (1.07)	5.8×10^{-6}	4.8
$NO_2 \rightarrow NO + O$	0.727 (248) 0.768 (296)	0.711	0.772 (1.09)	6.7×10^{-4}	0.86
$H_2O_2 \rightarrow OH + OH$	4.40×10^{-4} (260)[b] 4.98×10^{-4} (298)[b] 5.48×10^{-4} (298)[c] 6.17×10^{-4} (355)[b] 6.22×10^{-4} (355)[c]	5.07×10^{-4}	5.20×10^{-4} (1.03)	1.8×10^{-6}	3.5
$MeOOH + O_2 \rightarrow HCHO + HO_2 + OH$	3.63×10^{-4} (?)	3.63×10^{-4}	N.A. (1.00)	N.A.	N.A.
$HCHO + 2O_2 \rightarrow 2HO_2 + CO$	1.97×10^{-3} (223) 2.07×10^{-3} (298)	1.91×10^{-3}	2.07×10^{-3} (1.08)	1.3×10^{-6}	0.65
$HCHO \rightarrow H_2 + CO$	3.67×10^{-3} (298)	3.29×10^{-3}	N.A. (1.12)	N.A.	N.A.

[a]Kelvin temperature appears in parentheses. [b]Empirical formula, Sander et al., Table 4-10. [c]Tabulation, Sander et al., Table 4-9. [d]The quantity in parentheses is the ratio j_h/j_{CB05}.

Note that the values of Γ, as calculated for five different reactions, are always positive. This indicates that each of the photolytic reactions is slower at lower temperatures. Note also that the rates j can vary over several orders of magnitude; nevertheless, the value of Γ/j_h is relatively invariant, with a median value of about 0.002 K^{-1}. Taking this value to be typical of all photolytic reactions in the mechanism, and using the sensitivity values defined in the previous

section, we can estimate the severity of neglecting the temperature dependence of these reactions. The corrected estimate of the ozone peak concentration is given by Eq. 5-5:

$$P = P(0) + \sum_i \frac{\partial P}{\partial(\ln j_i)} \frac{\partial(\ln j_i)}{\partial T}\left(T_c - T_h\right) \qquad \text{(Eq. 5-5)}$$

where $P(0)$ represents the ozone peak in the base model, $P(0) = 122.5$ ppb. The sum extends over all of the photolytic reactions in the mechanism. Note that the first partial derivative is S_i, and the second partial derivative is Γ/j_h for the i^{th} reaction, which is estimated as 0.002 K^{-1}. CB05 has 11 photolytic reactions with detectable sensitivities, $\sum_i S_i$ for these 11 reactions is +131 ppb. We estimate, therefore, that

$$\Delta P = \left(0.002 K^{-1}\right) \times \left(-36 K\right) \times \left(131 ppb\right) = -9 ppb \qquad \text{(Eq. 5-6)}$$

A more accurate determination of the effect can be achieved by modifying the base mechanism. Let j_{CB05} represent the base rate for any particular photolytic reaction as it is defined in CB05. We assume that its value in the lower temperature range can be estimated as

$$j^*_{CB05} = j_{CB05}\left[1 + \left(\frac{\Gamma}{j_h}\right)\left(T_c - T_h\right)\right] \qquad \text{(Eq. 5-7)}$$

Γ/j_h has only been determined for 5 reactions; for all others, we use the estimate 0.002 K^{-1}. Let CB05* represent the mechanism for which all photolytic reactions are modified in this way, and for which all other reactions maintain the same rate expressions as in CB05. When the base model is run with the CB05* mechanism, we obtain

$$P(CB05^*) = 115.8 \text{ ppb} \qquad \text{(Eq. 5-8)}$$

or a decrease of 6.7 ppb. (The main reason that this correction is smaller than that of Eq. 5-6 is that the most sensitive reaction, that of NO_2, has a Γ/j_h value smaller than 0.002 K^{-1}.)

5.4 REACTIONS WITH NEGATIVE ACTIVATION ENERGIES

As mentioned above, it is conjectured that the reactions with negative activation energies might be giving poor extrapolations at lower temperatures. The empirical rate law is written

$$k = A \exp\left(\frac{-E_{ae}}{T}\right) \qquad \text{(Eq. 5-9)}$$

(We report all activation "energies" in Kelvin units – the activation energy divided by the gas constant.) Fig. 5-2 is based on the reaction OH + XYL (hydroxyl radical and xylene), which has the highest sensitivity, +39 ppb, among all the reactions with negative activation energies. In CB05, its rate expression is shown in Eq. 5-9 with Arrhenius parameters $E_{ae} = -116$ K and $A = 0.17 \times 10^{-10}$ cm^3 molecule^{-1} min^{-1}. A more appropriate extrapolation law could be a "power-Arrhenius" law:

$$k = B\left(\frac{T}{T_h}\right)^x \exp\left(\frac{-E_a}{T}\right) \qquad \text{(Eq. 5-10)}$$

where E_a is constrained to be positive. Given some constrained value of E_a, we determine B and x such that the two curves are tangent at $T = T_h$. This implies

$$\ln B = \ln A + \frac{\left(E_a - E_{ae}\right)}{T_h} \quad \text{and} \quad x = \frac{\left(E_{ae} - E_a\right)}{T_h} \qquad \text{(Eq. 5-11)}$$

For the OH + XYL example, employing $E_a = 300$ K gives $x = 1.387$ and $B = 0.6803 \times 10^{-10}$ cm^3 molecule^{-1} min^{-1}. Fig. 5-2 shows that the two curves are respectively concave up and concave down, and that they are detectably different at $T = T_c$. The power-Arrhenius extrapolation at T_c is 1.2% lower than the Arrhenius extrapolation. With a sensitivity of +39 ppb, the adjustment in this reaction alone will lead to a –0.5 ppb change in the ozone peak concentration.

OZIPR calculations were made to illustrate this effect, and rather than replace the existing Arrhenius law with a power-Arrhenius law, a new Arrhenius law was used:

$$k = A' \exp\left(\frac{-E'_{ae}}{T}\right) \qquad \text{(Eq. 5-12)}$$

This was chosen to be tangent to the power-Arrhenius law at $T = T_c$. The parameters of the new law obey

$$E'_{ae} = T_c x + E_a \qquad \text{(Eq. 5-13)}$$

and

$$\ln A' = \ln B - \frac{\left(E_a - E'_{ae}\right)}{T_c} + x \ln\left(\frac{T_c}{T_h}\right) \qquad \text{(Eq. 5-14)}$$

This modification was applied to all the Arrhenius laws that appear in the CB05* mechanism with negative activation energies, using three different values of E_a calculated at different

temperatures: E_a = 0 K, 200 K, and 300 K. The three modifications of the mechanism were denoted CB05*0, CB05*2, and CB05*3, respectively, and resulted in the following peak ozone concentrations:

P(CB05*0) = 115.5 ppb; P(CB05*2) = 115.2 ppb; P(CB05*3) = 115.0 ppb (Eq. 5-15)

These results show that this modification of the mechanism has a weaker effect, less than 1 ppb for the cases we examined.

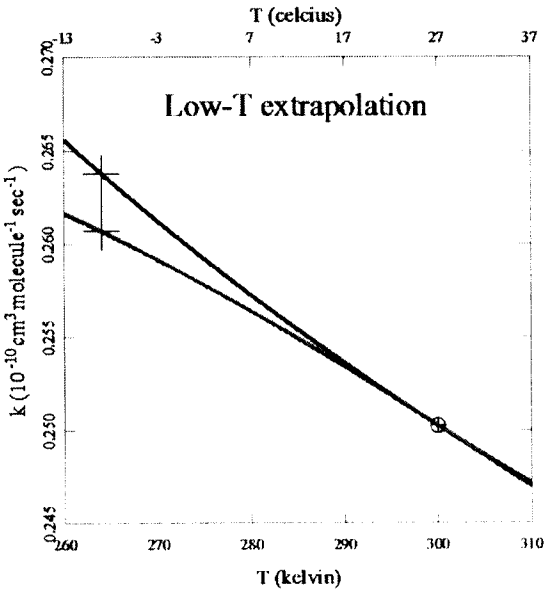

Figure 5-2. An Arrhenius law with negative activation energy (blue) overestimates the rate constant at low temperature.

5.5 REACTIONS WITHOUT TEMPERATURE DEPENDENCE

We now examine the effect of another modification of the CB05 mechanism. Approximately 40 reactions appear in the mechanism without any temperature dependence. Several of these have sensitivities approaching ±10 ppb (See Table 5-1). In most cases, this probably means that the reaction has only been measured near T_b. The following discussion shows the change in the predicted ozone peak concentrations if a typical Arrhenius structure is used for these reactions.

One way to estimate the effect is to assume that all the reactions in question have precisely the same activation energy. For consistency with other reactions, we will assume an activation energy, E_a = 336 K, which is the average activation energy taken of all the Arrhenius reactions in the mechanism. The change in the peak ozone concentration is given by Eq. 5-16:

$$\Delta P \approx \sum_i \frac{\partial P}{\partial(\ln k_i)} \Delta(\ln k_i) \approx \sum_i \frac{\partial P}{\partial(\ln k_i)} E_a \left(\frac{1}{T_b} - \frac{1}{T_i} \right) \qquad \text{(Eq. 5-16)}$$

where the sum extends over all of the reactions appearing without temperature-dependence. The partial derivative corresponds to our definition of sensitivity, S_i. In addition,

$$\Delta \ln k_i = E_a\left(\frac{1}{T_h} - \frac{1}{T_c}\right) = -0.153 \qquad \text{(Eq. 5-17)}$$

The net sum of S_i over all the relevant reactions is +19 ppb. Therefore, our prediction is a –2.9 ppb change in the maximum ozone level:

$$P(\text{CB05*3*}) = 112.1 \text{ ppb} \qquad \text{(Eq. 5-18)}$$

where "CB05*3*" denotes this latest version of the mechanism.

Monte Carlo techniques were also used to investigate the assumption of a single activation energy. In each independent Monte Carlo calculation, the activation energy was selected from a normal distribution with a pre-specified mean $\langle E_a \rangle$ and standard deviation σ. The rates of all other reactions were given by the CB05*3 modification described above. Separate runs were performed with $\langle E_a \rangle = \pm 336$ K, ± 200 K, ± 100 K, and 0 K; and with $\sigma = 1620$ K, 1000 K, and 100 K. +336 K and 1620 K are the mean and standard deviation, respectively, of all of the Arrhenius laws in the original CB05 mechanism. Therefore, for the run at $\langle E_a \rangle = +336$ K and $\sigma = 1620$ K, the proposed Arrhenius expressions are drawn from a spectrum of values that is typical of and statistically similar to the known Arrhenius expressions. Additional runs with different values of $\langle E_a \rangle$ and σ illustrate the dependence on the activation energy spectrum. Each separate run included 10,000 simulations. Fig. 5-3 shows the distribution in simulated ozone obtained for $\langle E_a \rangle = +336$ K and $\sigma = 1620$ K. The mode of each Monte Carlo distribution, P(mode) (the most probable value of P or maximum in the distribution) is well represented by a variant of Eq. 5-16,

$$P(\text{mode}) \approx P(CB05*3) + \sum_i S_i \langle E_a \rangle \left(\frac{1}{T_h} - \frac{1}{T_c}\right) \approx P(CB05*3) - \langle E_a \rangle \left(0.0086 \frac{ppb}{K}\right) \qquad \text{(Eq. 5-19)}$$

while the standard deviation of each distribution is approximately proportional to the standard deviation in the input activation energies:

$$\sigma(P) = \left(0.007 \frac{ppm}{K}\right)\sigma \qquad \text{(Eq. 5-20)}$$

Therefore, the most probable P is still given by equations such as 5-16 or 5-19 and, therefore, at about P(CB05*3*) = 112.1 ppb. Uncertainty in individual activation energies ($\sigma = 1620$ K), however, generates uncertainty in the final value of the ozone maximum concentration, with a standard deviation of $\sigma(P) = 11$ ppb.

5.6 SUMMARY

Winter ozone events have been observed in both the Uinta Basin in Utah and the UGRB in Wyoming. Modeling of these events relies on chemical mechanisms such as CB05 that were originally designed for predicting summer ozone concentrations. During the modeling efforts of this project, three areas of concern were identified with applying CB05 at lower temperatures, and calculations were performed to estimate the severity of each of these concerns. For these calculations, a base model was designed to simulate a late-winter day, Feb. 20, 2008 in the Upper Green River Basin (Tonnesen, 2011). Table 5-3 and Fig. 5-3 summarize the results of these calculations.

The first concern is that CB05 neglects temperature-dependence of all photolytic reactions. The temperature-dependence was calculated for five different reactions, which show that photolytic reactions slow down by roughly 1% for each 5 K drop in temperature. This slowdown decreases the predicted ozone concentration by about 7 ppb when the temperature changes from 27° C to -10° C (Table 5-3 and Fig. 5-3).

The second concern is that many reactions in CB05 appear with negative activation energies. If we assume that the true activation energies are positive and that the negative activation energy reflects a temperature dependence of the pre-exponential factor (Tonnesen, 2011), it follows that extrapolations to lower temperatures might not be valid. Consequently, "power-Arrhenius" rate laws were used to obtain new low-temperature extrapolations. The effect in this case is estimated to be weak, resulting in changes in predicted ozone concentrations of less than 1 ppb.

The third concern is that many reactions appear in the mechanism with no temperature dependence at all. The obvious conclusion is that most, if not all, of the reaction rates were only measured at a single temperature in the vicinity of 300 K. There are two possible approaches to estimating these rate constants at lower temperatures. The first approach is to assume that they all have the same constant activation energy set equal to the mean of all other tabulated activation energies in the mechanism, resulting in an additional 3 ppb decrease in the predicted ozone levels (See Table 5-3 and Fig. 5-3). The second approach is to assume a spectrum of activation energies for these reactions that was typical of all the tabulated activation energies in the mechanism. This approach was applied in Monte Carlo calculations, with the result that the most-probable value of predicted ozone concentrations agrees well with the value obtained for the constant activation energy case (the same –3 ppb change), but that predicted ozone concentration now has an uncertainty of about 11 ppb (one standard deviation).

The incremental differences in simulated ozone levels discussed previously are shown in Fig. 5-3 as vertical bars of different colors. The white bar shows the base prediction obtained using the unmodified CB05 mechanism. The yellow bar shows the prediction of the CB05*3 mechanism, with the modifications accounting for temperature-dependence of photolytic reactions and reactions with negative empirical activation energies. The red bar displays the prediction of the CB05*3* mechanism, with the above modifications and the modification that any reaction appearing without temperature dependence follows an Arrhenius law with a typical activation energy. The complete bar graph displays the prediction based on the assumption that activation energies for reactions appearing without temperature dependence may be drawn from a typical spectrum of activation energies. These incremental adjustments also appear in Table 5-3. According to the final distribution in Fig. 5-3, there is an 80% chance that a mechanism with the

discussed modified temperature dependence will predict ozone values lower than the values predicted with the original CB05 mechanism.

It is our recommendation that the CB05 mechanism be modified to incorporate the recent measurements of the OH + NO_2 + M reaction. Such a modification will probably produce an increase of 5 to 10 ppb in the predicted ozone peak concentrations (see Mollner et al., 2010 as well as calculations summarized above). All calculations discussed in this report, however, employed the standard CB05 mechanism, in part at least because the new measurements were only done at room temperature. To a first approximation, revision of the rate parameters for this reaction would apply equally to all of the results summarized in Fig. 5-3 or Table 5-3. Finally, our calculations indicate that the rate expression in CB05 for the photolytic reaction $O_3 \rightarrow O_2 + O$ is about a factor of 10 too large; however, the sensitivity of the CB05 mechanism to this reaction, at least relative to the calculations for this project, is very low, and revisions to this reaction did not affect our results.

It is hoped that these results will stimulate additional interest in measuring reaction rates at lower temperatures. The reactions listed in Table 5-1, especially those designated as "suspicious" and having large sensitivities, deserve special attention.

Table 5-3. Estimates of the effects of including improved temperature-dependence on predicted winter ozone concentrations.

Description	Designation	[O3] max, ppb
Base model	CB05	123
With temperature-dependent photochemistry.	CB05*	116
With power-Arrhenius extrapolation when empirical activation energy is negative.	CB05*0	116
	CB05*2	115
	CB05*3	115
With 336 K activation energy applied to all temperature independent non-photo reactions.	CB05*3*	112
Random activation energies assigned to all temperature independent non-photo reactions.		112 ± 11 (one s.d.)

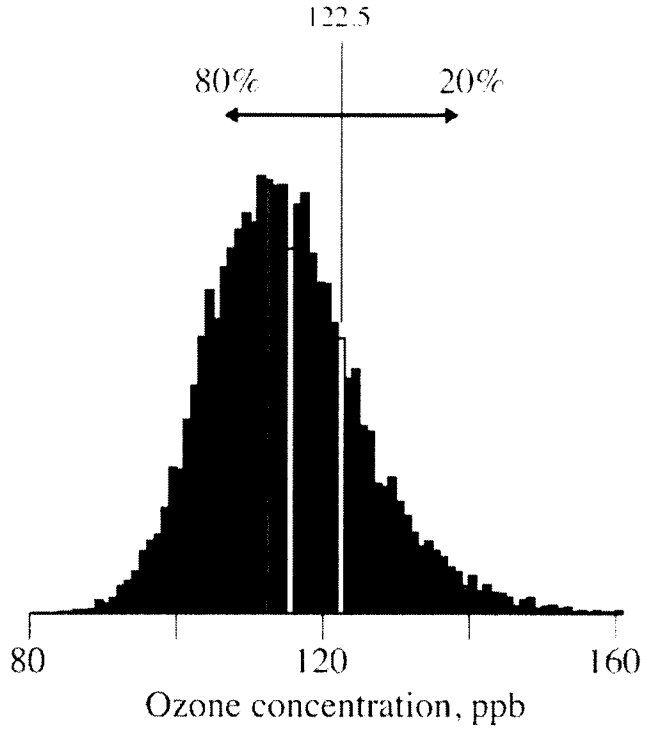

Figure 5-3. Predicted ozone concentration showing the effect of incremental adjustments in the mechanism.

6. SUMMARY/CONCLUSIONS

The results of the Basin-wide winter ozone study showed that elevated wintertime ozone concentrations were observed throughout most of the Uinta Basin during wintertime inversion events. The inversion events have the effect of reducing the movement of ozone precursors, resulting in increased ozone formation below the inversion layer. Although the data collected for this study cannot be used for regulatory purposes, the elevated ozone levels resulted in a high number of 8-hr exceedances at multiple locations throughout the Basin, with the fewest exceedances occurring in the higher elevations along the periphery of the study area. The highest ozone values typically were observed in the area centered along the Ouray/Pariette Draw locations and extending north to the Cedarview/Lapoint area, east to the Red Wash area, and west to Duchesne. The highest 1-hr value was observed at Ouray (149 ppb), and Pariette Draw was the site of both the highest observed 8-hr value (134.6 ppb) and the greatest observed fourth-highest (regulatory) ozone value (121.6 ppb). The highest number of 8-hr exceedances (25) was observed at both the Ouray and Horse Pool sites. And while Fruitland and Nine Mile Canyon were the only sites to show no exceedances of the 8-hr standard, the Altamont, Rabbit Mountain, and Rangely, CO, sites (one, three, and three exceedances, respectively) would also be considered attainment areas under the current ozone NAAQS.

The study indicated that two factors, proximity to oil/gas wells and elevation, figured prominently in ozone concentration levels at a given location. Closer proximity to oil/gas wells resulted in higher ozone levels, with the exception of those locations at higher elevations which were probably above the top of the inversion layer that occurred at ~5500 to 6000 ft. Only a limited number of vertical ozone profiles were measured, but these showed higher levels of ozone near the ground, indicative of a local formation rather than an external transportation of ozone precursors into the Basin.

NO_X measurements were highest at the Vernal location but at levels typically observed in rural/semi-urban areas. NO_X measurements also displayed a typical traffic-related diurnal profile. All observed levels of NO_2 were well below the NAAQS (100 ppb maximum, 1-hr average). The observed dominance of NO_2 suggests the presence of a readily oxidized air mass, which indicates sufficient available ozone or other oxidants to convert initially emitted NO to NO_2.

The observed CH_4 concentrations at Vernal were consistent with Northern Hemispheric background levels (1.7-1.8 ppm); however, the CH_4 concentrations measured at the Red Wash site (2.7-5.5 ppm) were significantly above the Northern Hemispheric background levels. CH_4 is usually considered non-reactive due to its relative slow reaction rates, but at levels observed at the Red Wash site, CH_4 could be a significant player in atmospheric photochemistry of ozone formation. NMHC measurements at the Red Wash location also were more than twice the observed concentrations at the Vernal site. The observed ratio of indicator compounds, benzene-to-toluene, is suggestive of oil and gas exploration and production.

Observed $PM_{2.5}$ concentrations were well below the NAAQS (35 $\mu g/m^3$) at both the Vernal and Red Wash sites, but concentrations at the Vernal location were approximately twice those of the Red Wash location. These results are inconsistent with previous UDAQ measurements in the mid-2000s that observed some exceedances of NAAQS. The chemical composition of the particulate matter measured at both sites was approximately 80% carbonaceous material, with

just under 70% being organic carbon (as opposed to elemental/black carbon). This percentage indicates an abundance of long-chain VOCs characteristic of the oil and gas industry.

Measurements of vertical meteorology at the Red Wash site indicate that during an inversion event, the mixing height (surface layer) was on the order of 20-80 m agl (65-265 ft agl) and was dependent on time of day. This conclusion was also supported by vertical ozone measurements at the Red Wash location. Meteorological data collected from ground stations throughout the Basin indicate that horizontal winds were generally light (< 2 m/s) during observed inversion conditions. The higher elevation stations (> 6500 ft asl) showed more between-station consistency for both wind direction and wind speed. These higher elevation areas were probably located above the inversion and under the influence of regional wind patterns.

7. REFERENCES

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8. RECOMMENDED FUTURE WORK

8.1 OVERVIEW

One of the main objectives of this first year study was to provide insights and direction for the design of a future, multi-year program to mitigate ozone levels in the Uinta Basin. The program would have two main components:

1. The design and implementation of a multi-year air quality study to provide sufficient understanding of ozone reactions in the Uinta Basin; and
2. The design, implementation, and validation of a mitigation strategy specific to the Uinta Basin based on the results of this and future air quality monitoring and modeling studies.

The list of tasks is intended only as a starting point for discussion of a more detailed task list to be assembled by stakeholders currently engaged in discussions regarding broader air quality management strategies. The broader strategies under consideration include (1) the creation of a Memorandum of Understanding between the Bureau of Land Management, the Department of Agriculture, and the Environmental Protection Agency; (2) the implementation of the Utah Governor's 10-year Energy Plan and Seven-Point Plan to address air quality in Utah; and (3) the implementation of the Bureau of Land Management's proposed Air Resources Management Strategy (ARMS) which includes recommendations of a regional photochemical grid model, robust monitoring program, and pollution controls/mitigation measures. The decisions reached on each of these important strategies will depend on the tasks being recommended in this document, including funding and designation of a responsible agency.

8.2 STAKEHOLDERS

Below is a list of potential stakeholders who might play key roles in the future study in such areas as leadership, design, monitoring, analysis, policy design and implementation, results interpretation, and so on. It is recommended that a lead agency (i.e., UDEQ) bring together representatives of each stakeholder group to solicit input on the design and implementation of an air quality program for the Uinta Basin. Such a strategic program will prove much more efficient and cost-effective if supported by all stakeholders and if all existing data is made available for the study.

8.2.1 State of Utah

Utah Department of Environmental Quality (UDEQ), Department of Natural Resources (DNR) Department of Oil, Gas, and Mining (DOGM), School Institutional Trust Lands Administration (SITLA), Utah Science Technology and Research Initiative (USTAR).

8.2.2 Federal Agencies

U.S. Bureau of Land Management (BLM), U.S. Environmental Protection Agency (EPA-Region 8), U.S. Forest Service (USFS).

8.2.3 Industry

Western Energy Alliance, National Oil Shale Association

8.2.4 Ute Indian Tribe

8.2.5 Local Government and Local Health District

Uintah County, Duchesne County, Carbon County, Uintah Impact Mitigation Special Service District, TriCounty Health Department

8.2.6 Research Institutes

Several universities and organizations in the state of Utah have a wealth of experience in air quality studies and could contribute significantly to this program. Utah State University/Energy Dynamics Laboratory (including the USU Uintah Basin Regional Campus) performed the initial study for ozone monitoring discussed previously.

8.3 TASKS

To accomplish project objectives, the proposed tasks are outlined below. The schedule of the various tasks will depend on available funding and on the results of related tasks.

8.3.1 Task 1: Air Quality Monitoring Program

- Perform detailed wintertime ozone, NO_x, and VOC chemistry at receptor and source locations to determine region-specific photochemistry and limiting reactions.
  - Designate Horse Pool and Roosevelt as primary study sites.
  - Obtain statistical confidence over a two to three year period.
  - Deploy cooperative team from USU, EDL, UDAQ, NOAA, EPA, BLM and others.
- Expand ozone survey network to verify the winter 2010-11 study and to procure understanding of untested areas, particularly in the Basin's southern region. In addition to ozone concentrations, ozone precursor pollutants (NO_x and VOCs) and meteorological conditions should be measured at locations collocated with the ozone measurements.
  - Utilize up to 20 ozone stations to be operated by project investigators.
  - Include four to six additional sites to be operated by other agencies/groups (e.g., BLM, NPS, Golder Associates, etc.).
  - Collocate passive NO_x and VOC samplers with ozone survey monitors to assess generalized precursor plumes and concentrations (week-long exposure).
  - Install meteorological instrumentation at ozone monitor locations (utilizing pre-existing met stations when possible).
  - Assess potential for a similar summertime ozone/air quality survey (to date, there is no evidence of a summertime concern in the Uinta Basin).

8.3.2 Task 2: Air Quality Modeling Program

- Develop and apply OZIPR (EPA-approved ozone chemistry modeling package) for the Uinta Basin.
- Adapt photochemical grid models (CAM_x, CMAQ, etc.) to the Basin (would require parallel or pre-development of an acceptable meteorological model, e.g., WRF).
- Validate photochemical grid models using monitoring data (Task 1).
- Apply validated grid models to investigate Basin air quality characteristics:
  - Outside transport of precursors
  - Elevation effects

8.3.3 Task 3: Policy Development

- Create focus group with stakeholders previously discussed.
- Develop industry credit program for implementing Best Available Practices (BAP) to mitigate impacts to air quality.
- Develop mitigation policy.

8.3.4 Task 4: Winter Ozone Assessment Program

- Complete detailed review of winter ozone studies performed in UGRB of Wyoming to determine if any information can benefit efforts in the Uinta Basin.

8.3.5 Task 5: Emissions Inventory of Ozone Precursors

- Develop understanding of major sources of ozone precursors in the Uinta Basin to prepare for the development of a mitigation strategy for reducing ozone levels.
- Perform preliminary assessment of ozone precursor sources in the Uinta Basin.
- Quantify significant ozone precursor sources.
- Measure fugitive emissions from representative sources of ozone precursors.
- Facilitate industry self-assessment of pollutant emissions.
- Characterize produced water ponds during winter and summer periods.

8.3.6 Task 6: Mitigation Potential Assessment

- Perform detailed study of mitigation efforts in Wyoming's UGRB.
- Encourage industry to perform self-assessment of pollutant emissions:
  - Improve drilling (consolidated)
  - Improve transportation (consolidated)
  - Implement Best Available Practices (BAP)
- Conduct study of potential Basin-wide mitigation options.
- Conduct study of available and emerging technologies for relevant mitigations options.
- Implement and validate mitigation options at specific locations.
- Apply validated photochemical grid models to specific mitigation options.

8.3.7 Task 7: Basin Pollutant Mitigation Strategies Development

- Design Basin-wide mitigation plan based on results of Task 5.
- Apply validated photochemical grid models to Basin-wide mitigation plan.
- Refine Basin-wide mitigation plan using modeling results.

8.3.8 Task 8: Basin Pollutant Mitigation Strategies Implementation

- Perform precursor and ozone monitoring at representative locations prior to implementing mitigation strategy.
- Implement Basin-wide mitigation plan.
- Perform precursor and ozone monitoring at representative locations after implementing mitigation strategy.

8.3.9 Task 9: Air Quality Modeling Program (incorporate most recent monitoring data)

- Continue utilization of OZIPR for the Uinta Basin.
- Continue application of photochemical grid models (CAM$_x$, CMAQ, etc.).
- Continue validation of photochemical grid models using all monitoring data.
- Continue application of grid models to characterize Basin air quality.

9. APPENDIX

The compiled, hourly averaged ozone concentrations for the winter 2010-11 study sites are available online at http://uintahbasin.usu.edu/htm/edl.

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Monitor Values Report

Geographic Area: Uintah County, UT
Pollutant: Ozone
Year: 2010
Exceptional Events: Included (if any)

Duration Description=1 HOUR

Duration Description	Num Obs	1st Max Value	2nd Max Value	3rd Max Value	4th Max Value	Num Exceedances	Percent Exceedances	Site Num	POC	1st Max Date	1st Max Hour	Method Code	Method Name	Site ID	Local Site Name	City	County	State	State Code
1 HOUR	3827	0.095	0.092	0.089	0.086	0	0.00	153	142	93	1	None	1	490471002	Dinosaur National Monument	Not in a city	Uintah	UT	08
1 HOUR	8148	0.12	0.114	0.111	0.108	0	0.00	153	148	97	5	None	1	490472002	2 Miles West Of Redwash Atop Deadman'S Bench	Not in a city	Uintah	UT	08
1 HOUR	8076	0.139	0.131	0.131	0.13	6	6.10	257	245	95	7	None	1	490472003	2 Miles South Of Ouray And South Of The White And Green River Confluence	Not in a city	Uintah	UT	08

Get detailed information about this report, including column descriptions, at http://www.epa.gov/airquality/airdata/ad_about_reports.html#mon

AirData reports are produced from a direct query of the AQS Data Mart. The data represent the best and most recent information available to EPA from state agencies. However, some values may be absent due to incomplete reporting, and some values may change due to quality assurance activities. The AQS database is updated daily by state, local, and tribal organizations who own and submit the data. Please contact the appropriate air quality monitoring agency to report any data problems.
<http://www.epa.gov/airquality/airdata/ad_contacts.html>

Readers are cautioned not to rank order geographic areas based on AirData reports. Air pollution levels measured at a particular monitoring site are not necessarily representative of the air quality for an entire county or urban area.

This report is based on monitor-level summary statistics. Air quality standards for some pollutants (PM2.5 and Pb) allow for combining data from multiple monitors into a site-level summary statistic that can be compared to the standard. In those cases, the site-level statistics may differ from the monitor-level statistics upon which this report is based.

Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: July 16, 2012

Monitor Values Report

Geographic Area: Uintah County, UT
Pollutant: Ozone
Year: 2010
Exceptional Events: Included (if any)

Duration Description=8-HR RUN AVG BEGIN HOUR

Duration Description	99th	98th	95th	90th	Annual	Actual Days	Est. Days	Max Value	Valid Days	Percent Complete	Missing Days	Exp. Events	Num Sites	AQS Site ID	POC	Address	City	County	State	EPA Region
8-HR RUN AVG BEGIN HOUR	3823	0.071	0.07	0.068	0.068	0	0.00	153	139	91	0	None	1	490471002	1	Dinosaur National Monument	Not in a city	Uintah	UT	08
8-HR RUN AVG BEGIN HOUR	8262	0.105	0.103	0.099	0.098	30	31.10	271	261	96	0	None	1	490472002	1	2 Miles West Of Redwash Atop Deadman'S Bench	Not in a city	Uintah	UT	08
8-HR RUN AVG BEGIN HOUR	8171	0.123	0.122	0.122	0.117	38	39.90	272	259	95	0	None	1	490472003	1	2 Miles South Of Ouray And South Of The White And Green River Confluence	Not in a city	Uintah	UT	08

Get detailed information about this report, including column descriptions, at http://www.epa.gov/airquality/airdata/ad_about_reports.html#mon

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Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: July 16, 2012

Monitor Values Report

Geographic Area: Uintah County, UT
Pollutant: Ozone
Year: 2011
Exceptional Events: Included (if any)

Duration Description=1 HOUR

Duration Description	Observations	Valid Days	Arithmetic Mean	1st Max Value	2nd Max Value	3rd Max Value	4th Max Value	1st Max Exceptional Value	2nd Max Exceptional Value	Expected Days	Percent Complete	Exceedances	Primary Exceedances	Exceptional Exceedances	AQS Site ID	Local Site Name	City Name	County Name	State Name	State Code
1 HOUR	8554	0.112	0.112	0.111	0.096	0	0.00	153	150	98	1	None	1	490471002	Dinosaur National Monument	Not in a city	Uintah	UT	08
1 HOUR	6126	0.14	0.13	0.109	0.107	2	2.00	229	224	98	3	None	1	490472002	2 Miles West Of Redwash Atop Deadman'S Bench	Not in a city	Uintah	UT	08
1 HOUR	6162	0.149	0.147	0.136	0.126	5	5.00	230	225	98	4	None	1	490472003	2 Miles South Of Ouray And South Of The White And Green River Confluence	Not in a city	Uintah	UT	08
1 HOUR	7063	0.091	0.089	0.084	0.075	0	0.00	153	153	100	0	None	1	490477022	Whiterocks & County Road	Not in a city	Uintah	UT	08

Get detailed information about this report, including column descriptions, at http://www.epa.gov/airquality/airdata/ad_about_reports.html#mon

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Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: July 16, 2012

Monitor Values Report

Geographic Area: Uintah County, UT
Pollutant: Ozone
Year: 2011
Exceptional Events: Included (if any)

Duration Description=8-HR RUN AVG BEGIN HOUR

Duration Description	Obs	First Max	Second Max	[illegible]	Fourth Max	Actual Exc	Est Exc	Required Days	[illegible]	Percent Obs	Missing Days	Exc Events	Monitor Number	Site ID	Address	[illegible]	[illegible]	[illegible]	EPA Region
8-HR RUN AVG BEGIN HOUR	8529	0.106	0.106	0.103	0.09	8	8.10	267	263	99	0	None	1	490471002	Dinosaur National Monument	Not in a city	Uintah	UT	08
8-HR RUN AVG BEGIN HOUR	6251	0.125	0.119	0.108	0.1	21	21.50	268	262	98	0	None	1	490472002	2 Miles West Of Redwash Atop Deadman'S Bench	Not in a city	Uintah	UT	08
8-HR RUN AVG BEGIN HOUR	6254	0.139	0.139	0.133	0.116	22	22.60	268	261	97	0	None	1	490472003	2 Miles South Of Ouray And South Of The White And Green River Confluence	Not in a city	Uintah	UT	08
8-HR RUN AVG BEGIN HOUR	7142	0.083	0.077	0.07	0.068	2	3.10	267	172	64	0	None	1	490477022	Whiterocks & County Road	Not in a city	Uintah	UT	08

Get detailed information about this report, including column descriptions, at http://www.epa.gov/airquality/airdata/ad_about_reports.html#mon

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Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: July 16, 2012

Monitor Values Report

Geographic Area: Los Angeles County, CA
Pollutant: Ozone
Year: 2010
Exceptional Events: Included (if any)

Duration Description=1 HOUR

1 HOUR	8220	0.104	0.102	0.102	0.097	0	0.00	365	356	98	9	None	1	060370002	803 N. Loren Ave., Azusa	Azusa	Los Angeles	CA	09
1 HOUR	7952	0.124	0.123	0.12	0.119	0	0.00	365	350	96	3	None	1	060370016	840 Laurel, Glendora	Glendora	Los Angeles	CA	09
1 HOUR	8095	0.099	0.098	0.092	0.089	0	0.00	365	360	99	5	None	1	060370113	Va Hospital, West Los Angeles	West Los Angeles	Los Angeles	CA	09
1 HOUR	7287	0.111	0.103	0.096	0.092	0	0.00	365	317	87	9	None	1	060371002	228 W. Palm Ave., Burbank	Burbank	Los Angeles	CA	09
1 HOUR	8118	0.098	0.09	0.087	0.081	0	0.00	365	357	98	6	None	1	060371103	1630 N Main St, Los Angeles	Los Angeles	Los Angeles	CA	09
1 HOUR	6795	0.122	0.12	0.116	0.114	0	0.00	365	295	81	1	None	1	060371201	18330 Gault St., Reseda	Reseda	Los Angeles	CA	09
1 HOUR	7762	0.081	0.073	0.069	0.062	0	0.00	365	338	93	6	None	1	060371302	700 North Bullis Road	Compton	Los Angeles	CA	09
1 HOUR	8089	0.112	0.087	0.086	0.074	0	0.00	365	358	98	2	None	1	060371602	4144 San Gabriel River Pkwy., Pico Rivera	Pico Rivera	Los Angeles	CA	09
1 HOUR	7665	0.115	0.114	0.103	0.102	0	0.00	365	342	94	3	None	1	060371701	924 N. Garey Ave., Pomona	Pomona	Los Angeles	CA	09
1 HOUR	7403	0.101	0.093	0.092	0.091	0	0.00	365	325	89	6	None	1	060372005	752 S. Wilson Ave., Pasadena	Pasadena	Los Angeles	CA	09
1 HOUR	8129	0.101	0.077	0.075	0.074	0	0.00	365	358	98	7	None	1	060374002	3648 N. Long Beach Blvd., Long Beach	Long Beach	Los Angeles	CA	09

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Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: July 16, 2012

Monitor Values Report

Geographic Area: Los Angeles County, CA
Pollutant: Ozone
Year: 2010
Exceptional Events: Included (if any)

Duration Description=1 HOUR

Duration Description	Obs	First Max	Second Max	Third Max	Fourth Max	Actual Exc	Est Exc	Required Days	Valid Days	Percent Days	Missing Days	Exc Events	Monitor Number	Site ID	Address	City	County	State	EPA Region
1 HOUR	8115	0.099	0.079	0.074	0.073	0	0.00	365	358	98	7	None	1	060374006	2425 Webster St., Long Beach, Ca	Long Beach	Los Angeles	CA	09
1 HOUR	7386	0.089	0.087	0.069	0.069	0	0.00	365	319	87	6	None	1	060375005	7201 W. Westchester Parkway	Los Angeles	Los Angeles	CA	09
1 HOUR	7247	0.126	0.115	0.113	0.113	1	1.20	365	313	86	4	None	1	060376012	22224 Placerita Canyon Rd. Santa Clarita	Santa Clarita	Los Angeles	CA	09
1 HOUR	8379	0.107	0.104	0.099	0.098	0	0.00	365	363	99	2	None	1	060379033	43301 Division St., Lancaster, Ca	Lancaster	Los Angeles	CA	09

Get detailed information about this report, including column descriptions, at http://www.epa.gov/airquality/airdata/ad_about_reports.html#mon

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This report is based on monitor-level summary statistics. Air quality standards for some pollutants (PM2.5 and Pb) allow for combining data from multiple monitors into a site-level summary statistic that can be compared to the standard. In those cases, the site-level statistics may differ from the monitor-level statistics upon which this report is based.

Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: July 16, 2012

Monitor Values Report

Geographic Area: Los Angeles County, CA
Pollutant: Ozone
Year: 2010
Exceptional Events: Included (if any)

Duration Description=8-HR RUN AVG BEGIN HOUR

Duration Description	Obs	First Max	Second Max	Third Max	Fourth Max	Actual Exc	Est Exc	Required Days	Valid Days	Percent Days	Missing Days	Exc Events	POC	Site ID	Address	City	County	State	EPA Region
8-HR RUN AVG BEGIN HOUR	8593	0.081	0.078	0.076	0.075	3	3.10	365	352	96	0	None	1	060370002	803 N. Loren Ave., Azusa	Azusa	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	8441	0.099	0.094	0.091	0.09	20	21.10	365	346	95	0	None	1	060370016	840 Laurel, Glendora	Glendora	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	8608	0.078	0.072	0.071	0.069	1	1.00	365	353	97	0	None	1	060370113	Va Hospital, West Los Angeles	West Los Angeles	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	7589	0.084	0.079	0.078	0.076	4	4.80	365	307	84	0	None	1	060371002	228 W. Palm Ave., Burbank	Burbank	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	8507	0.08	0.065	0.065	0.064	1	1.10	365	345	95	0	None	1	060371103	1630 N Main St, Los Angeles	Los Angeles	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	7091	0.091	0.089	0.087	0.086	19	23.70	365	293	80	0	None	1	060371201	18330 Gault St., Reseda	Reseda	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	8209	0.062	0.054	0.05	0.049	0	0.00	365	332	91	0	None	1	060371302	700 North Bullis Road	Compton	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	8605	0.086	0.063	0.062	0.059	1	1.00	365	354	97	0	None	1	060371602	4144 San Gabriel River Pkwy, Pico Rivera	Pico Rivera	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	8107	0.082	0.081	0.078	0.076	4	4.40	365	333	91	0	None	1	060371701	924 N. Garey Ave., Pomona	Pomona	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	7807	0.081	0.078	0.077	0.075	3	3.40	365	322	88	0	None	1	060372005	752 S. Wilson Ave., Pasadena	Pasadena	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	8565	0.084	0.062	0.061	0.056	1	1.00	365	352	96	0	None	1	060374002	3648 N. Long Beach Blvd., Long Beach	Long Beach	Los Angeles	CA	09

Get detailed information about this report, including column descriptions, at http://www.epa.gov/airquality/airdata/ad_about_reports.html#mon

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Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: July 16, 2012

US EPA ARCHIVE DOCUMENT

Monitor Values Report

Geographic Area: Los Angeles County, CA
Pollutant: Ozone
Year: 2010
Exceptional Events: Included (if any)

Duration Description=8-HR RUN AVG BEGIN HOUR

[illegible]	Obs	[illegible]	[illegible]	[illegible]	[illegible]	Actual Exc	Est. Exc	Required Days	[illegible]	[illegible]	Missing Days	Exc Events	[illegible]	[illegible]	Address	[illegible]	[illegible]	State	EPA Region
8-HR RUN AVG BEGIN HOUR	8638	0.084	0.063	0.062	0.059	1	1.00	365	355	97	0	None	1	060374006	2425 Webster St., Long Beach, Ca	Long Beach	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	7685	0.07	0.069	0.064	0.059	0	0.00	365	311	85	0	None	1	060375005	7201 W. Westchester Parkway	Los Angeles	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	7576	0.105	0.093	0.091	0.087	23	27.40	365	306	84	0	None	1	060376012	22224 Placerita Canyon Rd. Santa Clarita	Santa Clarita	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	8733	0.096	0.095	0.087	0.085	45	45.20	365	363	99	0	None	1	060379033	43301 Division St., Lancaster, Ca	Lancaster	Los Angeles	CA	09

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Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: July 16, 2012

Monitor Values Report

Geographic Area: Los Angeles County, CA
Pollutant: Ozone
Year: 2011
Exceptional Events: Included (if any)

Duration Description=1 HOUR

Duration Description	[illegible]	First Max	Second Max	Third Max	Fourth Max	[illegible]	Est [illegible]	[illegible]	Valid Days	Percent Days	[illegible]	[illegible]	[illegible]	Site ID	[illegible]	City	County	State	[illegible]
1 HOUR	8069	0.111	0.108	0.107	0.107	0	0.00	365	341	93	10	None	1	060370002	803 N. Loren Ave., Azusa	Azusa	Los Angeles	CA	09
1 HOUR	7997	0.134	0.133	0.132	0.125	4	4.10	365	346	95	9	None	1	060370016	840 Laurel, Glendora	Glendora	Los Angeles	CA	09
1 HOUR	7754	0.098	0.095	0.079	0.075	0	0.00	365	346	95	3	None	1	060370113	Va Hospital, West Los Angeles	West Los Angeles	Los Angeles	CA	09
1 HOUR	7617	0.12	0.111	0.109	0.099	0	0.00	365	334	92	5	None	1	060371002	228 W. Palm Ave., Burbank	Burbank	Los Angeles	CA	09
1 HOUR	8040	0.133	0.087	0.08	0.08	1	1.00	365	338	93	12	None	1	060371103	1630 N Main St, Los Angeles	Los Angeles	Los Angeles	CA	09
1 HOUR	8094	0.13	0.129	0.128	0.119	3	3.10	365	351	96	7	None	1	060371201	18330 Gault St., Reseda	Reseda	Los Angeles	CA	09
1 HOUR	8003	0.082	0.08	0.079	0.076	0	0.00	365	353	97	4	None	1	060371302	700 North Bullis Road	Compton	Los Angeles	CA	09
1 HOUR	7045	0.096	0.086	0.078	0.077	0	0.00	365	311	85	8	None	1	060371602	4144 San Gabriel River Pkwy, Pico Rivera	Pico Rivera	Los Angeles	CA	09
1 HOUR	8082	0.119	0.111	0.11	0.109	0	0.00	365	359	98	4	None	1	060371701	924 N. Garey Ave., Pomona	Pomona	Los Angeles	CA	09
1 HOUR	8083	0.107	0.101	0.098	0.096	0	0.00	365	354	97	7	None	1	060372005	752 S. Wilson Ave., Pasadena	Pasadena	Los Angeles	CA	09
1 HOUR	7305	0.073	0.072	0.07	0.069	0	0.00	365	316	87	8	None	1	060374002	3648 N. Long Beach Blvd., Long Beach	Long Beach	Los Angeles	CA	09

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Generated: July 16, 2012

Monitor Values Report

Geographic Area: Los Angeles County, CA
Pollutant: Ozone
Year: 2011
Exceptional Events: Included (if any)

Duration Description=1 HOUR

Duration Description	Obs	First Max	[illegible]	[illegible]	Fourth Max	Actual Exc	Est Exc	Required Days	Valid Days	[illegible]	Missing Days	Exc Events	Monitor Number	[illegible]	Address	[illegible]	County	State	EPA Region
1 HOUR	7934	0.074	0.074	0.066	0.065	0	0.00	365	349	96	12	None	1	060374006	2425 Webster St., Long Beach, Ca	Long Beach	Los Angeles	CA	09
1 HOUR	7010	0.078	0.076	0.073	0.073	0	0.00	365	301	82	5	None	1	060375005	7201 W. Westchester Parkway	Los Angeles	Los Angeles	CA	09
1 HOUR	7248	0.144	0.129	0.125	0.121	3	3.40	365	319	87	8	None	1	060376012	22224 Placerita Canyon Rd. Santa Clarita	Santa Clarita	Los Angeles	CA	09
1 HOUR	8350	0.115	0.115	0.111	0.11	0	0.00	365	362	99	3	None	1	060379033	43301 Division St., Lancaster, Ca	Lancaster	Los Angeles	CA	09

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Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: July 16, 2012

Monitor Values Report

Geographic Area: Los Angeles County, CA
Pollutant: Ozone
Year: 2011
Exceptional Events: Included (if any)

Duration Description=8-HR RUN AVG BEGIN HOUR

	Obs	99th Pctl	Second Max	Third Max	Annual 3yr	Exc	Required Days	Actual Days	Pct	Events Included	Exc	Method	Address	City	County	State	EPA Region
8-HR RUN AVG BEGIN HOUR	8405	0.092	0.091	0.086	0.082	12	13.00	365	336	92	0	None	1 060370002	803 N. Loren Ave., Azusa	Azusa	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	8419	0.111	0.109	0.103	0.095	30	32.00	365	342	94	0	None	1 060370016	840 Laurel, Glendora	Glendora	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	8268	0.068	0.068	0.062	0.062	0	0.00	365	341	93	0	None	1 060370113	Va Hospital, West Los Angeles	West Los Angeles	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	8075	0.084	0.083	0.081	0.081	6	6.70	365	327	90	0	None	1 060371002	228 W. Palm Ave., Burbank	Burbank	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	8326	0.065	0.064	0.061	0.06	0	0.00	365	327	90	0	None	1 060371103	1630 N Main St, Los Angeles	Los Angeles	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	8468	0.103	0.099	0.095	0.091	26	27.60	365	344	94	0	None	1 060371201	18330 Gault St., Reseda	Reseda	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	8455	0.065	0.062	0.062	0.061	0	0.00	365	350	96	0	None	1 060371302	700 North Bullis Road	Compton	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	7545	0.074	0.063	0.062	0.061	0	0.00	365	306	84	0	None	1 060371602	4144 San Gabriel River Pkwy, Pico Rivera	Pico Rivera	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	8602	0.096	0.091	0.088	0.086	16	16.50	365	355	97	0	None	1 060371701	924 N. Garey Ave., Pomona	Pomona	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	8559	0.084	0.082	0.08	0.077	5	5.20	365	353	97	0	None	1 060372005	752 S. Wilson Ave., Pasadena	Pasadena	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	7662	0.061	0.061	0.06	0.059	0	0.00	365	312	85	0	None	1 060374002	3648 N. Long Beach Blvd., Long Beach	Long Beach	Los Angeles	CA	09

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Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: July 16, 2012

Monitor Values Report

Geographic Area: Los Angeles County, CA
Pollutant: Ozone
Year: 2011
Exceptional Events: Included (if any)

Duration Description=8-HR RUN AVG BEGIN HOUR

8-HR RUN AVG BEGIN HOUR	8408	0.063	0.058	0.058	0.057	0	0.00	365	340	93	0	None	1	060374006	2425 Webster St., Long Beach, Ca	Long Beach	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	7267	0.067	0.066	0.063	0.062	0	0.00	365	297	81	0	None	1	060375005	7201 W. Westchester Parkway	Los Angeles	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	7704	0.122	0.107	0.103	0.101	31	35.50	365	319	87	0	None	1	060376012	22224 Placerita Canyon Rd, Santa Clarita	Santa Clarita	Los Angeles	CA	09
8-HR RUN AVG BEGIN HOUR	8704	0.1	0.098	0.096	0.094	53	53.40	365	362	99	0	None	1	060379033	43301 Division St., Lancaster, Ca	Lancaster	Los Angeles	CA	09

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Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: July 16, 2012

Monitor Values Report

Geographic Area: Sublette County, WY
Pollutant: Ozone
Year: 2005
Exceptional Events: Included (if any)

Duration Description=1 HOUR

1 HOUR	8086	0.119	0.118	0.113	0.107	0	0.00	214	206	96	2	None	1	560350098	Jonah Approx 40 Miles Nw Of Farson, Wy	Not in a city	Sublette	WY	08
1 HOUR	7681	0.109	0.1	0.097	0.093	0	0.00	214	201	94	7	None	1	560350099	Shell Boulder Approx 3 Miles West Of Boulder	Not in a city	Sublette	WY	08
1 HOUR	4332	0.075	0.072	0.07	0.069	0	0.00	214	117	55	4	None	1	560350100	Daniel South ~ 4 Miles So Of Daniel Wyo Off Of Hwy 189	Not in a city	Sublette	WY	08

Get detailed information about this report, including column descriptions, at http://www.epa.gov/airquality/airdata/ad_about_reports.html#mon

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Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: July 18, 2012

Monitor Values Report

Geographic Area: Sublette County, WY
Pollutant: Ozone
Year: 2005
Exceptional Events: Included (if any)

Duration Description=8-HR RUN AVG BEGIN HOUR

Duration Description	Num Obs	1st Max Value	2nd Max Value	3rd Max Value	4th Max Value	Num Exceed	Percent Exceed	Max Value	99th Percentile	98th Percentile	Num Missing	Exceptional Events	Num Monitors	AQS Site ID	Address	City	County	State	EPA Region
8-HR RUN AVG BEGIN HOUR	8167	0.097	0.088	0.077	0.075	3	3.10	281	274	98	0	None	1	560350098	Jonah Approx 40 Miles Nw Of Farson, Wy	Not in a city	Sublette	WY	08
8-HR RUN AVG BEGIN HOUR	7639	0.088	0.081	0.08	0.079	5	5.40	271	250	92	0	None	1	560350099	Shell Boulder Approx 3 Miles West Of Boulder	Not in a city	Sublette	WY	08
8-HR RUN AVG BEGIN HOUR	4331	0.07	0.066	0.066	0.066	0	0.00	214	117	55	0	None	1	560350100	Daniel South ~ 4 Miles So Of Daniel Wyo Off Of Hwy 189	Not in a city	Sublette	WY	08

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Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: July 18, 2012

Monitor Values Report

Geographic Area: Sublette County, WY
Pollutant: Ozone
Year: 2008
Exceptional Events: Included (if any)

Duration Description=1 HOUR

Duration Description	Days	1st Max Value	2nd Max Value	3rd Max Value	4th Max Value	1st Max Exceedances	Annual Mean	Percent Days	Valid Days	Required Days	Exceptional Events	Null Data Codes	Site ID	Site Name	City	County	State	AQCR
1 HOUR	2588	0.128	0.119	0.104	0.102	1	5.30	235	44	19	0	None	1	560350098	Jonah Approx 40 Miles Nw Of Farson, Wy	Not in a city	Sublette	WY	08
1 HOUR	8131	0.143	0.119	0.119	0.117	1	1.00	254	244	96	5	None	1	560350099	Shell Boulder Approx 3 Miles West Of Boulder	Not in a city	Sublette	WY	08
1 HOUR	8453	0.097	0.088	0.086	0.082	0	0.00	214	202	94	4	None	1	560350100	Daniel South ~ 4 Miles So Of Daniel Wyo Off Of Hwy 189	Not in a city	Sublette	WY	08

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Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: July 18, 2012

Monitor Values Report

Geographic Area: Sublette County, WY
Pollutant: Ozone
Year: 2008
Exceptional Events: Included (if any)

Duration Description=8-HR RUN AVG BEGIN HOUR

Duration Description	Obs	[illegible]	[illegible]	Third Max	Fouth Max	Actual Exc	[illegible]	[illegible]	Valid Days	Percent Days	Missing Days	[illegible]	[illegible]	Site ID	Address	City	County	State	[illegible]
8-HR RUN AVG BEGIN HOUR	2613	0.102	0.098	0.084	0.082	8	31.00	260	67	26	0	None	1	560350098	Jonah Approx 40 Miles Nw Of Farson, Wy	Not in a city	Sublette	WY	08
8-HR RUN AVG BEGIN HOUR	8450	0.122	0.104	0.102	0.101	14	14.90	265	249	94	0	None	1	560350099	Shell Boulder Approx 3 Miles West Of Boulder	Not in a city	Sublette	WY	08
8-HR RUN AVG BEGIN HOUR	8508	0.075	0.075	0.074	0.074	0	0.00	214	200	93	0	None	1	560350100	Daniel South - 4 Miles So Of Daniel Wyo Off Of Hwy 189	Not in a city	Sublette	WY	08

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Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: July 18, 2012

DAVE FREUDENTHAL
GOVERNOR

THE STATE OF WYOMING

STATE CAPITOL
CHEYENNE, WY 82002

Office of the Governor

March 12, 2009

Ms. Carol Rushin
Acting Regional Administrator
USEPA Region 8
Mail Code: 8P-AR
1595 Wynkoop Street
Denver, CO 80202-1129

RE: Wyoming 8-Hour Ozone Designation Recommendation

Dear Ms. Rushin:

This letter transmits my recommendations, as allowed for under Section 107(d)(1) of the Clean Air Act, for Wyoming area designations and nonattainment area boundaries for the new eight-hour ozone National Ambient Air Quality Standards. These recommendations are based on a Wyoming Department of Environmental Quality (WDEQ) staff analysis which follows EPA's guidance dated December 4, 2008, "Area Designations for the 2008 Revised Ozone National Ambient Air Quality Standards."

At this time, I am recommending that all areas of the State of Wyoming be designated as attainment/unclassifiable with respect to the 8-hour ozone standard except for Sublette County and partial sections of Sweetwater and Lincoln counties. Enclosed with this letter is a table listing all specific areas of the state with their corresponding recommended designations, along with a figure showing the boundary of the nonattainment area, and ozone monitoring data collected through 2008.[1] The technical support document, which includes a 9-Factor Analysis, is being sent by the Director of the Department of Environmental Quality under separate cover.

Elevated ozone in a truly rural environment when temperatures are well below freezing is an uncommon event. As we move forward to solve this problem, we are uniquely challenged by the lack of tools available to understand and predict ozone formation in the winter in a valley flanked by the Wind River Mountains.

The State of Wyoming is also challenged by the need to reduce emissions from the natural gas industry which has not traditionally been regulated for ozone nonattainment problems. While the EPA has a long list of control strategies to apply in nonattainment areas, very few of them will

[1] The recommendation does not extend to lands under the jurisdiction of Tribal Authority

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help to reduce ozone in Sublette County. Lowest Achievable Emissions Rate (LAER), Reasonably Available Control Technology (RACT), major source offsets, transportation control measures, and clean fuels programs are designed to reduce emissions from very large industrial sources and urban traffic which are not present in rural Wyoming. Therefore, the WDEQ has already identified the sources that require controls such as drill rigs, pneumatic pumps, dehydration units, and small heaters.

The State is not waiting for the nonattainment process to unfold to tackle the problem, but is addressing the issue on several fronts:

- Several significant field studies have been initiated to understand the processes leading to the occurrence of high ozone levels and to precisely define meteorological conditions that exist when these ozone events occur. These field operations began in 2007 and have continued through the winter of 2009.

- The AQD has deployed more Federal Reference Monitors in southwest Wyoming.

- DEQ is working with contractors to develop models to replicate the high wintertime ozone concentrations observed in the Upper Green.

- The University of Wyoming is conducting an ozone and precursor sampling program in 2009 to provide an independent perspective and further information on spatial variability of ozone in the Basin.

- The DEQ, the Wyoming Department of Health and the Sublette County Commissioners are working together to assess public health risks posed by air toxics associated with natural gas development. A study is now underway.

- The Air Quality Division has moved aggressively to reduce air pollution by applying BACT to all well sites in the Jonah and Pinedale Anticline gas fields, as well as a minor source offset permitting program. To my knowledge, there isn't another place in the world with this much attention given to permitting natural gas emission points.

I share the outline of our aggressive program for two reasons. First, we believe that the area designations should be based on the technical information painstakingly developed by the DEQ for a unique ozone nonattainment problem. If the EPA uses standard analytic tools appropriate for summertime ozone formation in large metropolitan areas, EPA will reach the wrong conclusions about what causes ozone in Sublette County and how to fix it.

Secondly, I understand that a nonattainment designation includes requirements to reduce air pollution from existing sources. Many local gas producers, working in cooperation with our DEQ, have aggressively reduced air emissions and those reductions will continue even as our natural gas resources continue to be developed. These air emission reductions have occurred

because of the application of Wyoming's stringent air pollution permitting requirements; because of industry response to our calls for voluntary emission reductions; and because of Wyoming's insistence on stringent air pollution mitigation requirements in the Jonah Infill and Pinedale Anticline Records of Decision. We have not waited for the federal declaration of nonattainment to solve our air pollution problems, and I do not want a nonattainment designation by EPA to penalize the State for instituting early emission reductions.

While we have submitted recommendations as required under the Act, I envision that much work remains. I would like to propose that my staff at DEQ work with US EPA Region 8 to formalize an approach to share technical information and consult over choices of the baseline EI, the size of the nonattainment area and the resulting classification. Should you have any questions or concerns regarding this matter, please contact Mr. John Corra (307-777-7192) or Mr. Dave Finley (307-777-3746).

Best regards,

Dave Freudenthal
Governor

Enclosures: Attachment 1 - Designation Areas
Attachment 2 - Boundary of Designation Area (Figure)
Attachment 3 - Ozone Monitoring Data

cc: John Corra, DEQ Director
David Finley, AQD Administrator
Lori Bocchino, AQD
Christine Anderson, AQD
Callie Videtich, Director, Air and Radiation Program, EPA Region 8 w/ Enclosures
Monica Morales, EPA Region 8 w/ Enclosures
Kerri Fiedler, EPA Region 8 w/ Enclosures

Attachment 1

2008 Primary and Secondary NAAQS 8-hour Primary and Secondary Ozone Standard
Wyoming Recommendations for Ozone Designations
For areas not under the jurisdiction of Tribal Authority

Region	8-hour Ozone Designation
Casper, WY: Natrona County (part) The portion within the City of Casper	Attainment/Unclassifiable
Cheyenne, WY: Laramie County (part) The portion within the City of Cheyenne	Attainment/Unclassifiable
Evanston, WY: Uinta County (part) The portion within the City of Evanston	Attainment/Unclassifiable
Gillette, WY: Campbell County (part) The portion within the City of Gillette	Attainment/Unclassifiable
Jackson, WY: Teton County (part) The portion within the City of Jackson	Attainment/Unclassifiable
Lander, WY: Fremont County (part) The portion within the City of Lander	Attainment/Unclassifiable
Laramie, WY: Albany County (part) The portion within the City of Laramie	Attainment/Unclassifiable
Riverton, WY: Fremont County (part) The portion within the City of Riverton	Attainment/Unclassifiable
Rock Springs, WY Sweetwater County (part) The portion within the City of Rock Springs	Attainment/Unclassifiable
Sheridan, WY Sheridan County (part) The portion within the City of Sheridan	Attainment/Unclassifiable
Albany County (remainder)	Attainment/Unclassifiable
Big Horn County	Attainment/Unclassifiable
Campbell County (remainder)	Attainment/Unclassifiable
Carbon County	Attainment/Unclassifiable
Converse County	Attainment/Unclassifiable
Crook County	Attainment/Unclassifiable
Fremont County (remainder)	Attainment/Unclassifiable
Goshen County	Attainment/Unclassifiable
Hot Springs County	Attainment/Unclassifiable
Johnson County	Attainment/Unclassifiable
Laramie County (remainder)	Attainment/Unclassifiable
Lincoln County (remainder)	Attainment/Unclassifiable
Natrona County (remainder)	Attainment/Unclassifiable
Niobrara County	Attainment/Unclassifiable
Park County	Attainment/Unclassifiable
Platte County	Attainment/Unclassifiable
Sheridan County (remainder)	Attainment/Unclassifiable
Sweetwater County (remainder)	Attainment/Unclassifiable
Teton County (remainder)	Attainment/Unclassifiable
Uinta County (remainder)	Attainment/Unclassifiable

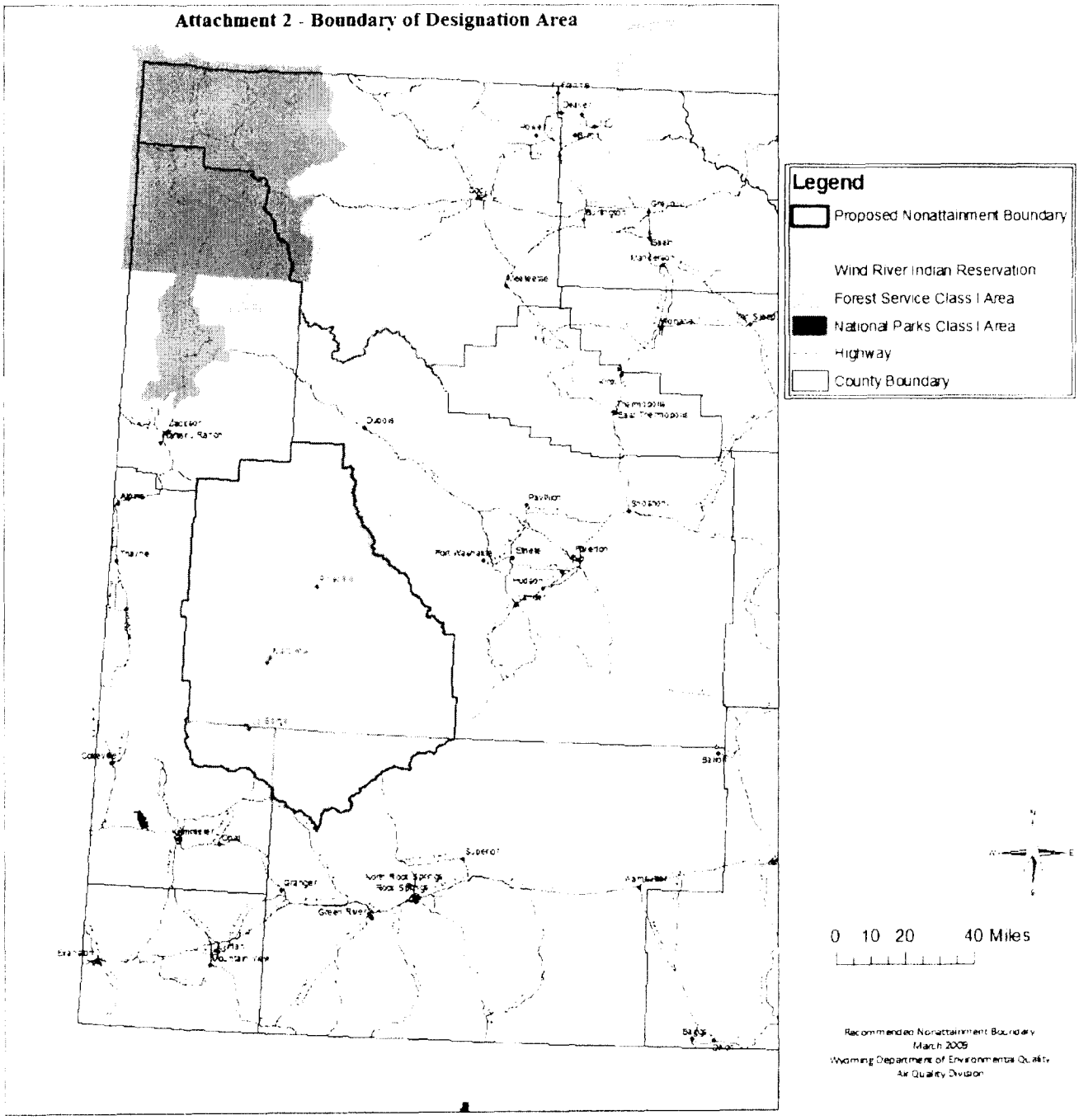
Attachment 1

2008 Primary and Secondary NAAQS 8-hour Primary and Secondary Ozone Standard
Wyoming Recommendations for Ozone Designations
For areas not under the jurisdiction of Tribal Authority

Region	8-hour Ozone Designation
Washakie County	Attainment/Unclassifiable
Weston County	Attainment/Unclassifiable
Upper Green River Basin Area: Sublette County: (all) Lincoln County: (part) The area of the county north and east of the boundary defined by a line starting at the point defined by the intersection of the southwest corner Section 30 Range (R) 115 West Township (T) 27N and the northwest corner of Section 31 R 115 West T 27N of Sublette County at Sublette County's border with Lincoln County. From this point the boundary moves to the west 500 feet to the Aspen Creek. The boundary follows the centerline of Aspen Creek downstream to the confluence of Aspen Creek and Fontenelle Creek (in R 116 W T26N, Section 1). From this point the boundary moves generally to the south along the centerline of Fontenelle Creek to the confluence of Fontenelle Creek and Roney Creek (in R115W T24N Section 6). From the confluence, the boundary moves generally to the east along the centerline of Fontenelle Creek and into the Fontenelle Reservoir (in R112W T24N Section 6). The boundary moves east southeast along the centerline of the Fontenelle Reservoir and then toward the south along the centerline of the Green River to where the Green River in R111W T24 N Section 31 crosses into Sweetwater County. Sweetwater County: (part) The area of the county west and north of the boundary which begins at the midpoint of the Green River, where the Green River enters Sweetwater County from Lincoln County in R111W T24N Section 31. From this point, the boundary follows the center of the channel of the Green River generally to the south and east to the confluence of the Green River and the Big Sandy River (in R109W R22 N Section 28). From this point, the boundary moves generally north and east along the centerline of the Big Sandy River to the confluence of the Big Sandy River with Little Sandy Creek (in R106W T25N Section 33). The boundary continues generally toward the northeast long the centerline of Little Sandy Creek to the confluence of Little Sandy Creek and Pacific Creek (in R106W T25N Section 24). From this point, the boundary moves generally to the east and north along the centerline of Pacific Creek to the confluence of Pacific Creek and Whitehorse Creek (in R103W T26N Section 10). From this point the boundary follows the centerline of Whitehorse Creek generally to the northeast until it reaches the eastern boundary of Section 1 R103W T 26North. From the point where Whitehorse Creek crosses the eastern section line of Section 1 R103W T 26North, the boundary moves straight north along the section line to the southeast corner of Section 36 R103W T27N in Sublette County where the boundary ends.	Non-attainment

R Range, T - Township, N - North, W - West

Attachment 2 - Boundary of Designation Area



Attachment 3

Design Values for Wyoming Ambient Ozone Monitors

Site Name	AQS ID	Year				3-Year Average 2005-2007 (ppm)	3-Year Average 2006-2008[1] (ppm)
		2005 (ppm)	2006 (ppm)	2007 (ppm)	2008 Q1-Q3[1] (ppm)		
Daniel South	56-035-0100	0.067[2]	0.075	0.067	0.074	N/A	0.072[1]
Boulder	56-035-0099	0.080[3]	0.073	0.067	0.101	0.073[3]	0.080[1]
Jonah	56-035-0098	0.076	0.070	0.069	0.082	0.072	0.074[1]
Yellowstone (NPS)	56-039-1011	0.060	0.069	0.064	0.065	0.064	0.066[1]
Thunder Basin	56-005-0123	0.063	0.072	0.072	0.074	0.069	0.073[1]
Campbell County	56-005-0456	0.063[4]	0.065	0.072	0.060	0.067[4]	0.066[1]

[1] Data collected and validated through 3rd quarter 2008
[2] Incomplete year; began operation in July 2005
[3] Incomplete year; began operation in February 2005
[4] One quarter with less than 75% data completeness

4th Maximum 8-Hour Ozone Values for Ambient Monitors without 3 years of data

Site Name	AQS ID	Year			
		2005 (ppm)	2006 (ppm)	2007 (ppm)	2008 Q1-Q3[1] (ppm)
Murphy Ridge	56-041-0101	---	---	0.070	0.061
South Pass	56-013-0099	---	---	0.071[2]	0.065
OCI[3]	56-037-0898	---	0.071[3]	0.066	0.072
Wamsutter	56-005-0123	---	0.067[4]	0.064	0.064
Atlantic Rim	56-007-0099	---	---	0.047[5]	0.064

[1] Data collected and validated through 3rd quarter 2008
[2] Incomplete year; began operation in March 2007
[3] Site operated by industry. Incomplete year; began operation in May 2006
[4] Incomplete year; began operation in March 2006
[5] Incomplete year; began operation in October 2007

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLORADO

UNITED STATES OF AMERICA,	)	
	)	
Plaintiff,	)	
	)	
and	)	
	)	
STATE OF COLORADO,	)	
	)	
Plaintiff-Intervenor,	)	
	)	
v.	)	Civil Action No.
	)	
KERR-McGEE CORPORATION,	)	
	)	
Defendant.	)	
	)	

CONSENT DECREE

TABLE OF CONTENTS

WHEREAS, Plaintiff, the United States of America, (the "United States") on behalf of the United States Environmental Protection Agency ("EPA"), has simultaneously with lodging this Consent Decree filed a Complaint alleging that Kerr-McGee Corporation, or one or more of its wholly-owned subsidiaries, (collectively "Defendant" or "Kerr-McGee" and as more specifically defined below), violated requirements of the Clean Air Act (the "Act") and the federal and state regulations implementing the Act applicable to: (i) five compressor stations referred to herein as the Hudson Facility, Dougan Facility, Frederick Facility, Fort Lupton Facility, and Platteville Facility, which are located in the Denver-Julesburg Basin in and near Adams and Weld Counties, Colorado (the "D-J Basin"), (which facilities are among those later defined as the "D-J Basin Facilities"); and (ii) three compressor stations referred to herein as the Cottonwood Wash Facility, Ouray Facility, and Bridge Station Facility which are in the Uinta Basin located near Vernal, Utah (the "Uinta Basin") (collectively the "Uinta Basin Facilities");

WHEREAS, EPA administers the Act's programs for the Prevention of Significant Deterioration ("PSD"), National Emission Standards for Hazardous Air Pollutants ("NESHAP"), and federal operating permits under Title V with respect to the Uinta Basin Facilities, and the Colorado Department of Public Health and Environment ("CDPHE") as well as EPA, through the Colorado State Implementation Plan ("SIP"), are authorized to administer the PSD, NESHAP, and Title V programs with respect to the D-J Basin Facilities;

WHEREAS, on September 9, 2004, Kerr-McGee disclosed to EPA, pursuant to EPA's policy titled "Incentives for Self-Policing: Discovery, Disclosure, Correction and Prevention of Violations" published at 65 Fed. Reg. 19,618 - 27 (April 11, 2000), that both the Cottonwood Wash Facility and Ouray Facility, which Kerr-McGee acquired as part of a June 2004 merger

with Westport Resources Corporation, had the potential to emit greater than major source thresholds and were subject to the federal operating permit requirements of Title V of the Act. Kerr-McGee subsequently submitted applications for Title V permits for both facilities to EPA, removed the conventional dehydrators at those facilities and replaced them with new "low-emission dehydrators" (as defined herein) incorporating integral vapor recovery capabilities and emitting insignificant amounts of Volatile Organic Compounds ("VOC") or other pollutants regulated under the Act;

WHEREAS, Plaintiff-Intervenor, the State of Colorado ("State"), on behalf of CDPHE, has simultaneously with lodging this Consent Decree, filed a Complaint in Intervention joining in the claims alleged by the United States to have occurred at the D-J Basin Facilities and additionally citing violations of the Colorado Air Pollution Prevention and Control Act (the "Colorado Act") and its implementing regulations. CDPHE previously issued to Kerr-McGee Rocky Mountain Corporation[1]: (i) a Notice of Violation ("NOV") on or about November 4, 2005 for failure to install pollution control equipment on compressor engines ("RICE" as further defined below) at four of the D-J Basin Facilities; (ii) a Compliance Advisory on or about May 5, 2005 for violations of Operating Permit No. 95OPWE013 and Construction Permit No. 00WE0583 for the Fort Lupton Facility; (iii) a NOV on or about June 15, 2005 for violations of CDPHE Permit No. 02WE0126 Initial Approval, and Modification 1 thereof applicable to the Thermal Oxidizer at the Platteville Station's Amine Unit; (iv) its findings that Kerr-McGee's records for 2005, maintained pursuant to Regulation No. 7, indicated Kerr-McGee's failure to achieve required emission reductions for 9 days between May 1, 2005, and September 30, 2005;

[1] Kerr-McGee Rocky Mountain Corporation no longer exists, and its former operating facilities in Colorado are now owned by Kerr-McGee Oil and Gas Onshore LP, a wholly-owned subsidiary of Kerr-McGee Corporation.

and (v) the preliminary findings of CDPHE on or about November 10, 2006, based on inspections during the 2006 Ozone Season of Kerr-McGee facilities with condensate storage tanks at which flares were installed to control VOC emissions pursuant to Colorado Air Quality Control Commission Regulation No. 7, Section XII, which findings indicated certain violations;

WHEREAS, Kerr-McGee does not admit the violations occurred and further does not admit any liability for civil penalties, fines, or injunctive relief to the United States or the State arising out of the transactions or occurrences alleged in the Complaint, the Complaint in Intervention, or the NOVs and Compliance Advisory issued by CDPHE;

WHEREAS, Kerr-McGee has worked cooperatively with the Plaintiff and Plaintiff-Intervenor (collectively referred to as Plaintiffs) to settle this matter and committed to reduce or avoid annual emissions in the Uinta Basin and the D-J Basin by an estimated 1,750 tons of nitrogen oxides ("NOx"), 1,156 tons of carbon monoxide ("CO"), 686 tons of sulfur dioxide (SO_2), and 2,195 tons of VOCs, and also to undertake various projects to conserve and return to the market place an estimated 456 million standard cubic feet of natural gas in the first twelve (12) months following full implementation of the Pneumatic Controller (defined herein) retrofits made pursuant to this Consent Decree;

WHEREAS, Kerr-McGee previously developed plans to extensively use electric power for a portion of its natural gas compression needs in the future development of its Uinta Basin operating assets, which if implemented will avoid the emission of significant quantities of air pollutants otherwise produced by natural gas-fired engines used for natural gas compression, and has already implemented "green completion" practices and procedures for completing new wells

in both its Uinta Basin and D-J Basin operations to prevent or minimize the flaring and/or venting of natural gas during well completion;

WHEREAS, the United States, the State, and Kerr-McGee (the "Parties") recognize, and the Court by entering this Consent Decree finds, that this Consent Decree has been negotiated by the Parties in good faith and at arm's length, will avoid litigation among the Parties, and that this Consent Decree is fair, reasonable, consistent with the goals of the Act, the Colorado Act, and their implementing regulations, and that its entry is in the best interests of the Parties and is in the public interest;

NOW, THEREFORE, before the taking of any testimony, without the adjudication or admission of any issue of fact or law except as provided in Section I (Jurisdiction and Venue), and with the consent of the Parties,

IT IS HEREBY ADJUDGED, ORDERED, AND DECREED as follows:

I. JURISDICTION AND VENUE

1. This Court has jurisdiction over the subject matter of this action and the Parties pursuant to 28 U.S.C. §§ 1331, 1345, and 1355, and Sections 113(b), 167, and 304 of the Act, 42 U.S.C. §§ 7413(b), 7477 and 7604. Venue lies in this District pursuant to Sections 113(b) and 304(c) of the Act, 42 U.S.C. §§ 7413(b) and 7604(c), and 28 U.S.C. §§ 1391(b) & (c) and 1395(a), because some of the violations alleged in the Complaint and the Complaint in Intervention are alleged to have occurred in, and Kerr-McGee conducts business in, this judicial district. The Uinta Basin Facilities are located on "Indian country" lands as defined at 18 U.S.C. § 1151 in Uintah County. For purposes of this Consent Decree, or any action to enforce this Consent Decree, Kerr-McGee consents to and will not contest the jurisdiction of the Court over

this matter. For purposes of this Consent Decree, Kerr-McGee agrees that the Complaint and the Complaint in Intervention state claims upon which relief may be granted pursuant to Sections 113, 167, and 304(a) of the Act, 42 U.S.C. §§ 7413, 7477 and 7604(a) and Sections 115, 121, and 122 of the Colorado Act, §§ 25-7-115, 121, and 122 C.R.S.

II. APPLICABILITY

2. The obligations of this Consent Decree apply to and are binding upon the United States and the State, and upon Kerr-McGee, as defined herein, and any of its successors and assigns.

3. Kerr-McGee shall ensure that any of its corporate subsidiaries or affiliates that now or in the future may own or operate any of the Uinta Basin Facilities, the D-J Basin Facilities, or other natural gas production or gathering facilities subject to any work or compliance requirements of this Consent Decree, take all necessary and appropriate actions and provide EPA and/or the State access to facilities, equipment, and information as may be required to enforce this Consent Decree so that Kerr-McGee may fully and timely comply with all requirements of this Consent Decree.

4. In any action to enforce this Consent Decree, Kerr-McGee shall not raise as a defense the failure by any of its officers, directors, employees, agents, contractors, or corporate affiliates or subsidiaries to take any actions necessary to comply with the provisions of this Consent Decree.

III. DEFINITIONS

5. Terms used in this Consent Decree that are defined in the Act or in regulations promulgated pursuant to the Act shall have the meanings assigned to them in the Act or such

regulations, unless otherwise provided in this Decree. Whenever the terms set forth below are used in this Consent Decree, the following definitions shall apply:

a. "CDPHE" shall mean the Colorado Department of Public Health and Environment and any of its successor agencies or departments.

b. "Consent Decree" or "Decree" shall mean this Consent Decree and all appendices attached hereto (listed in Section XXX).

c. "Day" shall mean a calendar day unless expressly stated to be a business day. In computing any period of time under this Consent Decree, where the last day would fall on a Saturday, Sunday, or federal holiday, the period shall run until the close of business of the next business day.

d. "D-J Basin Facilities" shall collectively mean the Hudson Facility, Dougan Facility, Frederick Facility, Fort Lupton Facility, Brighton Facility, Hambert Facility, and Platteville Facility, all located in the D-J Basin in Weld and Adams Counties, Colorado, as more specifically described in Appendix A. These facilities do not include wellhead facilities.

e. "EPA" shall mean the United States Environmental Protection Agency and any of its successor departments or agencies.

f. "HAP" shall mean hazardous air pollutant.

g. "Kerr-McGee" shall mean Kerr-McGee Corporation, a Delaware corporation, and the wholly-owned subsidiary of Anadarko Petroleum Corporation as of August 10, 2006, and any of its corporate subsidiaries or

affiliates that own or operate any of the Uinta Basin Facilities or the D-J Basin Facilities (each as defined herein), or any other natural gas production or gathering facilities subject to any work or compliance requirements of this Consent Decree, and for which Kerr-McGee Corporation certifies pursuant to Paragraph 112 that it has authority to legally bind such entity to take all actions necessary for Kerr-McGee Corporation to comply with the provisions of this Consent Decree, including but not limited to: Kerr-McGee Oil and Gas Onshore LP, Westport Field Services LLC, Kerr-McGee (Nevada) LLC, and Kerr-McGee Gathering LLC.

h. "Low-Emission Dehydrator" shall be defined as set forth in Paragraph 6 of this Consent Decree.

i. "Paragraph" shall mean a portion of this Decree identified by an Arabic numeral.

j. "Performance Optimization Review" shall mean an evaluation of energy efficiency and the potential for product recovery at certain facilities for purposes of conserving natural gas and returning it to the marketplace.

k. "Plaintiffs" shall mean the United States and the State.

l. "Pneumatic Controller" shall mean a natural gas-driven pneumatic controller.

m. "Potential to Emit" or "PTE" shall mean the maximum capacity of a stationary source to emit a pollutant regulated under the Act under its

physical and operational design. Any physical or operational limitation on the capacity of the source to emit a pollutant regulated under the Act, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, shall be treated as part of its design if the limitation or the effect it would have on emissions is federally enforceable and, as applicable, also legally and practicably enforceable by a state or local air pollution control agency.

n. "Regulation No. 7" shall mean Colorado Air Quality Control Commission ("AQCC") Regulation No. 7, 5 Colo. Code Regs. § 1001-9 (2007).

o. "RICE" shall mean one or more stationary, natural gas-fired reciprocating internal combustion engines.

p. "Section" shall mean a portion of this Decree identified by a Roman numeral.

q. "Title V Permit" shall mean a permit issued pursuant to the federal operating permit program established by Title V of the Act, 42 U.S.C. §§ 7661 - 7661f, and as implemented by 40 C.F.R. Parts 70 (applicable to states) or 71 (applicable to EPA).

r. "TPY" shall mean tons per year.

s. "Uinta Basin Facilities" shall collectively mean the Cottonwood Wash Facility, Ouray Facility, and Bridge Station Facility each located in the

Uinta Basin near Vernal, Utah, as more specifically described in Appendix B.

t. "VOC" shall mean volatile organic compounds as defined in 40 C.F.R. § 51.100(s).

IV. EMISSION REDUCTION REQUIREMENTS

A. LOW-EMISSION DEHYDRATORS

6. "Low-Emission Dehydrator." For purposes of this Consent Decree, a "Low-Emission Dehydrator" shall meet the specifications set forth in Appendix C and shall mean a dehydration unit that:

a. incorporates an integral vapor recovery function such that the dehydrator cannot operate independent of the vapor recovery function;

b. either returns the captured vapors to the inlet of the facility where such dehydrator is located or routes the captured vapors to that facility's fuel gas supply header; and

c. has a PTE less than 1.0 TPY of VOCs, inclusive of VOC emissions from the reboiler burner.

Existing Uinta Basin Facilities

7. Kerr-McGee shall continue to operate and maintain Low-Emission Dehydrators for all gas dehydration performed at its existing Uinta Basin Facilities.

8. By no later than 30 Days after the date of lodging of this Consent Decree, Kerr-McGee shall provide a written notice to EPA and certify that each Low-Emission Dehydrator

installed at Kerr-McGee's existing Uinta Basin Facilities meets the criteria set forth in Paragraph 6.

New Facilities in the Uinta Basin

9. Beginning as of the date of lodging of this Consent Decree, and continuing for so long as this Consent Decree is in effect, Kerr-McGee shall install and operate Low-Emission Dehydrators at all compressor stations or other facilities utilizing equipment to dehydrate natural gas in the Uinta Basin.

10. Kerr-McGee shall provide written notice to EPA within 60 Days of each installation under Paragraph 9, and include a description of the equipment installed and a certification pursuant to Paragraph 112 that the Low-Emission Dehydrator meets the criteria set forth in Paragraph 6.

11. General Record-Keeping Requirement: Kerr-McGee shall maintain records and information adequate to demonstrate its compliance with the requirements of this Section IV.A., and shall report the status of its compliance with these requirements in its Annual Reports submitted pursuant to Section XII (Reporting Requirements).

B. CONDENSATE STORAGE TANKS

Cottonwood Wash and Ouray Facilities in the Uinta Basin

12. Within 180 Days after the date of lodging of this Consent Decree, Kerr-McGee shall install and operate enclosed flares at the Cottonwood Wash Facility and Ouray Facility or install a non-flare alternative pursuant to Paragraph 18 to meet a 95% or greater reduction of VOC emissions from all condensate storage tanks located at each facility.

13. Kerr-McGee shall design, install, and operate each enclosed flare required pursuant to this Section IV.B. in accordance with the requirements of 40 C.F.R. § 60.18(c)-(e) and the manufacturer's written instructions or procedures necessary to achieve the emission reductions listed in Paragraph 12. Kerr-McGee shall submit to EPA a worksheet setting forth the design calculations for each proposed enclosed flare, including heat content determination, exit velocity determination, and flow rate estimates, within 60 Days after the lodging this Consent Decree.

14. Upon startup of each enclosed flare, Kerr-McGee shall operate and maintain an auto-ignition device equipped with a thermocouple that reignites the pilot flame whenever it goes out.

15. No later than 60 Days following the start-up of each enclosed flare, Kerr-McGee shall submit a certification pursuant to Paragraph 112 to EPA that Kerr-McGee has complied with the requirements of Paragraphs 12 through 14.

16. Kerr-McGee shall inspect each enclosed flare weekly and document whether the pilot light on each enclosed flare was lit or the enclosed flare was bypassed at the time of the inspection.

17. Kerr-McGee shall notify EPA of all instances that a pilot light on each enclosed flare was not lit or the enclosed flare was bypassed, and the duration of each incident, with each Annual Report submitted pursuant to Section XII (Reporting Requirements).

18. Instead of designing, operating, maintaining, and monitoring an enclosed flare in accordance with the applicable requirements of this Section IV.B., or as a future replacement of, or preferred primary means of emission control over, an enclosed flare installed to comply with

this Section IV.B., Kerr-McGee may elect to control emissions from condensate storage tanks at these facilities by installing and operating a vapor recovery unit ("VRU"), system for cascading stabilization of condensate, or any other system to capture and beneficially use or prevent VOC emissions from condensate tanks. No later than 30 Days prior to installation, Kerr-McGee shall submit to EPA a monitoring plan to ensure the non-flare alternative meets a 95% or greater reduction in VOC emissions.

19. By no later than 60 Days after the start-up of any such enclosed flare and/or non-flare alternative, Kerr-McGee shall, where applicable, obtain all necessary federally-enforceable, non-Title V permits and amend its Title V Permit applications for the Cottonwood Wash and Ouray Facilities, as appropriate, to incorporate all enclosed flare and/or non-flare alternative installation, operation, monitoring and reporting requirements as set forth in this Section IV.B.

Brighton Facility in the D-J Basin

20. By no later than June 30, 2007, Kerr-McGee shall install and operate an enclosed flare at the Brighton Facility to meet a 95% destruction efficiency for VOC emissions from all condensate storage tanks located at the Brighton Facility.

21. Kerr-McGee shall design, install and operate the enclosed flare in accordance with the requirements of "Regulation No. 7", and the manufacturer's written instructions or procedures necessary to achieve the emission reductions listed in Paragraph 20.

22. By no later than June 1, 2007, Kerr-McGee shall have submitted a worksheet to CDPHE setting forth its design calculations for the proposed enclosed flare, including heat content determination, exit velocity determination, and flow rate estimates.

23. Upon startup of the enclosed flare, Kerr-McGee shall operate and maintain an auto-ignition device equipped with a thermocouple that reignites the pilot flame whenever it goes out.

24. By no later than 60 Days following start-up of the enclosed flare, Kerr-McGee shall submit a certification pursuant to Paragraph 112 to CDPHE that it has complied with the requirements of Paragraphs 20-23.

25. Kerr-McGee shall inspect the enclosed flare and document whether the pilot light on the enclosed flare was lit or the enclosed flare was bypassed at the time of the inspection, as required by Regulation No. 7.

26. Kerr-McGee shall notify CDPHE of all instances that a pilot light on the enclosed flare was not lit or the enclosed flare was bypassed, and the duration of each incident, with each Annual Report submitted pursuant to Section XII (Reporting Requirements), and any other reports required to be submitted to CDPHE under Regulation No. 7.

27. By no later than 60 Days after the start-up of such enclosed flare, Kerr-McGee shall apply to CDPHE for a construction permit and to amend its Title V Permit, as appropriate, to incorporate all enclosed flare installation, operation, monitoring and reporting requirements as set forth in this Section IV.B., or to request that CDPHE rescind its Title V Permit, as appropriate.

28. General Record-Keeping Requirement: Kerr-McGee shall maintain records and information adequate to demonstrate its compliance with the requirements of this Section IV.B., and shall report the status of its compliance with these requirements in its Annual Reports submitted pursuant to Section XII (Reporting Requirements).

C. COMPRESSOR ENGINES IN THE D-J BASIN

29. Kerr-McGee shall install, operate and maintain emission control equipment to reduce: (i) NO_x, CO and VOC emissions from seven existing two-stroke, lean-burn ("2SLB") RICE located at the Frederick, Dougan, and Hudson Facilities; and (ii) CO and VOC emissions from four existing 2SLB RICE located at the Fort Lupton Facility, in accordance with the control requirements of this Section IV.C. Alternatively, Kerr-McGee may permanently remove from service any of these existing eleven 2SLB RICE located at the Frederick, Dougan, Hudson or Fort Lupton Facilities either before or after meeting the additional control requirements of this Section IV.C., and it may also replace one or more such existing 2SLB RICE with new RICE subject to all applicable permitting requirements then in effect, in accordance with the schedule in Paragraphs 30 and 31. Any such new RICE shall meet the requirements of Regulation No. 7, § XVII regardless of whether such new RICE is relocated from a site within the State. Such new RICE shall have a manufacture date no earlier than January 1, 2004.

30. The emission control equipment for the seven 2SLB RICE located at the Frederick, Dougan, and Hudson Facilities shall consist of: (i) new or remanufactured turbochargers; (ii) pre-combustion chambers; (iii) after-coolers with auxiliary water cooling, as needed; (iv) high-pressure fuel injection; and (v) oxidation catalysts. All such equipment shall be installed and operational, or one or more of the 2SLB RICE shall be replaced, in accordance with the following schedule:

a. One Clark TLAD engine at the Hudson Facility - no later than January 4, 2008;

b. A second Clark TLAD engine at the Hudson Facility - no later than February 22, 2008;

c. A third Clark TLAD engine at the Hudson Facility - no later than April 11, 2008;

d. The fourth and last Clark TLAD engine at the Hudson Facility - no later than May 30, 2008;

e. One Cooper-Quad engine at the Frederick Facility - no later than November 14, 2008 or certify by November 14, 2008 pursuant to Paragraph 112 that one Cooper-Quad RICE, specifically identified by AIRS Identification Number and serial number, will be replaced no later than January 16, 2009;

f. The second and last Cooper-Quad engine at the Frederick Facility - no later than January 16, 2009 or replace the Cooper-Quad RICE, specifically identified by AIRS Identification Number and serial number, no later than January 16, 2009; and

g. Dougan Engine 21 (a Cooper-Quad) - no later than March 20, 2009 or replace the Cooper-Quad RICE no later than March 20, 2009.

31. The emission control equipment for the 2SLB RICE at the Fort Lupton Facility shall consist of oxidation catalysts. The oxidation catalysts shall be installed and operational, or the 2SLB RICE shall be replaced, in accordance with the following schedule:

a. One Fairbanks-Morse MEP engine at the Fort Lupton Facility - no later than January 4, 2008 or certify by January 4, 2008 pursuant to Paragraph

112 that one Fairbanks-Morse MEP RICE, specifically identified by AIRS Identification Number and serial number, will be replaced no later than May 30, 2008;

b. A second Fairbanks-Morse MEP engine at the Fort Lupton Facility - no later than February 22, 2008 or certify by February 22, 2008 pursuant to Paragraph 112 that one Fairbanks-Morse MEP RICE, specifically identified by AIRS Identification Number and serial number, will be replaced no later than May 30, 2008;

c. A third Fairbanks-Morse MEP engine at the Fort Lupton Facility - no later than April 11, 2008 or certify by April 11, 2008 pursuant to Paragraph 112 that one Fairbanks-Morse MEP RICE, specifically identified by AIRS Identification Number and serial number, will be replaced no later than May 30, 2008; and

d. The fourth and last Fairbanks-Morse MEP engine at the Fort Lupton Facility - no later than May 30, 2008 or replace the Fairbanks-Morse MEP RICE, specifically identified by AIRS Identification Number and serial number no later than May 30, 2008.

32. The emission control equipment for each existing 2SLB RICE at the Frederick, Dougan and Hudson Facilities shall meet the following control requirement for NOx: 2.0 grams/hp-hr., or an equivalent lbs./MMBTU limit, when the RICE is operating at a 90% load or higher.

33. The emission control equipment for each existing 2SLB RICE shall have a control requirement of 58% destruction efficiency for CO when the RICE is operating at a 90% load or higher.

34. All emission control equipment shall be appropriately sized for each existing 2SLB RICE. Immediately following installation of each emission control device, Kerr-McGee shall operate and maintain each existing 2SLB RICE and associated emission control and related equipment according to all manufacturer's written instructions or procedures necessary to achieve the emission reductions listed in Paragraphs 32 and/or 33. Oxidation catalysts shall be operated in accordance with Regulation No. 7, Section XVI.

35. Kerr-McGee shall conduct an initial emission test on each existing 2SLB RICE to demonstrate compliance with the control requirements of Paragraphs 32 and/or 33 pursuant to the Test Protocols set forth in Appendix D. Such initial emission tests shall be conducted no later than 60 Days after installation of the emission control equipment and startup of each existing 2SLB RICE.

36. If any emission control equipment fails to meet the control requirements of Paragraphs 32 and/or 33, Kerr-McGee shall take appropriate steps to correct such non-compliance and retest the emission control equipment no later than 30 Days after the initial emission test. Kerr-McGee shall submit a report to CDPHE no later than 30 Days after each such retest. The retest report will include a summary of the steps taken to comply with the control requirements of Paragraphs 32 and/or 33, and the retest results.

37. Upon successful demonstration that the emission control equipment has met the control requirements of Paragraphs 32 and/or 33, Kerr-McGee shall thereafter operate and

maintain the emission control equipment to meet those requirements in accordance with the Operation and Maintenance Plan ("O&M Plan") Kerr-McGee submits for approval to CDPHE. Kerr-McGee shall submit a proposed O&M Plan to CDPHE no later than 60 Days after a successful test or retest.

38. Kerr-McGee shall apply to CDPHE for a construction permit and amend its existing Title V Permit for each facility to incorporate the use of the emission control equipment required by this Section IV.C., as well as the applicable performance, monitoring and reporting requirements. Kerr-McGee shall submit such applications for each facility no later than 60 Days after the date of the last compliance demonstration for the last affected 2SLB RICE at each such facility.

39. General Record-Keeping Requirement: Kerr-McGee shall maintain records and information adequate to demonstrate its compliance with the requirements of this Section IV.C., and any applicable regulatory requirements, and shall report the status of its compliance with these requirements in its Annual Reports, submitted pursuant to Section XII (Reporting Requirements).

D. COMPRESSOR ENGINES IN THE UINTA BASIN

Existing RICE in the Uinta Basin

40. By no later than December 15, 2007, Kerr-McGee shall install and operate oxidation catalysts on each RICE operating in the Uinta Basin with a nameplate rating of 500 horsepower ("hp") or greater listed in Appendix E (all of which Kerr-McGee represents are located at HAP minor sources).

41. The oxidation catalysts installed on each RICE listed in Appendix E shall achieve a 93% destruction efficiency for CO when each RICE is operating at a 90% load or higher.

42. Immediately following installation of each oxidation catalyst, Kerr-McGee shall operate and maintain each RICE and oxidation catalyst according to the catalyst manufacturer's written instructions or procedures necessary to achieve the emission reductions listed in Paragraph 41.

43. Kerr-McGee shall conduct an initial emissions test of each oxidation catalyst to demonstrate compliance with the CO destruction efficiency specified in Paragraph 41 using a portable analyzer in accordance with the Test Protocol set forth in Appendix F. An initial emissions test on each oxidation catalyst installed pursuant to the requirements of Paragraph 40 shall be completed no later than 60 Days after the last oxidation catalyst installation on the RICE listed in Appendix E.

44. If any oxidation catalyst fails to meet the destruction efficiency specified in Paragraph 41, Kerr-McGee shall take appropriate steps to correct such non-compliance and retest the oxidation catalysts within 30 Days after the initial test(s). Kerr-McGee shall submit a report to EPA no later than 30 Days after each retest. The retest report will include a summary of the steps taken to comply with the control requirement in Paragraph 41 and the retest results.

45. Upon successful demonstration that an oxidation catalyst has met the destruction efficiency as specified in Paragraph 41, Kerr-McGee shall thereafter test the oxidation catalyst emission control efficiency on a semi-annual calendar-year basis using a portable analyzer in accordance with the Test Protocol set forth in Appendix F.

46. Kerr-McGee shall report to EPA in writing concerning all activities completed pursuant to the preceding Paragraphs 40 through 45. Such report shall be submitted no later than 60 Days after the initial test deadline contained in Paragraph 43. The report shall contain the following information applicable to each RICE:

a. RICE make, model, nameplate hp rating, location, installation date (when available) and manufacturer emission data;

b. catalyst make, model, installation date and manufacturer emission data;

c. initial emission test results including dates and times of test runs, names of employee(s) or contractor(s) who conducted the test, and oxygen (O_2) and CO concentration results at the inlet and outlet of the oxidation catalyst for each run; the percent reduction of CO achieved for each test run after normalizing CO concentration to a dry basis and to 15% oxygen; length of run times, and average percent engine load during each run;

d. a catalyst maintenance log (e.g., date of last catalyst replacement, number of engine operating hours since last catalyst replacement, and date and description of any catalyst maintenance activities); and

e. a certification pursuant to Paragraph 112 of the information contained in the report in accordance with Section XII (Reporting Requirements).

47. All subsequent semi-annual test results shall be included in Annual Reports to be submitted by Kerr-McGee regarding the RICE listed in Appendix E, as required by Section XII (Reporting Requirements), and shall include the information set forth in the preceding Paragraph 46.

48. If otherwise required by applicable regulations implementing the Act, Kerr-McGee shall apply for a permit for any RICE in Appendix E prior to termination of the Consent Decree.

New RICE in the Uinta Basin at HAP Minor Sources

49. Beginning on the date of the lodging of this Consent Decree, and continuing for so long as this Consent Decree is in effect, any new RICE with a nameplate rating of 500 hp or greater installed by Kerr-McGee at any facility in the Uinta Basin shall be lean-burn or achieve comparable emission reductions, and be equipped with catalyst controls.

50. For those RICE installed by Kerr-McGee in the Uinta Basin, the oxidation catalysts that are required to be installed pursuant Paragraph 49 shall achieve a 93% destruction efficiency for CO when each RICE is operating at a 90% load or higher.

51. By no later than 60 Days following the installation of a catalyst on any new RICE pursuant to Paragraph 49, Kerr-McGee shall conduct an initial emissions test of such catalyst to demonstrate compliance with the destruction efficiency specified in Paragraph 50, using a portable analyzer in accordance with the Test Protocol set forth in Appendix F.

52. If the catalyst fails to meet the destruction efficiency as specified in Paragraph 50, Kerr-McGee shall take appropriate steps to correct such non-compliance and retest the oxidation catalyst within 30 Days after the initial test. Kerr-McGee shall submit a report to EPA no later than 30 Days after each retest. The retest report shall include a summary of the steps taken to comply and the retest results.

53. Upon successful demonstration that the catalyst has met the destruction efficiency specified in Paragraph 50, Kerr-McGee shall thereafter test the oxidation catalyst emission

control efficiency on a semi-annual calendar-year basis using a portable analyzer in accordance with the Test Protocol set forth in Appendix F.

54. Kerr-McGee shall submit a report to EPA within 60 Days after each initial test is performed pursuant to Paragraph 51. The report shall contain the initial test results and the following information applicable to each RICE:

a. RICE make, model, nameplate hp rating, location, installation date and manufacturer emission data;

b. catalyst make, model, installation date and manufacturer emission data;

c. initial emission test results including date and times of test runs, name(s) of employee(s) or contractor(s) who conducted the test, and O_2 and CO concentration results at the inlet and outlet of the oxidation catalyst for each run; the percent reduction of CO achieved for each test run after normalizing CO concentration to a dry basis and to 15% oxygen; length of run times, and percent engine load at each run;

d. a certification pursuant to Paragraph 112 of the information contained in the report in accordance with Section XII (Reporting Requirements).

55. Kerr-McGee shall include all subsequent semi-annual results in the Annual Report submitted pursuant to Section XII (Reporting Requirements), as well as the information gathered pursuant to the preceding Paragraph 54, and a catalyst maintenance log (e.g., date of last catalyst replacement, number of engine operating hours since last catalyst replacement, and date and description of any catalyst activities).

56. If otherwise required by applicable regulations implementing the Act, Kerr-McGee shall apply for a permit for any new RICE subject to this Section IV.D. prior to termination of the Consent Decree.

57. General Record-Keeping Requirement: Kerr-McGee shall maintain records and information adequate to demonstrate its compliance with the requirements of this Section IV. D., and shall report the status of its compliance with these requirements in its Annual Reports submitted pursuant to Section XII (Reporting Requirements).

E. **PNEUMATIC CONTROLLERS**

Existing High-Bleed Pneumatic Controllers

58. Retrofits: Kerr-McGee shall retrofit all "high-bleed" Pneumatic Controllers listed in Appendices G and H, with "low-bleed" Pneumatic Controllers, in accordance with the requirements of this Section IV.E. For purposes of this Consent Decree, a "high-bleed" Pneumatic Controller is any Pneumatic Controller that has the capacity to bleed in excess of six standard cubic feet of natural gas per hour (50,000 scf/year) in normal operation. During the performance of such work Kerr-McGee shall, to the extent practicable, repair or replace leaking gaskets, tubing fittings and seals, and all work will be completed so as to minimize potential emissions associated with the retrofitting project.

59. By no later than September 30, 2007, Kerr-McGee shall install retrofit "low-bleed" Pneumatic Controllers on at least one-half of the high-bleed Pneumatic Controllers listed in Appendix G, and on at least one-half of the high-bleed Pneumatic Controllers listed in Appendix H.

60. Kerr-McGee shall install retrofit "low-bleed" Pneumatic Controllers on the remainder of the high-bleed Pneumatic Controllers listed in Appendices G and H by no later than May 31, 2008.

61. Replacements: By no later than two years after the date of lodging of this Consent Decree, Kerr-McGee shall replace no less than 370 additional high-bleed Pneumatic Controllers that were not amenable to retrofit with low or no-bleed Pneumatic Controllers in the Wattenberg Gas Gathering System, and as many more such high-bleed Pneumatic Controllers as may be replaced at a total cost of $500,000 (inclusive of both capital and installation costs).

62. Within 60 Days after the retrofit of Pneumatic Controllers listed in Appendices G and H is completed, and within 60 Days after the replacement of Pneumatic Controllers required by Paragraph 61, Kerr-McGee shall provide EPA, and as applicable CDPHE, a report that certifies the completion of each such project and an accompanying spreadsheet that identifies each unit retrofitted or replaced, its site location, its service, the date the retrofit or replacement was completed, the estimated bleed rate reductions and corresponding estimates of both annual VOC reductions (on a calendar-year basis) and the amount of natural gas conserved, and the approximate cost of each retrofit and replacement.

New Construction

63. Beginning on the date of the lodging of this Consent Decree, and continuing through January 1, 2017, Kerr-McGee shall install and operate low or no-bleed Pneumatic Controllers to conserve natural gas at all newly constructed facilities in the Uinta Basin and D-J Basin, where instrument air is not otherwise available. Kerr-McGee need not, however, install

low or no-bleed controllers at sites for which Kerr-McGee can demonstrate that the use of low or no-bleed pneumatic devices would not be technically or operationally feasible.

64. Kerr-McGee shall have implemented the mandatory management directive (Appendix I) which requires the use of low-bleed Pneumatic Controllers at all newly constructed facilities in the D-J and Uinta Basins.

65. General Record-Keeping Requirement: Kerr-McGee shall maintain records and information adequate to demonstrate its compliance with the requirements of this Section IV. E., and shall report the status of its compliance with these requirements, in its Annual Reports submitted pursuant to Section XII (Reporting Requirements).

F. SULFUR REMOVAL TECHNOLOGY IN THE UINTA BASIN

66. Beginning on the date of lodging of this Consent Decree and continuing for so long as this Consent Decree is in effect, Kerr-McGee shall install and operate solid-bed or liquid-bed sulfur removal processes when necessary to remove hydrogen sulfide ("H_2S") from natural gas in the Uinta Basin, in lieu of amine-based sulfur removal with flaring of removed H_2S.

67. Kerr-McGee shall provide written notice to EPA no later than 60 Days following each installation and startup of a liquid-bed sulfur removal unit under Paragraph 66. Such notice shall include a description and the location of all liquid-bed sulfur removal equipment installed, an estimate of the annual amount of SO_2 emissions to be avoided (on a calendar-year basis), and a summary spreadsheet showing service conditions and actual capital costs.

68. General Record-Keeping Requirement: Kerr-McGee shall maintain records and information adequate to demonstrate its compliance with the requirements of this Section IV. F.,

and shall report the status of its compliance with these requirements in its Annual Reports submitted pursuant to Section XII (Reporting Requirements).

V. ADMINISTRATIVE REQUIREMENTS

A. PLATTEVILLE FACILITY

69. Within 30 Days after the date of lodging of this Consent Decree, Kerr-McGee shall submit for CDPHE's approval and incorporation as a requirement of Colorado Construction Permit No. 02WE0126 an operation and maintenance ("O&M") plan for the reboiler that controls VOC emissions from the amine gas treatment system at the Platteville Facility.

70. Kerr-McGee's O&M plan shall:

a. Provide a routine program to minimize soot build-up of the reboiler burner;

b. Incorporate the burner manufacturer's written instructions or procedures necessary to ensure proper combustion; and

c. Conform to applicable requirements of CDPHE's AQCC Common Provisions Regulation, AQCC's Regulation Nos. 1, 2, 3, and 6, and 40 C.F.R. Part 60, Subparts A and Dc.

71. CDPHE shall either approve Kerr-McGee's plan or provide written comments and requested changes within 30 Days of submission of the plan. Kerr-McGee shall have an additional 30 Days from receipt of CDPHE's written response to either amend the plan and resubmit it to CDPHE, or to begin implementation of O&M in accordance with the approved plan. Upon CDPHE's approval, the O&M plan shall become an enforceable requirement of Colorado Construction Permit No. 02WE0126.

B. FORT LUPTON FACILITY

72. Within 30 Days after the date of lodging of this Consent Decree, Kerr-McGee shall propose to CDPHE a consolidated annual allowable VOC emission limit for equipment leaks from components at the Fort Lupton Facility that are in VOC hydrocarbon service as described at 40 C.F.R. § 60.632(f). The following sources of VOC emissions shall be subject to such consolidated emission limit:

a. Equipment leaks from those components of the Fort Lupton Facility subject to Condition 6.1 of CDPHE Operating Permit No. 95OPWE013 (30.8 TPY); and

b. Equipment leaks from components of the natural gas liquids ("NGL") extraction unit subject to Condition 2 of CDPHE Construction Permit No. 00WE0583 (46.4 TPY).

73. Kerr-McGee's proposal to CDPHE shall be made as an application to amend the Title V Permit for the Fort Lupton facility. The Parties agree that incorporation of this requirement into the Title V Permit for the Fort Lupton facility may be made by "administrative amendment" under 40 C.F.R. § 70.7(d) and corresponding State Title V rules, where allowed by State law. CDPHE shall administer Kerr-McGee's application as a routine application for a Title V permit amendment. Until such time as CDPHE has taken final agency action with regard to such application, Kerr-McGee shall comply with the following interim emission limit for the Fort Lupton Facility, consistent with applicable EPA guidance on appropriate emission factors and control percentages for components in hydrocarbon service at facilities with quarterly leak detection and repair ("LDAR") programs in place: 77.2 TPY of VOCs during any 12-month

period (on a rolling basis) from equipment leaks at the Fort Lupton Facility subject to the requirements of 40 C.F.R. Part 60, Subpart KKK and Regulation No. 7. For the purpose of demonstrating compliance with this interim emission limit, emissions shall be calculated in accordance with the methodology contained in Appendix J.

VI. LIMITS ON POTENTIAL TO EMIT

74. The control requirements established in Sections IV.A. (Low-Emission Dehydrators), IV.B. (Condensate Storage Tanks), IV.C. (Compressor Engines in the D-J Basin), IV.D. (Compressor Engines in the Uinta Basin) and IV.E. (Pneumatic Controllers), under this Consent Decree shall be considered "federally enforceable" and, as applicable, "legally and practicably enforceable" for purposes of calculating the PTE of a source or facility as may be applicable under the Act and the Colorado Act and any implementing federal or Colorado regulations.

75. The PTE for VOCs from Low-Emission Dehydrators installed and certified pursuant to this Consent Decree at any facility in the Uinta or D-J Basins shall be limited by the control requirements set forth in Section IV.A. (Low-Emission Dehydrators), and shall be federally enforceable on that basis.

76. The PTE for VOC emissions from condensate storage tanks at the Cottonwood Wash Facility and Ouray Facility shall be limited by the requirement that such emissions will be controlled by a flare, VRU, or other non-flare alternatives pursuant to the criteria set forth in Section IV.B. (Condensate Storage Tanks) and shall be federally enforceable on that basis.

77. The PTE for CO and formaldehyde for all RICE in the Uinta Basin with a nameplate rating of 500 hp or greater shall be limited by the requirement that emissions be

controlled by catalysts which meet a destruction efficiency for CO set forth in Paragraphs 41 and 50 and shall be federally enforceable on that basis.

78. The PTE for CO for the eleven 2SLB RICE in the D-J Basin shall be limited by the requirements of Section IV.C. (Compressor Engines in the D-J Basin) that such emissions will be controlled by oxidation catalysts which meet the control requirements set forth in Paragraph 33 and shall be federally enforceable on that basis.

79. The PTE for NOx for the 2SLB RICE at the Frederick, Dougan and Hudson Facilities shall be limited by the requirement that equipment be upgraded for purposes of reducing emissions which meet the control requirements set forth in Paragraph 32 and shall be federally enforceable on that basis.

VII. AMBIENT AIR MONITORING

80. By no later than six months after entry of this Consent Decree, Kerr-McGee shall fund the purchase, installation and initial operation of ambient air quality and meteorological monitoring station(s) in and/or adjacent to the Uinta Basin, subject to a $300,000 cap on Kerr-McGee's total expenditures to comply with this Section VII. The ambient air quality monitor(s) shall be designed to monitor ozone, NOx and $PM_{2.5}$ concentrations. The meteorological station(s) shall have a 10 meter tower and be designed to monitor wind speed, wind direction, temperature and solar radiation. The station(s) shall be designed to gather multilevel meteorological data necessary for use in air quality monitoring under current federal and state laws and regulations.

81. Kerr-McGee shall work cooperatively with EPA, the Utah Department of Environmental Quality (UDEQ) and the Ute Indian Tribe of the Uintah and Ouray Reservation

(the "Northern Ute Tribe") regarding the location of monitor(s), schedule for project implementation and coordination of their initial operation. The station(s) shall meet the siting, methodology and operational requirements of 40 C.F.R. Part 58, and shall be sited in a representative location upwind of the Uinta Basin and/or a representative central location within the Uinta Basin. Additional guidance for meteorological monitoring is contained in "Quality Assurance Handbook for Air Pollution Measurement Systems, " Vol. IV, "Meteorological Measurements." Actual monitoring site selection shall be subject to approval by EPA and Kerr-McGee, after review and comment on proposed locations by the UDEQ and the Northern Ute Tribe. All monitoring data shall be collected in a manner reasonably calculated to meet EPA's quality assurance/quality control ("QA/QC") requirements of 40 C.F.R. Part 58, App. A. Additional guidance is provided in "Quality Assurance Handbook for Air Pollution Measurement Systems."

82. Subject to a $300,000 cost cap, Kerr-McGee shall fund the operation and maintenance of up to two (2) stations, and the collection and distribution of monitoring data for the station(s) until Kerr-McGee has expended $300,000 in capital, installation, operation and maintenance costs. Kerr-McGee shall certify in accordance with Paragraph 112 that it has expended $300,000 in capital, installation, operation and maintenance costs for up to two (2) stations.

VIII. MULTI-PHASE PIPING/TANKLESS WELL-SITE PILOT PROJECT

83. Kerr-McGee shall complete a study of the technical and operational feasibility of using a system to gather multi-phase fluids (liquid and gas constituents) from multiple producing natural gas well-sites for collection, separation and metering at a central facility in the Uinta

Basin ("Feasibility Study"), and if technically and operationally feasible, shall implement a pilot project to demonstrate such technology in the Uinta Basin ("Multi-Phase Pilot"), in accordance with the requirements of this Section VIII. The Feasibility Study and Multi-Phase Pilot shall focus on a proposed system to: (i) eliminate the storage of hydrocarbon liquids and produced water at individual wellhead facilities within the system; and (ii) reduce emissions of VOCs from condensate storage tanks to be located at a central collection point. Subject to the cost cap set forth in Paragraph 86, the Multi-Phase Pilot shall include: (i) at least sixteen new or existing well pads and multi-phase piping from those well pads to a central collection point; and (ii) separation, liquid storage, gas metering equipment, and VOC emission control or capture, to the extent emissions are not otherwise prevented through process changes.

84. Feasibility Study: Kerr-McGee shall complete the Feasibility Study in accordance with the scope of work ("FS SOW") attached as Appendix K. No later than 90 Days after the date of lodging this Consent Decree, Kerr-McGee shall submit a written report of the conclusions of the Feasibility Study to EPA for review and concurrence. In the event the Feasibility Study concludes that the Multi-Phase Pilot is not technically or operationally feasible to implement, Kerr-McGee shall have no further obligations under this Section VIII.

85. Multi-Phase Pilot: If the Multi-Phase Pilot is found to be technically and operationally feasible in the Feasibility Study, Kerr-McGee shall submit to EPA for review and approval a proposed scope of work ("Multi-Phase Pilot SOW") to implement the Multi-Phase Pilot in a manner consistent with the conclusions of the Feasibility Study. The Multi-Phase Pilot SOW shall include an estimate of "Added Incremental Costs," which for purposes of this Section VIII, are defined as the total costs over and above the costs of conventional well-site

development, accounting for normal construction. EPA shall either approve the Multi-Phase Pilot SOW or provide written comments on requested changes within 30 Days of receipt of such Multi-Phase Pilot SOW. Kerr-McGee shall have an additional 30 Days from receipt of EPA's written response to either amend the Multi-Phase Pilot SOW and resubmit it to EPA, or to invoke the dispute resolution procedures set forth in Section XV (Dispute Resolution), and EPA shall have an additional 30 Days from resubmission to comment upon or approve such revised Multi-Phase Pilot SOW.

86. In the event that Kerr-McGee can document to EPA's satisfaction, in accordance with Paragraph 85, that the Added Incremental Costs of the Multi-Phase Pilot to be implemented pursuant to the EPA-approved Multi-Phase Pilot SOW will exceed $750,000, Kerr-McGee shall implement the Multi-Phase Pilot at as many well pads as can be funded for $750,000 in Added Incremental Costs. In the event that EPA and Kerr-McGee disagree on the total Added Incremental Costs, Kerr-McGee shall bear the burden of demonstrating by a preponderance of evidence that such costs exceed the $750,000 cost cap.

87. Kerr-McGee shall provide EPA with semi-annual, calendar-year progress reports, beginning 180 Days following EPA's approval of the Multi-Phase Pilot SOW, documenting progress on the Multi-Phase Pilot. The progress report shall include a description of the schedule status for engineering, procurement, construction and start up of the Multi-Phase Pilot, and an updated estimate of "Added Incremental Costs."

88. By no later than 18 months following EPA's approval of the Multi-Phase Pilot SOW, Kerr-McGee shall have installed and begun operation of the Multi-Phase Pilot in accordance with the approved Multi-Phase Pilot SOW.

89. Within 90 Days of the installation and startup of the Multi-Phase Pilot, Kerr-McGee shall provide EPA a final report that includes the following information:

a. A description of the project as completed, including: (i) a topographic area map showing the well pads, multi-phase pipelines, and central liquids gathering; (ii) a process description with a summary of gas, condensate and water production rates since project startup; (iii) process flow diagrams for a typical well pad and for central liquids gathering equipment; (iv) a representative condensate liquids sample analysis from a well pad and from the outlet of central liquid separation; and (v) the API gravity and RVP for such required condensate samples;

b. A discussion of the operating challenges presented by the Multi-Phase Pilot and their means of resolution;

c. An itemization of the Added Incremental Costs of the project as completed;

d. An itemized estimate of both incremental added and saved operating costs compared to conventional gas gathering methods; and

e. A description of air quality and other environmental benefits attributable to the project, together with any calculations and process simulations used to estimate air emission reductions and natural gas conserved.

90. General Record-Keeping Requirement: Kerr-McGee shall maintain records and information adequate to demonstrate its compliance with the requirements of this Section VIII, and any applicable regulatory requirements, and shall report the status of its compliance with

these requirements in its Annual Reports until the Multi-Phase Pilot is fully implemented and operating, as set forth in Section XII (Reporting Requirements).

IX. PERFORMANCE OPTIMIZATION REVIEW

91. Within one year after the date of lodging of this Consent Decree, Kerr-McGee shall complete a Performance Optimization Review ("POR") to increase energy efficiency and enhance product recovery at five facilities in the Uinta Basin and five facilities in the D-J Basin in accordance with the Scope of Work attached as Appendix L. The five facilities in the Uinta Basin shall consist of four well-site facilities (two shall be at least five years old, one shall be less than five years old, and one shall be a new drill) and one (1) compressor station. The five facilities in the D-J Basin will consist of four well-site facilities (two shall be at least ten years old, one shall be less than ten years old, and one shall be a new drill) and the Platteville Facility.

92. Kerr-McGee's POR shall be performed by third-party consultants acceptable to EPA and CDPHE. Performance of the POR may be temporarily suspended during entry pursuant to Paragraph 140.

93. The scope of the POR is expressly limited to the following activities, as set forth in the POR SOW:

a. Pressure Relief Devices - repair or replace components, as appropriate, to specifically reduce product losses;

b. Pneumatic Controllers - evaluate for use of low-bleed devices or instrument air;

c. Production Separators - identify optimal pressures and temperatures, and reset as needed;

d. Dehydrators - evaluate for use of condensers, flares, flash tanks and electric pumps to reduce product losses;

e. Internal Combustion Engines - evaluate maintenance practices and planned shutdown procedures to minimize product losses from blow down and the use of starter gas;

f. Flare and Vent Systems - evaluate flare and vent system components and associated operating procedures to reduce the loss of product, where possible;

g. Producing Wells - install plunger lifts and perform "green completion" practices on new wells, as appropriate;

h. Operating Pressures - review and optimize, where possible; and

i. Component Inspections and Repairs - perform component inspections using OVA, TVA, or other CDPHE-approved leak detection field equipment and repair or replace leaking components, as appropriate, to enhance product recovery.

94. POR Reports. Within 60 Days of completion of the POR, Kerr-McGee shall submit a POR Report to EPA for the Uinta Basin and a POR Report to CDPHE for the D-J Basin which shall include:

a. the contractor(s) used to conduct the POR;

b. the name, location and original construction date of each of the well-site facilities and the compressor station at which the POR was completed;

c. a general description of the components by type and service that were inspected, how they were inspected, a summary and description of any repairs made, an estimate of natural gas conserved as a result of the repairs to the extent quantifiable, and the repair cost;

d. a general description of the pressure relief devices that were inspected, how they were inspected, a summary description of any repairs made, an estimate of natural gas conserved as a result of the repairs to the extent quantifiable, and the repair cost;

e. an evaluation of pneumatic devices for use of low-bleed devices or instrument air, and potential product losses avoided;

f. a description of the review of production separators, identification of those for which optimal pressures and temperatures were calculated and how that was done; a comparison of those values to prior separator operating conditions, a summary of the adjustments to pressures or temperatures that were made, an estimate of the amount of natural gas conserved as a result, and the cost if significant, to adjust pressures and temperatures;

g. a description of the evaluation of dehydrators for the use of condensers, flares, flash tanks, and electric pumps; a summary of the projects identified as a result of such review for possible future implementation by Kerr-McGee on a voluntary basis; if sufficient data exists to prepare an estimate, an estimate of the amount of natural gas potentially conserved if such projects were implemented, and the cost to implement such projects;

h. a description of the review of RICE shutdown procedures to reduce blow down and the use of starter gas; a summary of any changes that were made based on such review; an estimate of product losses avoided as a result of any changes made, if reasonably capable of estimation; and the cost to implement such changes;

i. a description of the review of flare and vent systems, a summary of the repairs made, if any; an estimate of the amount of natural gas conserved as a result of repairs made, and the cost to implement such repairs;

j. a list of well names and locations at which plunger lift systems were installed, if any, or at which green completion procedures were followed; a description of any plunger lift system(s) used and the well condition(s) that made such system(s) practicable or how new well completion procedures were "green"; an estimate of the amount of natural gas conserved as a result of POR evaluations of certain producing wells, and the cost to implement any such systems and/or procedures; and

k. a description of how operating pressures were evaluated and, where possible, optimized; an estimate of the amount of natural gas conserved as a result of such evaluation, and an estimate of the cost, if non-negligible, to optimize operating pressures.

95. Within 120 Days of completion of the POR, Kerr-McGee may identify in writing to EPA, and as applicable CDPHE, any areas of non-compliance with the Act and the Colorado Act (including federal and state implementing regulations) that are discovered during the POR.

Under this Paragraph, for other than PSD/NSR, Kerr-McGee shall include in its written submission: (1) a certification pursuant to Paragraph 112 that it has subsequently complied with all applicable statutory and regulatory requirements, or it shall propose a schedule for coming into compliance; (2) a description of the corrective measures taken, or proposed to be taken; and (3) a proposed calculation of any economic benefit pursuant to the EPA Stationary Source Civil Penalty Policy and BEN Model. EPA and/or CDPHE will review Kerr-McGee's certifications, and/or proposed schedule for compliance, corrective measures, and economic benefit calculation(s), and will respond with written concurrence or comments. In the event that EPA and/or CDPHE do not approve of the proposed corrective measures or economic benefit calculation(s), each, as applicable, will respond with written comments. Should EPA and/or CDPHE still not agree with the economic benefit calculation(s), EPA and/or CDPHE's independent economic benefit calculations shall be final and payable. If necessary, the Parties will address any PSD/NSR violations as a new and separate enforcement action. Kerr-McGee's release from liability as specified in Section XVII (Effect of Settlement/Reservation of Rights) for the areas of non-compliance identified and corrected pursuant to this Section IX will take effect upon the Plaintiffs' written concurrence with Kerr-McGee's certification and its payment in full of any economic benefit. Any areas of non-compliance discovered by EPA or CDPHE, and any disclosures by Kerr-McGee beyond this specific 120-Day period, are not covered by this provision.

X. CIVIL PENALTY

96. Within 30 Days after the Effective Date of this Consent Decree, Kerr-McGee shall pay to the Plaintiffs a total civil penalty pursuant to Section 113 of the Act, 42 U.S.C. §

7413, in the amount of $200,000, with interest accruing from the date on which the Consent Decree is entered by the Court at the rate specified in 28 U.S.C. § 1961 as of the date of entry.

97. Federal Payment Instructions: Of the total amount of the civil penalty, Kerr-McGee shall pay $150,000 to the United States. Kerr-McGee shall make payment by Electronic Funds Transfer ("EFT") to the United States Department of Justice ("DOJ"), in accordance with current EFT procedures, referencing the United States Attorney's Office ("USAO") File Number and DOJ Case Number 90-5-2-1-08656. Payment shall be made in accordance with instructions provided by the USAO for the District of Colorado. Any funds received after 11:00 a.m. (EST/EDT) shall be credited on the next business Day. Kerr-McGee shall provide notice of payment, referencing the USAO File Number, DOJ Case Number 90-5-2-1-08656 and the civil case name and case number, to DOJ and to EPA, as provided in Section XX (Notices).

98. State Payment Instructions: Of the total amount of the civil penalty, Kerr-McGee shall pay $50,000 to the State. Kerr-McGee shall make payment by certified, corporate or cashier's check drawn to the order of "Colorado Department of Public Health and Environment" and delivered to the attention of Legal Administrative Specialist, Air Pollution Control Division, 4300 Cherry Creek Drive South, APCD-SS-B1, Denver, CO 80246-1530. Kerr-McGee shall provide notice of payment, referencing USAO File Number and DOJ Case Number 90-5-2-1-08656, and the civil case name and case number, to CDPHE, as provided in Section XX (Notices).

99. No amount of the civil penalty to be paid by Kerr-McGee shall be used to reduce its federal or Colorado tax obligations.

XI. SUPPLEMENTAL ENVIRONMENTAL PROJECTS

A. Uintah County Road Dust SEP

100. Subject to approval by the Uintah County Commissioners, Kerr-McGee shall implement a Supplemental Environmental Project ("SEP"), to improve a portion of a County Road in Uintah County, Utah, in the Uinta Basin, to reduce particulate matter (road dust), in accordance with the provisions of Appendix M (the "Road Dust SEP"). The Road Dust SEP shall be completed within 12 months after entry of this Decree. In implementing the Road Dust SEP, Kerr-McGee shall spend not less than $100,000 in eligible Road Dust SEP costs. Eligible Road Dust SEP costs include the costs of planning and implementing the Road Dust SEP, or contracting for the work through the Uintah County Roads Department.

101. Kerr-McGee is responsible for the satisfactory completion of the Road Dust SEP in accordance with the requirements of this Consent Decree. Kerr-McGee may use contractors or consultants in planning and implementing the Road Dust SEP or coordinating such planning and implementation by the Uintah County Roads Department. "Satisfactory completion" means completion of the work in accordance with all work plans and specifications for the project and expenditure of not less than $100,000.

B. Accelerated Vehicle Retirement State SEP

102. No later than 30 Days after the Effective Date of this Consent Decree, Kerr-McGee shall implement a SEP to reduce air pollution from high-emitting vehicles in the Denver metropolitan area (the "Accelerated Vehicle Retirement State SEP") by transferring $150,000 ("SEP Funds") to the Regional Air Quality Council ("RAQC"). The criteria, terms and procedures for the Accelerated Vehicle Retirement State SEP are described in Appendix N. The

transfer of funds to the RAQC shall be by certified, corporate or cashiers check made payable to the Regional Air Quality Council and delivered to the attention of Steve McCannon, Program Manager, Regional Air Quality Council, 1445 Market St., Suite 260, Denver, CO 80202. Prior to transferring the funds, Kerr-McGee shall obtain a written statement from the RAQC acknowledging and agreeing that the RAQC will expend the SEP Funds to implement the Accelerated Vehicle Retirement State SEP in accordance with the criteria, terms and procedure described in Appendix N. Within 10 days of transferring the SEP Funds, Kerr-McGee will provide a copy of the check and the RAQC's written statement to CDPHE.

C. General Requirements

103. With regard to both the Road Dust SEP and the Accelerated Vehicle Retirement State SEP, Kerr-McGee certifies the truth and accuracy of each of the following:

a. that, as of the date of executing this Decree, Kerr-McGee was not required to perform or develop either SEP by any federal, state, or local law or regulation and was not required to perform or develop the SEPs by prior agreement, grant, or as injunctive relief awarded in any other action in any forum;

b. that neither SEP is a project that Kerr-McGee was planning or intending to construct, perform, or implement other than in settlement of the claims resolved in this Decree;

c. that Kerr-McGee has not received and will not receive credit for either SEP in any other enforcement action by a government entity; and

d. that Kerr-McGee will not receive any reimbursement for any portion of the SEP costs from any other person.

104. SEP Completion Reports: Within 30 Days after the date set for completion of each SEP, Kerr-McGee shall submit a SEP Completion Report to the United States, and with regard to the Accelerated Vehicle Retirement State SEP also to CDPHE, in accordance with Section XIX (Notices) of this Consent Decree. The SEP Completion Reports shall contain the following information:

a. a detailed description of the SEP, as implemented;

b. a description of any problems encountered in completing the SEP and the solutions thereto;

c. an itemized list of all eligible SEP costs;

d. certification pursuant to Paragraph 112 that the SEP has been fully implemented pursuant to the provisions of this Decree; and

e. a description of the air quality benefits resulting from implementation of the SEP, including an estimate of associated emission reductions.

105. EPA, or as applicable CDPHE, may require information in addition to that described in the preceding Paragraph 104, which is reasonably necessary to determine satisfactory completion of the SEPs or eligibility of SEP costs. Kerr-McGee shall provide such additional information to which it has access.

106. Within 60 Days after receiving each SEP Completion Report, the United States and/or CDPHE shall notify Kerr-McGee whether the SEP at issue has been satisfactorily completed. If a SEP has not been satisfactorily completed in accordance with all applicable

work plans and schedules, or if the amount expended on performance of a SEP is less than the amount set forth in Paragraphs 100 and 102, stipulated penalties may be assessed under Section XIII (Stipulated Penalties) of this Consent Decree.

107. Disputes concerning the satisfactory completion of a SEP and the amount of eligible SEP costs may be resolved under Section XV (Dispute Resolution) of this Consent Decree. No other disputes arising under this Section shall be subject to Dispute Resolution.

108. Each submission required under this Section shall be signed by an official with knowledge of the SEP and shall bear the certification language set forth in Paragraph 112.

109. Any public statement by Kerr-McGee making reference to either SEP, whether oral or written, in print, film, or other media, shall include the following language: "This project was undertaken in connection with the settlement of an enforcement action taken on behalf of the U.S. Environmental Protection Agency and/or the State of Colorado for alleged violations of the Clean Air Act and/or the Colorado Air Pollution Prevention and Control Act."

XII. REPORTING REQUIREMENTS

110. Kerr-McGee shall submit the following reports:

a. All initial performance test results, retest reports, initial status reports, progress reports, final reports, notices, and monitoring data pursuant to any specific requirement of this Consent Decree for each annual reporting period (not a cumulative requirement).

b. By no later than March 1 of each year, Kerr-McGee shall submit an Annual Report for the preceding calendar year to EPA, and for any matters involving the D-J Basin also to CDPHE. Kerr-McGee shall

provide a paper and electronic copy of each Annual Report to EPA and, as applicable, CDPHE. The Annual Report shall: (i) describe all work or other activities that Kerr-McGee performed pursuant to any requirement of this Consent Decree during the applicable reporting period; (ii) transmit any specific (non-annual) reports to be included in an Annual Report; (iii) describe compliance status; and (iv) describe any non-compliance with the requirements of this Consent Decree and explain the likely cause(s) of the violation(s) and the remedial steps taken, or to be taken, to prevent or minimize such violation(s).

c. If Kerr-McGee violates, or has reason to believe that it may violate, any requirement of this Consent Decree, Kerr-McGee shall notify EPA, and as applicable CDPHE, of such violation(s), and its likely duration, in writing, within 10 Days of the Day Kerr-McGee first becomes aware of the violation(s), or potential violation(s), with an explanation of the likely cause of such violation(s) and the remedial steps taken, or to be taken, to prevent or minimize such violation(s) should it occur. If the cause of a violation cannot be fully explained at the time the notification is due, Kerr-McGee shall state this in the notice, investigate the cause of each such violation in the event that it occurs, and submit a full written explanation of the cause of the violation within 30 Days of the date that Kerr-McGee determines such cause. Nothing in this Paragraph relieves

Kerr-McGee of its obligation to provide the notice required by Section XIV (Force Majeure).

111. All reports shall be submitted to the persons designated in Section XIX (Notices) of this Consent Decree.

112. Each Annual Report submitted by Kerr-McGee shall be signed by a Responsible Official. All other reports or submissions may be signed by a delegated employee representative, unless otherwise required by applicable statute or regulation. All reports and submissions shall include the following certification:

> I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete.

113. The reporting requirements of this Section shall continue until termination of this Consent Decree; however, upon written agreement by EPA, or as applicable CDPHE, where a Consent Decree reporting requirement is added to a final Title V permit or other non-Title V permit such that the permit meets or exceeds such Consent Decree reporting requirement, Kerr-McGee may fulfill that Consent Decree reporting requirement by notifying EPA, and as applicable CDPHE, that the required report has been provided pursuant to a permit requirement, and by identifying the relevant permit in Kerr McGee's Annual Reports, submitted pursuant to this Section XII (Reporting Requirements).

114. Any information provided pursuant to this Consent Decree may be used by the United States or as applicable the State in any proceeding to enforce the provisions of this

Consent Decree and as otherwise permitted by law, except for disclosures made pursuant to Paragraph 95 of this Consent Decree.

XIII. STIPULATED PENALTIES

115. Kerr-McGee shall be liable for stipulated penalties to the United States and the State for violations of this Consent Decree as specified below, unless excused under Section XIV (Force Majeure), or reduced or waived by one or both Plaintiffs pursuant to Paragraph 121 of this Decree. A violation includes failing to perform any obligation required by the terms of this Decree, including any work plan or schedule approved under this Decree, according to all applicable requirements of this Decree and within the specified time schedules established by or approved under this Decree.

a. Low-Emission Dehydrators (Section IV.A.).

	Violation	Stipulated Penalty
1.	For failure to provide written notice as required by Paragraph 8 per unit per Day.	For each unit: $200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.
2.	For failure to install and operate Low-Emission Dehydrators at new facilities as required by Paragraph 9.	For each unit: $1,000 per Day for the first 30 Days of noncompliance, $1,500 per Day from the 31st to 60th Day of noncompliance, and $2,000 per Day thereafter.
3.	For failure to provide written notice as required by Paragraph 10.	For each unit: $200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.
4.	For failure to maintain records and information as required by Paragraph 11.	For each unit: $200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.

b. Condensate Storage Tanks (Section IV.B.).

	Violation	Stipulated Penalty
1.	For failure to install and operate a flare, VRU, or other non-flare alternative as required by Paragraphs 12, 18, & 20.	For each unit: $1,000 per Day for the first 30 Days of noncompliance, $2,500 per Day from the 31st to 60th Day of noncompliance, and $5,000 per Day thereafter.
2.	For failure to submit a worksheet on flare design and certification of compliance as required by Paragraphs 13, 15, 22, & 24.	For each unit: $200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.
3.	For failure to conduct inspections, submit reports, maintain records and apply to amend Title V permit applications as required by Paragraphs 16, 17, 19, 25, 26 & 27.	For each unit: $200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.
4.	For failure to maintain records and information as required by Paragraph 28.	For each unit: $200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.

c. Compressor Engines (Section IV.C. & D.).

	Violation	Stipulated Penalty
1.	For failure to install emission controls on RICE or alternatively replace with new RICE as required by the dates set forth in Paragraphs 30, 31, 40, & 49.	For each engine: $1,000 per Day for the first 30 Days of noncompliance, $2,500 per Day from the 31st to 60th Day of noncompliance, and $5,000 per Day thereafter.
2.	For failure to conduct initial performance test on the RICE emission controls as required by Paragraphs 35, 43, & 51.	For each engine: $500 per Day for the first 30 Days of noncompliance, $1,000 per Day from the 31st to 60th Day of noncompliance, and $1,500 per Day thereafter.
3.	For failure to retest and submit a report as required by Paragraphs 36, 44, & 52.	For each engine: $500 per Day for the first 30 Days of noncompliance, $1,000 per Day from the 31st to 60th Day of noncompliance, and $1,500 per Day thereafter.
4.	For failure to submit an O&M plan as required by Paragraph 37.	$200per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.
5.	For failure to conduct semi-annual tests on RICE emission controls on a semi-annual, calendar-year basis as required by Paragraphs 45 & 53.	For each engine: $500 per Day for the first 30 Days of noncompliance, $1,000 per Day from the 31st to 60th Day of noncompliance, and $1,500 per Day thereafter.
6.	For failure to submit reports as required by Paragraphs 46, 47, 54, & 55.	For each report: $200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.
7.	For failure to maintain records and apply to amend Title V permits as required by Paragraphs 38, 39, 56 & 57.	For each engine: $200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.
8	For failure to comply with the NOx control requirements and CO destruction efficiency required by Paragraphs 32 and 33.	For each engine: $500 per Day for the first 30 Days of noncompliance, $1,000 per Day from the 31st to 60th Day of noncompliance, and $1,500 per Day thereafter.

d. Pneumatic Controllers (Section IV.E.).

	Violation	Stipulated Penalty
1.	For failure to complete the first one-half of the Pneumatic Controller retrofits as required by Paragraph 59 in the Uinta Basin (as one project) and in the D-J Basin (as a separate project).	For each project: $500 per Day for the first 30 Days of noncompliance, $1,000 per Day from the 31st to 60th Day of noncompliance, and $1,500 per Day thereafter.
2.	For failure to complete all the remaining Pneumatic Controller retrofits as required by Paragraph 60 in the Uinta Basin (as one project) and in the D-J Basin (as a separate project).	For each project: $500 per Day for the first 30 Days of noncompliance, $1,000 per Day from the 31st to 60th Day of noncompliance, and $1,500 per Day thereafter.
3.	For failure to provide a final completion report for retrofitting Pneumatic Controllers in the Uinta Basin and the D-J Basin as required by Paragraph 62.	For each project: $100 per Day for the first 30 Days of noncompliance, $250 per Day from the 31st to 60th Day of noncompliance, and $500 per Day thereafter.
4.	For failure to replace high-bleed Pneumatic Controllers in the D-J Basin as required by Paragraph 61.	$100 per Day for the first 30 Days of noncompliance, $250 per Day from the 31st to 60th Day of noncompliance, and $500 per Day thereafter.
5.	For failure to install low or no-bleed Pneumatic Controllers at newly constructed facilities in the Uinta Basin or the D-J Basin as required by Paragraph 63.	For each project: $100 per Day for the first 30 Days of noncompliance, $250 per Day from the 31st to 60th Day of noncompliance, and $500 per Day thereafter.
6.	For failure to implement Appendix I and maintain records as required by Paragraphs 64 & 65.	For each project: $200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.

e. Sulfur Removal Technology (Section IV.F.).

	Violation	Stipulated Penalty
1.	For failure to install and operate liquid-bed sulfur removal technology in the Uinta Basin as required by Paragraph 66.	For each unit: $1,000 per Day for the first 30 Days of noncompliance, $2,500 per Day from the 31st to 60th Day of noncompliance, and $5,000 per Day thereafter.
2.	For failure to submit notification of each installation as required by Paragraph 67.	For each unit: $100 per Day for the first 30 Days of noncompliance, $200 per Day from the 31st to 60th Day of noncompliance, and $500 per Day thereafter.
3.	For failure to maintain records as required by Paragraph 68.	For each unit: $100 per Day for the first 30 Days of noncompliance, $250 per Day from the 31st to 60th Day of noncompliance, and $500 per Day thereafter.

f. Administrative Requirements (Section V).

	Violation	Stipulated Penalty
1.	For failure to submit a proposed O&M plan as required by Paragraph 69.	$200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.
2.	For failure to timely implement the approved O&M plan as required by Paragraph 71.	$500 per Day for the first 30 Days of noncompliance, $1,000 per Day from the 31st to 60th Day of noncompliance, and $1,500 per Day thereafter.
3.	For failure to submit a proposed permit amendment for a consolidated allowable VOC limit for the Fort Lupton Facility as required by Paragraph 72.	$200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.
4.	For failure to apply to amend the Title V permit as required by Paragraph 73.	$200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.
5	For failure to comply with the interim emission limit established in Paragraph 73.	$500 per Day for the first 30 Days, $1,000 per Day for the 31st to 60th Day, and $1,500 per Day thereafter

g. Ambient Air Monitoring (Section VII).

	Violation	Stipulated Penalty
1.	For failure to fund the purchase of ambient air monitoring station(s) as required by Paragraph 80.	$200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.

h. Multi-Phase Piping/Tankless Well-Site Pilot Project (Section VIII).

	Violation	Stipulated Penalty
1.	For failure to complete the Feasibility Study, submit a written Feasibility Study report, submit a proposed SOW for the implementation of the Multi-Phase Pilot, or provide an Added Incremental Cost report as required by Paragraphs 83, 84, & 85, per deliverable.	$200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.
2.	For failure to submit a semi-annual progress report as required by Paragraph 87.	$200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.
3.	For failure to implement and complete the Multi-Phase Pilot as required by Paragraphs 86 & 88.	$500 per Day for the first 30 Days of noncompliance, $1,000 per Day from the 31st to 60th Day of noncompliance, and $1,500 per Day thereafter.
4.	For failure to submit a final report as required by Paragraph 89.	$200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.
5.	For failure to maintain records as required by Paragraph 90.	$200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.

i. Performance Optimization Review (Section IX).

	Violation	Stipulated Penalty
1.	For failure to complete the POR by the date specified in Paragraph 91 for either the Uinta Basin or the D-J Basin, as separate projects.	For each project: $500 per Day for the first 30 Days of noncompliance, $1,000 per Day from the 31st to 60th Day of noncompliance, and $1,500 per Day thereafter.
2.	For failure to submit a POR report as required by Paragraph 94.	$200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.

j. SEPs (Section XI).

	Violation	Stipulated Penalty
1.	For failure to transfer funds to the Uintah County Road Department by the date specified in Paragraph 100.	For each project, $500 per Day for the first 30 Days of noncompliance, $1,000 per Day from the 31st to 60th Day of noncompliance, and $1,500 per Day thereafter
2.	For failure to transfer SEP Funds to the RAQC by the date specified by Paragraph 102.	For each project, $500 per Day for the first 30 Days of noncompliance, $1,000 per Day from the 31st to 60th Day of noncompliance, and $1,500 per Day thereafter
3.	For failure to submit a report as required by 104.	$200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1,000 per Day thereafter.
4.	For failure to spend at least the amounts set forth in Paragraphs 100 or 102.	For each SEP, an amount equal to the difference between the amount of total eligible SEP costs expended and the amount set forth in Paragraphs 100 or 102.

116. Late Payment of Civil Penalty: If Kerr-McGee fails to pay the civil penalty required to be paid under Section X (Civil Penalty) of this Consent Decree to the United States

or as applicable the State, when due, Kerr-McGee shall pay a stipulated penalty of $1,000 per Day for each Day that the payment is late.

117. Stipulated penalties under this Section shall begin to accrue on the Day after performance is due or on the Day a violation occurs, whichever is applicable, and shall continue to accrue until performance is satisfactorily completed or until the violation ceases. Stipulated penalties shall accrue simultaneously for separate violations of this Consent Decree.

118. Kerr-McGee shall pay any stipulated penalty within 30 Days of receipt of written demand of the United States, or as applicable the State, and shall continue to make such payments every 30 Days thereafter until the violation(s) no longer continue, unless Kerr-McGee elects within 20 Days of receipt of written demand from the United States, or as applicable the State, to dispute the accrual of stipulated penalties in accordance with the provisions in Section XV (Dispute Resolution) of this Consent Decree.

119. For violations that concern or relate to facilities in the Uinta Basin, Kerr-McGee shall pay the total amount of stipulated penalties to the United States. For violations that concern or relate to facilities in the D-J Basin, Kerr-McGee shall pay 40 percent to the United States and 60 percent to the State.

120. Kerr-McGee shall pay stipulated penalties in accordance with the federal and state payment instructions set forth in Paragraphs 97 and 98.

121. The United States or the State may, in the unreviewable exercise of their respective discretion, reduce or waive stipulated penalties otherwise due such Plaintiff under this Consent Decree. The determination by one Plaintiff not to seek stipulated penalties, or

subsequently to waive or reduce the amount it seeks, shall not preclude the other Plaintiff from seeking the full amount of stipulated penalties owing.

122. Stipulated penalties shall continue to accrue as provided in Paragraph 117 during any dispute, with interest on accrued stipulated penalties payable and calculated by the Secretary of Treasury, pursuant to 28 U.S.C. § 1961, but need not be paid until the following:

a. If the dispute is resolved by agreement or by a decision of Plaintiffs pursuant to Section XV (Dispute Resolution) of this Consent Decree that is not appealed to the Court, Kerr-McGee shall pay accrued stipulated penalties and accrued interest agreed or determined to be owing within 30 Days of the effective date of such agreement or the receipt of Plaintiffs' decision.

b. If the dispute is appealed to the Court, and the Plaintiffs prevail in whole or in part, Kerr-McGee shall pay all accrued stipulated penalties determined by the Court to be owing, together with accrued interest, within 60 Days of receiving the Court's decision or order, except as provided in Subparagraph c., below.

c. If any Party appeals the Court's decision, Kerr-McGee shall pay all accrued penalties determined by the appellate court to be owing, together with accrued interest, within 15 Days of receiving the final appellate court decision.

123. Kerr-McGee shall not deduct stipulated penalties paid under this Section XIII in calculating its federal or state income tax.

124. Subject to the provisions of Section XVII (Effect of Settlement/Reservation of Rights), the stipulated penalties provided for in this Consent Decree shall be in addition to any other rights, remedies, or sanctions available to the United States for Kerr-McGee's violation of this Consent Decree or applicable law. Where a violation of this Consent Decree is also a violation of the Act or regulatory requirements of the Act, or the Colorado Act or the regulatory requirements of the Colorado Act, Kerr-McGee shall be allowed a dollar-for-dollar credit, for any stipulated penalties paid, against any statutory penalties imposed for such violation.

XIV. FORCE MAJEURE

125. If any event occurs which causes or may cause a delay or impediment to performance in complying with any provision of this Consent Decree (*e.g.* would require operation in an unsafe manner), and which Kerr-McGee believes qualifies as an event of *Force Majeure*, Kerr-McGee shall notify the Plaintiffs in writing as soon as practicable, but in any event within 45 Days of when Kerr-McGee first knew of the event or should have known of the event by the exercise of reasonable diligence. In this notice Kerr-McGee shall specifically reference this paragraph of this Consent Decree and describe the anticipated length of time the delay may persist, the cause or causes of the delay, the measures taken and/or to be taken by Kerr-McGee to prevent or minimize the delay and the schedule by which those measures will be implemented. Kerr-McGee shall adopt all reasonable measures to avoid or minimize such delays.

126. Failure by Kerr-McGee to substantially comply with the notice requirements of Paragraph 125, as specified above, shall render this Section voidable by the Plaintiffs, as to the

specific event for which Kerr-McGee has failed to comply with such notice requirement. If so voided, this Section shall be of no effect as to the particular event involved.

127. The Plaintiffs shall notify Kerr-McGee in writing regarding their agreement or disagreement with any claim of a Force Majeure event within 45 Days of receipt of each Force Majeure notice provided under Paragraph 125.

128. If the Plaintiffs agree that the delay or impediment to performance has been or will be caused by circumstances beyond the control of Kerr-McGee, including any entity controlled or contracted by it, and that Kerr-McGee could not have prevented the delay by the exercise of reasonable diligence, the Parties shall stipulate to an extension of the required deadline(s) for all requirement(s) affected by the delay by a period equivalent to the delay actually caused by such circumstances, or such other period as may be appropriate in light of the circumstances. Such stipulation may be filed as a modification to this Consent Decree by agreement of the Parties pursuant to the modification procedures established in this Consent Decree. Kerr-McGee shall not be liable for stipulated penalties for the period of any such delay.

129. If the Plaintiffs do not agree that the delay or impediment to performance has been or will be caused by circumstances beyond the control of Kerr-McGee, including any entity controlled or contracted by it, the position of the Plaintiffs on the Force Majeure claim shall become final and binding upon Kerr-McGee, and Kerr-McGee shall pay applicable stipulated penalties, unless Kerr-McGee submits the matter to this Court for resolution by filing a petition for determination with this Court within 20 business Days after receiving the written notification of the Plaintiffs as set forth in Paragraph 127. In the event that the United States and the State disagree, the position of the United States shall become the Plaintiffs' final position with regard

to Kerr-McGee's Force Majeure claim. Once Kerr-McGee has submitted such matter to this Court, the Plaintiffs shall have 20 business Days to file a response to the petition. If Kerr-McGee submits the matter to this Court for resolution and the Court determines that the delay or impediment to performance has been or will be caused by circumstances beyond the control of Kerr-McGee, including any entity controlled or contracted by Kerr-McGee, and that it could not have prevented the delay by the exercise of reasonable diligence, Kerr-McGee shall be excused as to such event(s) and delay (including stipulated penalties) for all requirements affected by the delay for a period of time equivalent to the delay caused by such circumstances or such other period as may be determined by the Court.

130. Kerr-McGee shall bear the burden of proving that any delay of any requirement(s) of this Consent Decree was (were) caused by or will be caused by circumstances beyond its control, including any entity controlled or contracted by Kerr-McGee, and that it could not have prevented the delay by the exercise of reasonable diligence. Kerr-McGee shall also bear the burden of proving the duration and extent of any delay(s) attributable to such circumstances. An extension of one compliance date based on a particular event may, but does not necessarily, result in an extension of a subsequent compliance date or dates. Unanticipated or increased costs or expenses associated with the performance of obligations under this Consent Decree shall not constitute circumstances beyond the control of Kerr-McGee.

131. As part of the resolution of any matter submitted to this Court under this Section, the Parties by agreement, or this Court by order, may in appropriate circumstances extend or modify the schedule for completion of work under this Consent Decree to account for the delay in the work that occurred as a result of any delay or impediment to performance on which an

agreement by the Plaintiffs or approval by this Court is based. Kerr-McGee shall be liable for stipulated penalties for its failure thereafter to complete the work in accordance with the extended or modified schedule, except to the extent that such schedule is further modified, extended or otherwise affected by a subsequent Force Majeure event under this Section XIV.

XV. DISPUTE RESOLUTION

132. Unless otherwise expressly provided for in this Consent Decree, the dispute resolution procedures of this Section shall be the exclusive mechanism to resolve disputes arising under or with respect to this Consent Decree. For any dispute that concerns D-J Basin Facilities, the provisions of this Section apply equally to both the United States and the State, as Plaintiffs.

133. Informal Dispute Resolution: Any dispute subject to Dispute Resolution under this Consent Decree shall first be the subject of informal negotiations. The dispute shall be considered to have arisen when Kerr-McGee sends the Plaintiff(s) a written Notice of Dispute. Such Notice of Dispute shall state clearly the matter in dispute. The period of informal negotiations shall not exceed 20 Days from the date the dispute arises, unless that period is modified by written agreement. If the Parties cannot resolve a dispute by informal negotiations, then the position advanced by the Plaintiff(s) shall be considered binding unless, within 20 Days after the conclusion of the informal negotiation period, Kerr-McGee invokes formal dispute resolution procedures as set forth below. In the event that the United States and the State are unable to reach agreement with regard to Kerr-McGee's claim, the position of the United States shall be the Plaintiffs' final position.

134. Formal Dispute Resolution: Kerr-McGee may only invoke formal dispute resolution procedures, within the time period provided in the preceding Paragraph, by serving on

the Plaintiff(s) a written Statement of Position regarding the matter in dispute. The Statement of Position shall include, but may not necessarily be limited to, any factual data, analysis, or opinion supporting Kerr-McGee's position and any supporting documentation relied upon by Kerr-McGee.

135. The Plaintiff(s) shall serve its (their) Statement of Position within 30 Days of receipt of Kerr-McGee's Statement of Position. The Plaintiff(s)' Statement of Position shall include, but may not necessarily be limited to, any factual data, analysis, or opinion supporting that position and any supporting documentation relied upon by the Plaintiff(s). The Plaintiff(s)' Statement of Position shall be binding on Kerr-McGee, unless Kerr-McGee files a motion for judicial review of the dispute in accordance with Paragraph 136. In the event that the United States and the State are unable to reach agreement with regard to Kerr-McGee's claim, the position of the United States shall be the Plaintiffs' final position.

136. Kerr-McGee may seek judicial review of the dispute by filing with the Court and serving on the Plaintiff(s), in accordance with Section XIV of this Consent Decree (Notices), a motion requesting judicial resolution of the dispute. The motion must be filed within 30 Days of receipt of the Plaintiff(s)' Statement of Position pursuant to the preceding Paragraph. The motion shall contain a written statement of Kerr-McGee's position on the matter in dispute, including any supporting factual data, analysis, opinion, or documentation, and shall set forth the relief requested and any schedule within which the dispute must be resolved for orderly implementation of the Consent Decree.

137. The Plaintiff(s) shall respond to Kerr-McGee's motion within the time period allowed by the Local Rules of the Court. Kerr-McGee may file a reply memorandum, to the extent permitted by the Local Rules and allowed by the Court.

138. Except as otherwise provided in this Consent Decree, in any dispute brought under Paragraph 133, Kerr-McGee shall bear the burden of demonstrating that its position complies with this Consent Decree.

139. The invocation of dispute resolution procedures under this Section shall not, by itself, extend, postpone, or affect in any way any obligation of Kerr-McGee under this Consent Decree, unless and until final resolution of the dispute so provides. Stipulated penalties with respect to the disputed matter shall continue to accrue from the first Day of alleged noncompliance, but payment shall be stayed pending resolution of the dispute as provided in Paragraph 122. If Kerr-McGee does not prevail on the disputed issue, stipulated penalties shall be assessed and paid as provided in Section XIII (Stipulated Penalties).

XVI. INFORMATION COLLECTION AND RETENTION

140. The United States, and its representatives, including attorneys, contractors, and consultants, shall have the right of entry into any facility covered by this Consent Decree, and the State, and its representatives, including attorneys, contractors, and consultants, shall have the right of entry into any facility in the D-J Basin subject to any requirement of this Consent Decree, at all reasonable times, upon presentation of credentials, for the purpose of monitoring compliance with any provision of this Consent Decree, including to:

a. monitor the progress of activities required under this Consent Decree;

b. inspect equipment and facilities covered by this Consent Decree; and

c. inspect and copy documents, records, or other information to be maintained in accordance with the terms of this Consent Decree.

141. Kerr-McGee shall be entitled to: (1) splits of samples, where feasible, and (2) copies of any sampling and analytical results, documentary evidence and data obtained by the United States or the State pursuant to Paragraph 140 of this Consent Decree.

142. Until five years after the termination of this Consent Decree, Kerr-McGee shall retain, and shall instruct its contractors and agents to preserve, all non-identical copies of all documents, records, or other information (including documents, records, or other information in electronic form) in its or its contractors' or agents' possession or control, or that come into its or its contractors' or agents' possession or control, and that relate in any manner to Kerr-McGee's performance of its obligations under this Consent Decree. Such documents, records, or other information may be kept in electronic form. This information-retention requirement shall apply regardless of any contrary corporate or institutional policies or procedures. At any time during this information-retention period, upon request by the United States or the State, Kerr-McGee shall provide copies of any non-privileged documents, records, or other information required to be maintained under this Paragraph.

143. At the conclusion of the information-retention period provided in the preceding Paragraph, Kerr-McGee shall notify the United States and the State at least 90 Days prior to the destruction of any documents, records, or other information subject to the requirements of the preceding Paragraph and, upon request by the United States or the State, Kerr-McGee shall deliver the requested non-privileged documents, records, or other information to EPA or CDPHE.

144. Kerr-McGee may assert that certain documents, records, or other information is privileged under the attorney-client privilege or any other privilege recognized by federal and/or state law. If Kerr-McGee asserts such a privilege, it shall provide the following: (1) the title of the document, record, or information; (2) the date of the document, record, or information; (3) the name and title of each author of the document, record, or information; (4) the name and title of each addressee and recipient; (5) a description of the subject of the document, record, or information; and (6) the privilege asserted by Kerr-McGee. However, no final documents, records or other information that Kerr-McGee is explicitly required to create or generate to satisfy a specific requirement of this Consent Decree shall be withheld on the grounds of privilege.

145. Kerr-McGee may also assert that information required to be provided under this Section is protected as Confidential Business Information ("CBI") under 40 C.F.R. Part 2 and/or C.R.S. § 25-7-111(4). As to any information that Kerr-McGee seeks to protect as CBI, Kerr-McGee shall follow the procedures set forth in 40 C.F.R. Part 2 and/or C.R.S. § 25-7-111(4).

146. This Consent Decree in no way limits or affects any right of entry and inspection, or any right to obtain information, held by the United States or the State pursuant to applicable federal or state laws, regulations, or permits, nor does it limit or affect any duty or obligation of Kerr-McGee to maintain documents, records, or other information imposed by applicable federal or state laws, regulations, or permits.

XVII. EFFECT OF SETTLEMENT/RESERVATION OF RIGHTS

147. This Consent Decree resolves all civil claims of the United States and the State for violations alleged in the Complaint and Complaint in Intervention through the date of lodging of this Consent Decree.

148. This Consent Decree further resolves the civil and administrative claims, if any, of the United States and the State for civil penalties and injunctive relief, through the date of lodging of this Consent Decree, under the PSD requirements of Part C of the Act, and the regulations promulgated thereunder at 40 C.F.R. § 52.21 (the "PSD Rules"), and Section 25-7-101 *et seq.* of the Colorado Act, and the regulations promulgated thereunder for:

a. any increase in emissions resulting from the construction by Kerr-McGee's corporate predecessor of the Dougan and Frederick facilities;

b. the disabling of the VRU at the Brighton facility by a Kerr-McGee predecessor and the subsequent failure to operate the VRU;

c. claims that relate to any allegations of engine modifications to RICE located at D-J Basin Facilities, any horsepower discrepancies used to describe RICE in any applicable permit for D-J Basin Facilities, and any failure or error in horsepower documentation to specify appropriate horsepower and related operational parameters for RICE located at D-J Basin Facilities.

149. This Consent Decree resolves the civil claims of the United States and the State for violations disclosed under Paragraph 95, except for non-compliance that would trigger PSD/NSR.

150. The United States and the State reserve all legal and equitable remedies available to enforce the provisions of this Consent Decree, except as expressly stated in Paragraphs 147-149. This Consent Decree shall not be construed to limit the rights of the United States or the State to obtain penalties or injunctive relief under the Act or Colorado Act or their implementing regulations, or under other federal or state laws, regulations, or permit conditions, except as expressly provided in Section VI (Limits on Potential to Emit), and Paragraphs 147 - 149.

151. This Consent Decree is not a permit, or a modification of any permit, under any federal, State, or local laws or regulations. Nothing in this Consent Decree shall relieve Kerr-McGee of its obligation to achieve and maintain full compliance with all applicable federal, State, and local laws, regulations, and permits. Kerr-McGee's compliance with this Consent Decree shall be no defense to any action commenced pursuant to any such laws, regulations, or permits, except as otherwise provided in Paragraphs 147-149. The United States and the State do not, by their consent to the entry of this Consent Decree, warrant or aver in any manner that Kerr-McGee's compliance with any aspect of this Consent Decree will result in compliance with other provisions of the Act, the Colorado Act, or their implementing regulations or with any other provisions of federal, State, or local laws, regulations, or permits.

152. This Consent Decree does not limit or affect the rights of Kerr-McGee or of the United States or the State against any third parties, not party to this Consent Decree, nor does it limit the rights of third parties, not party to this Consent Decree, against Kerr-McGee, except as provided herein and as otherwise provided by law.

153. This Consent Decree shall not be construed to create rights in, or grant any cause of action to, any third party not a party to this Consent Decree.

XVIII. EMISSION REDUCTION CREDIT GENERATION

154. Kerr-McGee shall not generate or use any NOx, CO, VOC or SO_2 emission reductions that result from any projects conducted pursuant to this Consent Decree as credits or offsets in any PSD, major non-attainment and/or minor New Source Review ("NSR") permit or permit proceeding. The foregoing notwithstanding, Kerr-McGee may conduct projects pursuant to this Consent Decree that create more emission reductions of NOx, CO, VOCs or SO_2 than are required for these pollutants by the underlying applicable requirement(s). In such instances, Kerr-McGee may retain a portion of the achieved emissions reductions for use as credits or offsets. All other emission sources of NOx, CO, VOCs or SO_2, and any netting associated with other pollutants, are outside the scope of these netting limitations and are subject to PSD/NSR applicability as implemented by the appropriate permitting authority or EPA. Use of emission reductions in netting and as offsets in any PSD, major non-attainment and/or minor NSR permit or permit proceeding pursuant to the limitations herein shall be further limited by the applicable regulations, and by the PSD, major non-attainment, and/or minor NSR permit(s) in question, as applicable.

XIX. COSTS

155. The Parties shall bear their own costs of this action, including attorneys' fees, except that the United States and the State shall be entitled to collect the costs (including attorneys' fees) incurred in any action necessary to collect any portion of the civil penalty or any stipulated penalties if due.

XX. NOTICES

156. Unless otherwise specified herein, whenever notifications, submissions, or communications are required by this Consent Decree, they shall be made in writing and mailed or hand delivered addressed as follows:

As to the United States:

Chief, Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611, Ben Franklin Station
Washington, D.C. 20044-7611
Re: DOJ No. 90-5-2-1-08656

and

Director, Air Enforcement Division
Office of Enforcement and Compliance Assurance
U.S. Environmental Protection Agency
Ariel Rios Building [2242A]
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

and

Assistant Regional Administrator
Office of Enforcement, Compliance, and Environmental Justice
U.S. Environmental Protection Agency, Region 8
1595 Wynkoop Street
Denver, CO 80202-1129

As to the State of Colorado:

Director
Air Pollution Control Division
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South
Denver, CO 80246-1530

As to Kerr-McGee:

Vice President
Kerr-McGee Corporation
1099 18th Street
Denver, CO 80202

and

Director, Environmental, Health and Safety, Rocky Mountain Region
Kerr-McGee Corporation
1099 18th Street
Denver, CO 80202

157. Any Party may, by written notice to the other Parties, change its designated notice recipient or notice address provided above.

158. Notices submitted by mail pursuant to this Section XX shall be deemed submitted upon mailing, unless otherwise provided in this Consent Decree or by mutual agreement of the Parties in writing.

XXI. SALES OR TRANSFERS OF OWNERSHIP/OPERATOR INTERESTS

159. If Kerr-McGee proposes to sell or transfer all or part of its ownership or its responsibility as operator of any of the Uinta Basin Facilities, D-J Basin Facilities, or any other facilities that are subject to any requirement of this Consent Decree, except for individual wells

or groups of wells and associated wellhead facilities, to any entity unrelated to the Defendant ("Third Party"), Kerr-McGee shall advise the Third Party in writing of the existence of this Consent Decree prior to such sale or transfer and shall send a copy of such written notification to the Plaintiffs pursuant to Section XX (Notices) of this Consent Decree at least 60 Days before such proposed sale or transfer.

160. No sale or transfer of ownership to a Third Party shall take place before the Third Party consents in writing, by a stipulation to be filed with the Court, to: (a) accept all of the obligations, terms and conditions of this Consent Decree applicable to Uinta Basin Facilities or D-J Basin Facilities, or any other facilities, exclusive of wellhead facilities, that are subject to any requirement of this Consent Decree; (b) the jurisdiction of the Court to enforce the terms of this Consent Decree as to such party; and (c) become a party to this Consent Decree. Notwithstanding such a sale or transfer to a Third Party, Kerr-McGee shall remain jointly and severally liable with the Third Party unless the Consent Decree is modified or Kerr-McGee's joint and several liability is restricted in accordance with Paragraph 161.

161. If the United States, and as applicable the State, agrees, the Parties and the Third Party may execute a modification to this Consent Decree that relieves Kerr-McGee of its liability under this Consent Decree for, and makes the Third Party liable for, all obligations and liabilities applicable to the purchased or transferred facilities or operator responsibility. Notwithstanding the foregoing, Kerr-McGee may not assign, and may not be released from, obligations under this Consent Decree to pay the civil penalty in accordance with Section X (Civil Penalty), undertake the Supplemental Environmental Projects in accordance with Section XI (Supplemental Environmental Projects), pay stipulated penalties with respect to actions occurring prior to the

date of transfer of ownership or operator responsibility in accordance with Section XIII (Stipulated Penalties), or maintain documents or provide reports with respect to those obligations in accordance with Sections XII (Reporting Requirements) and XVI (Information Collection and Retention). Kerr-McGee may propose, and the United States and as applicable the State, may agree to restrict the scope of the joint and several liability of any purchaser or transferee for any obligations of this Consent Decree that are not specific to the transferred or purchased facilities or operator responsibility, to the extent such obligations may be adequately separated in an enforceable manner.

XXII. EFFECTIVE DATE

162. Unless otherwise specifically provided herein, the Effective Date of this Consent Decree shall be the date upon which this Consent Decree is entered by the Court.

XXIII. RETENTION OF JURISDICTION

163. The Court shall retain jurisdiction over this case until termination of this Consent Decree, for the purpose of resolving disputes arising under this Decree pursuant to Section XV (Dispute Resolution) or entering, partially terminating or terminating orders modifying this Decree, pursuant to Sections XXI (Sales or Transfers of Ownership/Operator Interests) XXIV (Modification) and XXV (Termination), or otherwise effectuating, or enforcing compliance with, the terms of this Consent Decree.

XXIV. MODIFICATION

164. The terms of this Consent Decree, including any attached appendices, may be modified only by a subsequent written agreement signed by all the Parties. With respect to any modification that constitutes a material change to this Decree, such written agreement shall be

filed with the Court and effective only upon the Court's approval. Any modification of a reporting requirement of this Consent Decree shall be deemed a non-material modification. Any disputes concerning modification of this Decree shall be resolved pursuant to Section XV (Dispute Resolution) of this Consent Decree.

XXV. TERMINATION

165. This Consent Decree shall remain in effect until terminated or partially terminated in accordance with the provisions of this Section.

166. Kerr-McGee shall serve upon the United States and the State a Request for Termination after January 1, 2017. The Request for Termination shall certify that Kerr-McGee has paid the civil penalty and all stipulated penalties, if any, that have accrued, and has fulfilled all other obligations of this Consent Decree.

167. Where a control requirement, recordkeeping requirement, reporting requirement or other requirement of this Consent Decree is incorporated into a federally enforceable permit, Kerr-McGee may serve upon the United States and the State a Request for Partial Termination. Upon approval of such request by the Plaintiffs, the filing of a joint stipulation by the Parties and the Court's approval in accordance with Paragraph 168, the Consent Decree provision in question shall be superseded by the corresponding permit provision, which shall govern as the applicable requirement.

168. Following receipt by the United States and the State of Kerr-McGee's Request for Termination or Partial Termination, the Parties shall confer informally concerning the Request for Termination or Partial Termination and any disagreement that the Parties may have as to whether Kerr-McGee has satisfactorily complied with the requirements for termination of this

Consent Decree. If the United States and the State agree that the Decree may be terminated or partially terminated, the Parties shall submit, for the Court's approval, a joint stipulation terminating or partially terminating the Decree.

169. If the United States or the State does not agree that the Decree may be terminated, Kerr-McGee may immediately appeal the disposition of its Request for Termination to the Court.

XXVI. PUBLIC PARTICIPATION

170. This Consent Decree shall be lodged with the Court for a period of not less than 30 Days for public notice and comment in accordance with 28 C.F.R. § 50.7. The United States and the State reserve the right to withdraw or withhold their respective consent if the comments regarding the Consent Decree disclose facts or considerations indicating that the Consent Decree is inappropriate, improper, or inadequate. Kerr-McGee consents to entry of this Consent Decree without further notice and agrees not to withdraw from or oppose entry of this Consent Decree by the Court or to challenge any provision of the Consent Decree, unless the United States or the State has notified Kerr-McGee in writing that it no longer supports entry of the Consent Decree.

XXVII. SIGNATORIES/SERVICE

171. Each undersigned representative of Kerr-McGee, the Director, Air Pollution Control Division, CDPHE, and the Assistant Attorney General for the Environment and Natural Resources Division of DOJ certifies that he or she is fully authorized to enter into this Consent Decree and to execute and legally bind the Party he or she represents to the terms and conditions of this document.

172. Kerr-McGee represents that it has authority to legally obligate any of its corporate subsidiaries or affiliates that own or operate any of the Uinta Basin Facilities, the D-J Basin

Facilities, or any other natural gas production or gathering facilities subject to any work or compliance requirements of this Consent Decree, including but not limited to Kerr-McGee Oil and Gas Onshore LP, Westport Field Services LLC, Kerr-McGee (Nevada) LLC, and Kerr-McGee Gathering LLC, to take all actions necessary to comply with the provisions of this Consent Decree.

173. This Consent Decree may be signed in counterparts, and its validity shall not be challenged on that basis. Kerr-McGee agrees to accept service of process by mail pursuant to the provisions of Section XX (Notices) with respect to all matters arising under or relating to this Consent Decree and to waive the formal service requirements set forth in Rules 4 and 5 of the Federal Rules of Civil Procedure and any applicable Local Rules of this Court including, but not limited to, service of a summons.

XXVIII. INTEGRATION

174. This Consent Decree constitutes the final, complete, and exclusive agreement and understanding among the Parties with respect to the settlement of matters addressed in the Decree, and supersedes all prior agreements and understandings, whether oral or written, concerning such matters. Other than the appendices listed in Section XXX (Appendices), which are attached to and incorporated in this Decree, and deliverables that are subsequently submitted and approved pursuant to this Decree, no other document, representation, inducement, agreement, understanding, or promise constitutes any part of this Decree or the settlement it memorializes, nor shall evidence of any such document, representation, inducement, agreement, understanding or promise be used in construing the terms of this Decree.

XXIX. FINAL JUDGMENT

175. Upon approval and entry of this Consent Decree by the Court, this Consent Decree shall constitute a final judgment of the Court as to the United States, the State, and Kerr-McGee.

XXX. APPENDICES

176. The following appendices are attached to and incorporated into this Consent Decree:

"Appendix A" lists the D-J Basin Facilities.

"Appendix B" lists the Uinta Basin Facilities.

"Appendix C" is the Description of Low-Emission Dehydrators.

"Appendix D" is the Protocol for RICE Compliance Demonstration in the D-J Basin.

"Appendix E" lists the Existing >500 hp RICE at Minor Sources in the Uinta Basin to be Controlled with Oxidation Catalysts.

"Appendix F" is the Protocol for RICE Compliance Demonstration in the Uinta Basin.

"Appendix G" lists the High-Bleed Pneumatic Controllers in the Uinta Basin to be Retrofitted with Low-Bleed Pneumatic Controllers.

"Appendix H" lists the High-Bleed Pneumatic Controllers in the D-J Basin to be Retrofitted with Low-Bleed Pneumatic Controllers.

"Appendix I" is the Kerr-McGee Management Directive Regarding Low-Bleed Pneumatic Controllers in New Construction.

"Appendix J" is the Emission Calculation Methodology for the Fort Lupton facility.

"Appendix K" is the Scope of Work for the Feasibility Study of the Multi-Phase Piping/Tankless Well-Site Pilot Project.

"Appendix L" is the Scope of Work for the Performance Optimization Review Project.

"Appendix M" is the Scope of Work for the Road Dust SEP.

"Appendix N" is the Scope of Work for the Accelerated Vehicle Retirement State SEP.

Dated and entered this _____ Day of _____, 2007

_____
UNITED STATES DISTRICT JUDGE
District of Colorado

FOR PLAINTIFF, UNITED STATES OF AMERICA

s/ Matthew J. McKeown Date 5/15/07
MATTHEW J. McKEOWN
Acting Assistant Attorney General
Environment & Natural Resources Division
950 Pennsylvania Avenue, N.W.
Room 2143
Washington, D.C. 20530

s/ Jerry L. Ellington Date 5/17/07
JEREL ("JERRY") L. ELLINGTON
DIANNE S. SHAWLEY
Senior Counsel
Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
1961 Stout Street – 8th Floor
Denver, CO 80294
Telephone (303) 844-1363
Fax (303) 844-1350

s/ Troy A. Eid Date 5/17/07
TROY A. EID
United States Attorney for the District of Colorado
U.S. Attorney's Office
1225 17th Street #700
Denver, Colorado 80202
Telephone (303) 454-0100
Fax (303) 454-0400

FOR U.S. ENVIRONMENTAL PROTECTION AGENCY

s/ Granta Y. Nakayama
GRANTA Y. NAKAYAMA
Assistant Administrator
Office of Enforcement and Compliance Assurance
U.S. Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Date May 16, 2007

FOR PLAINTIFF-INTERVENOR, THE STATE OF COLORADO

s/ Paul Tourangeau Date 5/10/07
PAUL TOURANGEAU
Director, Air Pollution Control Division
Colorado Department of Public Health & Environment
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530
Telephone: (303)-692-3114
Fax: (303) 782-5493

s/ Stephen M. Brown Date 5/16/07
STEPHEN M. BROWN
Assistant Attorney General
Natural Resources and Environmental Section
Colorado Department of Law
1525 Sherman Street, 7th Floor
Denver, Colorado 80203
Telephone: (303) 866-4434
Fax: (303) 866-3558

FOR DEFENDANT, KERR-McGEE CORPORATION

s/ James J. Kleckner Date 5-8-07

JAMES J. KLECKNER
Vice President
Kerr-McGee Corporation
1099 18th Street
Denver, Colorado 80202
Telephone: (303) 575-0167
Fax: (303) 607-3462

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF UTAH, CENTRAL DIVISION

UNITED STATES OF AMERICA Plaintiff, v. COLORADO INTERSTATE GAS COMPANY Defendant.	)	Civil Action No. 2:09CV006 Judge Ted

CONSENT DECREE

WHEREAS, Plaintiff, the United States of America (the "United States"), on behalf of the United States Environmental Protection Agency ("EPA"), has simultaneously with lodging this Consent Decree filed a Complaint alleging that Colorado Interstate Gas Company ("CIG") violated requirements of the Clean Air Act (the "Act") and the federal regulations implementing the Act applicable to the Natural Buttes natural gas processing plant ("Natural Buttes Facility") owned and operated by CIG in Uintah County, Utah, within the exterior boundaries of the Uintah and Ouray Indian Reservation;

WHEREAS, EPA administers the Act's programs for the National Emission Standards for Hazardous Air Pollutants ("NESHAP"), New Source Performance Standards ("NSPS"), prevention of significant deterioration ("PSD") of air quality, and federal operating permits under Title V (among other requirements) with respect to the Natural Buttes Facility;

WHEREAS, CIG does not admit the violations referenced in the Complaint occurred and further does not admit any liability for civil penalties, fines, or injunctive relief to the United States arising out of the transactions or occurrences alleged in the Complaint;

WHEREAS, the United States and CIG (the "Parties") recognize, and the Court by entering this Consent Decree finds, that this Consent Decree has been negotiated by the Parties in good faith and at arm's length, will avoid litigation among the Parties, and that this Consent Decree is fair, reasonable, consistent with the goals of the Act, and that its entry is in the best interest of the Parties and is in the public interest;

NOW, THEREFORE, before the taking of any testimony, without the adjudication or admission of any issue of fact or law except as provided in Section I (Jurisdiction and Venue), and with the consent of the Parties,

IT IS HEREBY ADJUDGED, ORDERED, AND DECREED as follows:

I. JURISDICTION AND VENUE

1. This Court has jurisdiction over the subject matter of this action and the Parties pursuant to 28 U.S.C. §§ 1331, 1345, and 1355, and Sections 113(b) and 167 of the Act, 42 U.S.C. §§ 7413(b) and 7477. Venue lies in this District pursuant to Section 113(b) of the Act, 42 U.S.C. § 7413(b), and 28 U.S.C. §§ 1391(b) & (c) and 1395(a), because the violations alleged in the Complaint are alleged to have occurred in, and CIG conducts business in, this judicial district. The Natural Buttes Facility is located in Uintah County, Utah, within the exterior boundaries of the Uintah and Ouray Indian Reservation. For purposes of this Consent Decree, or any action to enforce this Consent Decree, CIG consents to and will not contest the jurisdiction of the Court over this matter.

2. For purposes of this Consent Decree, CIG agrees that the Complaint states claims upon which relief may be granted pursuant to Sections 113 and 167 of the Act, 42 U.S.C. §§ 7413 and 7477.

II. APPLICABILITY

3. The obligations of this Consent Decree apply to and are binding upon the United States and upon CIG and any of their successors, assigns, or other entities or persons otherwise bound by law.

4. In any action to enforce this Consent Decree, CIG shall not raise as a defense the failure by any of its officers, directors, employees, agents, contractors, or corporate affiliates or subsidiaries to take any actions necessary to comply with the provisions of this Consent Decree.

III. DEFINITIONS

5. Terms used in this Consent Decree that are defined in the Act or in regulations promulgated pursuant to the Act shall have the meanings assigned to them in the Act or such regulations, unless otherwise provided in this Decree. Whenever the terms set forth below are used in this Consent Decree, the following definitions shall apply:

a. "Caterpillar Engines" shall mean the three Caterpillar engines identified as EG1, EG2, and EG3 in CIG's Title V Permit for the Natural Buttes Facility.

b. "Consent Decree" or "Decree" shall mean this Consent Decree.

c. "Day" shall mean a calendar day unless expressly stated to be a business day. In computing any period of time under this Consent Decree, where the last day would fall on a Saturday, Sunday, or federal holiday, the period shall run until the close of business of the next business day.

d. "Facility" or "Natural Buttes Facility" shall mean the natural gas processing plant owned and operated by CIG in Uintah County, Utah, within the exterior boundaries of the Uintah and Ouray Indian Reservation, that is comprised of, among other things, five reciprocating internal combustion engines ("RICE"), one dehydration unit, slug catchers, pressure vessels, turbines, separators, a reboiler, a flare, generators, and storage tanks.

e. "EPA" shall mean the United States Environmental Protection Agency and any of its successor departments or agencies.

f. "CIG" shall mean Colorado Interstate Gas Company, a Delaware general partnership.

g. "Paragraph" shall mean a portion of this Decree identified by an arabic numeral.

h. "Parties" shall mean the United States and CIG.

i. "Plaintiff" shall mean the United States.

j. "Section" shall mean a portion of this Decree identified by a Roman numeral.

k. "Title V Permit" shall mean a permit issued pursuant to the federal operating permit program established by Title V of the Act, 42 U.S.C. §§ 7661 - 7661f, and as implemented by 40 C.F.R. Parts 70 (applicable to states) or 71 (applicable to EPA).

l. "White Superior Engines" shall mean the engines identified as CG01 and CG02 in CIG's Title V Permit for the Natural Buttes Facility.

IV. INJUNCTIVE REQUIREMENTS

6. Control of Engines

a. Short Term Control of Caterpillar Engines. Not later than 30 Days after entry of this Consent Decree, CIG shall operate the Caterpillar Engines such that the engines meet an emission limit of 5 lbs. NOx/hr. Not later than 45 Days after entry of this Consent Decree, CIG shall submit a report to EPA, pursuant to Section VII of this Consent Decree, identifying the changes that were made to the Caterpillar Engines or their method of operation to enable them to meet the 5 lbs. NOx/hr. emission limit and the date such changes were completed and/or implemented.

b. Long Term Control of Caterpillar Engines. Not later than 30 Days after entry of this Consent Decree, CIG shall apply for a Certificate of Abandonment for the Natural Buttes Facility from the Federal Energy Regulatory Commission ("FERC"). Not later than 90 Days after entry of this Consent Decree or final FERC action on the application for a Certificate of Abandonment (whichever is later), CIG shall either (1) operate the Caterpillar Engines such that each engine meets an emission limit of 3.3 lbs. NOx/hr.; (2) certify pursuant to Paragraph 16 that the Caterpillar Engines, specifically identified by Title V Permit Emission Unit ID and serial number, have been replaced and/or decommissioned; or (3) certify pursuant to Paragraph 16 that the Caterpillar Engines, specifically identified by Title V Permit Emission Unit ID and serial number, have been converted to emergency standby status and will only be used as Emergency Stationary Reciprocating Internal Combustion Engines ("RICE") as defined in 40 C.F.R. § 63.6675. In the event FERC does not rule on the application for a Certificate of Abandonment within one (1) year after entry of this Consent Decree, CIG shall, not later than thirteen (13)

months after entry of this Consent Decree, either (1) operate the Caterpillar Engines such that each engine meets an emission limit of 3.3 lbs. NOx/hr.; (2) certify pursuant to Paragraph 16 that the Caterpillar Engines, specifically identified by Title V Permit Emission Unit ID and serial number, will be replaced and/or decommissioned not later than sixteen (16) months after entry of this Consent Decree; or (3) certify pursuant to Paragraph 16 that the Caterpillar Engines, specifically identified by Title V Permit Emission Unit ID and serial number, will be converted to emergency standby status and will only be used as Emergency Stationary Reciprocating Internal Combustion Engines ("RICE") as defined in 40 C.F.R. § 63.6675 not later than sixteen (16) months after entry of this Consent Decree. Not later than seventeen (17) months after entry of this Consent Decree, CIG shall submit a report to EPA, pursuant to Section VII of this Consent Decree, identifying (1) the changes that were made to the Caterpillar Engines or their method of operation to enable them to meet the 3.3 lbs. NOx/hr. emission limit and the date such changes were completed and/or implemented or (2) the date the Caterpillar Engines were replaced, decommissioned and/or converted to emergency standby status.

i. Notwithstanding the provisions of Subparagraph 6.b. that permit CIG to elect to operate the Caterpillar Engines an Emergency Stationary RICE as defined in 40 C.F.R. § 63.6675, the Caterpillar Engines must meet the short term emission limit set forth in Paragraph 6.a.

ii. If CIG complies with Subparagraph 6.b. by replacing, decommissioning, and/or converting to emergency standby service the Caterpillar Engines, CIG shall, not later than 120 Days after the engines are replaced, decommissioned, and/or converted

to emergency standby service, submit an amendment to its Title V Permit reflecting the change in the operation of the Facility.

iii. If CIG complies with Subparagraph 6.b. by controlling the Caterpillar engines, CIG shall, not later than 90 Days after the control equipment is installed, submit an amendment to its Title V Permit reflecting an emission limit of 3.3 lbs. NOx/hr. for the Caterpillar Engines. Not later than 120 Days after the control equipment is installed, CIG shall submit to EPA for review and approval a protocol for testing each engine for NOx (using EPA Reference Method 7(e) or other method subject to EPA approval). If EPA does not approve or disapprove of the testing protocol within 30 Days of its submission, CIG shall deem the protocol approved. CIG shall complete the testing of each engine for NOx pursuant to the testing protocol not later than ninety (90) days after EPA approval of such protocol. CIG shall submit to EPA a test report indicating the results of the reference method testing not later than 60 Days after the completion of the testing. CIG shall retest the Caterpillar engines using a portable analyzer semi-annually, using the State of Wyoming Air Quality Division Portable Analyzer Monitoring Protocol or other method approved by EPA in writing. CIG shall submit to EPA the results of the portable analyzer testing with the semi-annual monitoring report required by the Title V Permit for the Facility.

c. Control of White Superior Engines. Not later than 30 Days after entry of this Consent Decree, CIG shall submit an amendment to its Title V Permit reflecting an emission limit of 3.9 lbs. NOx/hr. for the White Superior engines. Not later than 120 Days after entry of this Consent Decree, CIG shall submit to EPA for review and approval a protocol for testing each engine for NOx (using EPA Reference Method 7(e) or other method subject to EPA approval). If

EPA does not approve or disapprove of the testing protocol within 30 Days of its submission, CIG shall deem the protocol approved. CIG shall complete the testing of each engine for NOx pursuant to the testing protocol not later than 90 Days after EPA approval of such protocol. CIG shall submit to EPA a test report indicating the results of the reference method testing not later than 60 Days after the completion of the testing. CIG shall retest the White Superior engines using a portable analyzer semi-annually, using the State of Wyoming Air Quality Division Portable Analyzer Monitoring Protocol or other method approved by EPA in writing. CIG shall submit to EPA the results of the portable analyzer testing with the semi-annual monitoring report required by the Title V Permit for the Facility.

7. Dehydrator Compliance

a. CIG's dehydrator at the Natural Buttes Facility is subject to 40 C.F.R. Part 63, Subpart HH – National Emission Standards for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities.

b. CIG shall operate and maintain the flare located on the dehydrator at the Natural Buttes Facility pursuant to the requirements of 40 C.F.R. § 63.11(b) and the manufacturer's written instructions or procedures for its operation.

V. CIVIL PENALTY/EMISSION FEE PAYMENT

8. Not later than thirty (30) Days after the Effective Date of this Consent Decree, CIG shall pay to the United States a civil penalty pursuant to Section 113 of the Act, 42 U.S.C. § 7413, in the amount of $987,757, with interest accruing from the date on which the Consent Decree is lodged with the Court at the rate specified in 28 U.S.C. § 1961 as of the date of lodging. CIG shall make payment by Electronic Funds Transfer ("EFT") to the United States

Department of Justice ("DOJ"), in accordance with current EFT procedures, referencing DOJ Case Number 90-5-2-1-07660/2. Payment shall be made in accordance with instructions provided by the United States Attorney's Office for the District of Utah ("USAO"). Any funds received after 11:00 a.m. (EST) shall be credited on the next business day. CIG shall provide notice of payment, referencing DOJ Case Number 90-5-2-1-07660/2 and the civil case name and case number, to DOJ and to EPA, as provided in Section XIV ("Notices").

9. No amount of the civil penalty to be paid by CIG shall be used to reduce its federal or state tax obligations.

10. Not later than 30 Days after the Effective Date of this Consent Decree, CIG shall pay to EPA unpaid permit fees pursuant to 40 C.F.R. § 71.9 in the amount of $32,243. CIG shall make the payment by check payable to "Environmental Protection Agency" and sent by first class mail to:

United States Environmental Protection Agency
FOIA and Miscellaneous Payments
Cincinnati Finance Center
P.O. Box Number 979078
St. Louis, MO 63197-9000

The amount will be deemed paid on the date it is postmarked. CIG shall enclose a completed copy of EPA Form 5900-06 with the payment. CIG shall send a copy of the check and the completed form (also referencing DOJ Case Number 90-5-2-1-07660/2 and the civil case name and case number) to DOJ and to EPA, as provided in Section XIV ("Notices").

VI. AMBIENT AIR MONITORING

11. CIG shall fund the operation and maintenance of two ambient air quality and meteorological monitoring station(s) ("Monitoring Stations") located in the Uinta Basin and shall

fund the collection and distribution of monitoring data for the two Monitoring Stations. The two Monitoring Stations shall be those installed and/or utilized to monitor ozone, NOx and $PM_{2.5}$ concentrations and collect certain meteorological data pursuant to the Consent Decrees in *United States v. Kerr-McGee Corporation* (D. Colo. Civil Action No. 07-cv-01034-WDMMJW) and *United States v. Miller Dyer* (D. Utah Civil Action No. 2:09-CV-003320 DAK). CIG shall fund the monitoring at the two Monitoring Stations for a consecutive time period of two years following the completion of the monitoring period funded in the *Miller Dyer* Consent Decree. Not later than 30 Days after entry of this Consent Decree (unless such time period is extended by written agreement of the parties), CIG shall enter into a contract for the operation and maintenance of the two Monitoring Stations. CIG shall select a contractor that is acceptable to EPA. The ambient air quality monitors shall monitor ozone, NOx and $PM_{2.5}$ concentrations. The meteorological stations shall monitor wind speed, wind direction, temperature and solar radiation.

12. CIG shall work cooperatively with EPA, UDEQ, and the Ute Indian Tribe of the Uintah and Ouray Indian Reservation regarding the operation and maintenance of the Monitoring Stations. The Monitoring Stations shall meet the methodology and operational requirements set forth in 40 C.F.R. Part 58 and the data capture requirements set forth in 40 C.F.R. Part 50. Additional guidance for meteorological and air quality monitoring is contained in "Quality Assurance Handbook for Air Pollution Measurement Systems," Vol. IV, "Meteorological Measurements" and the "Quality Assurance Handbook for Air Pollution Measurement Systems."

13. CIG shall certify, in accordance with Paragraph 16, that it has met all the requirements of this Section VI (Ambient Air Monitoring).

14. EPA and CIG intend and contemplate that CIG will utilize the two air monitoring sites on a turnkey basis, including but not limited to utilizing (i) the site access and rights of surface use for the two air monitoring sites, and (ii) the air monitoring equipment purchased pursuant to the Kerr McGee Consent Decree. In the event that the operational conditions in (i) and (ii) are not met, CIG may demonstrate compliance with this provision by asserting and establishing a Force Majeure claim pursuant to Section IX (Force Majeure).

VII. REPORTING REQUIREMENTS

15. All reports required to be submitted pursuant to this Consent Decree shall be submitted to the persons designated in Section XIV (Notices) of this Consent Decree.

16. Each report submitted by CIG shall be signed by an authorized official and include the following certification:

> I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.

17. The reporting requirements of this Consent Decree do not relieve CIG of any reporting obligations required by the Act or its implementing regulations or by any other federal, state, or local law, regulation, permit, or other requirement.

18. Any information provided pursuant to this Consent Decree may be used by the United States in any proceeding to enforce the provisions of this Consent Decree and as otherwise permitted by law.

VIII. STIPULATED PENALTIES

19. CIG shall be liable for stipulated penalties to the United States for violations of this Consent Decree as specified below, unless excused under Section IX (Force Majeure). A violation includes failing to perform any obligation required by the terms of this Decree, including any work plan or schedule approved under this Decree, according to all applicable requirements of this Decree and within the specified time schedules established by or approved under this Decree.

a. Injunctive Requirements (Section IV)

Violation	Stipulated Penalty
For failure to either (1) replace, decommission, and/or convert to emergency standby use the Caterpillar Engines or 2) meet an emission limit of 3.3 lbs. NOx/hr within the time frame specified in Paragraph 6.b.	$1,000 per day for the first 30 days of noncompliance, $2,000 per day from the 31st to 60th day of noncompliance, and $3,000 per day thereafter.

For failure to submit an amendment to the Title V permit reflecting (1) the replacement, decommissioning, or conversion to emergency standby use of the Caterpillar Engines or (2) an emission limit of 3.3 lbs. NOx/hr for the Caterpillar Engines as required in Paragraph 6.b.ii.	$200 per day for the first 30 days of noncompliance, $500 per day from the 31st to 60th day of noncompliance, and $1,000 per day thereafter.
For failure to submit a protocol for testing or failure to conduct testing as specified in Paragraph 6.b.iii.	$500 per day for the first 30 days of noncompliance, $1,000 per day from the 31st to 60th day of noncompliance, and $1,500 per day thereafter.
For failure to submit any report as required in Paragraph 6.b.	$200 per day for the first 30 days of noncompliance, $500 per day from the 31st to 60th day of noncompliance, and $1,000 per day thereafter.
For failure to submit an amendment to the Title V permit reflecting an emission limit of 3.9 pounds NOx/hour for the White Superior Engines) as specified in Paragraph 6.c.	$200 per day for the first 30 days of noncompliance, $500 per day from the 31st to 60th day of noncompliance, and $1,000 per day thereafter.

b. Ambient Air Monitoring (Section VI)

Violation	Stipulated Penalty
For failure to fund, operate, maintain and certify the Monitoring Stations as required by Paragraph 11.	$200 per day for the first 30 days of noncompliance, $500 per day from the 31st to 60th day of noncompliance, and $1,000 per day thereafter.

20. Late Payment of Civil Penalty. If CIG fails to pay the civil penalty and emission fee required to be paid under Section V (Civil Penalty/Emission Fee Payment) of this Consent Decree to the United States when due, CIG shall pay a stipulated penalty of $1,000 per day for each day that the payment is late.

21. Stipulated penalties under this Section shall begin to accrue on the day after performance is due or on the day a violation occurs, whichever is applicable, and shall continue to accrue until performance is satisfactorily completed or until the violation ceases. Stipulated penalties shall accrue simultaneously for separate violations of this Consent Decree.

22. CIG shall pay any stipulated penalty within 30 Days of receipt of written demand of the United States and shall continue to make such payments every 30 Days thereafter until the violation(s) no longer continues, unless CIG elects within 20 Days of receipt of written demand from the United States to dispute the accrual of stipulated penalties in accordance with the provisions in Section X (Dispute Resolution) of this Consent Decree.

23. CIG shall pay stipulated penalties in accordance with the payment instructions set forth in Paragraph 8.

24. The United States may, in the unreviewable exercise of its discretion, reduce or waive stipulated penalties otherwise due under this Consent Decree.

25. Stipulated penalties shall continue to accrue as provided in Paragraph 21 during any dispute, with interest on accrued stipulated penalties payable and calculated by the Secretary of Treasury, pursuant to 28 U.S.C. § 1961, but need not be paid until the following:

a. If the dispute is resolved by agreement or by a decision of Plaintiff pursuant to Section X (Dispute Resolution) of this Consent Decree that is not appealed to the Court, CIG shall pay accrued stipulated penalties agreed or determined to be owing, together with accrued interest, within 30 Days of the effective date of the agreement or the receipt of Plaintiff's decision.

b. If the dispute is appealed to the Court, and the Plaintiff prevails in whole or in part, CIG shall pay all accrued stipulated penalties determined by the Court to be owing, together with accrued interest, within 60 Days of receiving the Court's decision or order, except as provided in Subparagraph c., below.

c. If any Party appeals the Court's decision, CIG shall pay all accrued penalties determined to be owing, together with accrued interest, within 15 Days of receiving the final appellate court decision.

26. CIG shall not deduct stipulated penalties paid under this Section VIII in calculating its federal income tax.

27. Subject to the provisions of Section XII (Effect of Settlement/Reservation of Rights), the stipulated penalties provided for in this Consent Decree shall be in addition to any other rights, remedies, or sanctions available to the United States for CIG's violation of this

Consent Decree or applicable law. Where a violation of this Consent Decree is also a violation of the Act or regulatory requirements of the Act, CIG shall be allowed a credit, for any stipulated penalties paid, against any statutory penalties imposed for such violation.

IX. FORCE MAJEURE

28. If any event occurs which causes or may cause a delay or impediment to performance in complying with any provision of this Consent Decree (*e.g.* would require operation in an unsafe manner), and which CIG believes qualifies as an event of Force Majeure, CIG shall notify the United States in writing as soon as practicable, but in any event within 30 Days of when CIG first knew of the event or should have known of the event by the exercise of due diligence. In this notice CIG shall specifically reference this Paragraph of this Consent Decree and describe the anticipated length of time the delay may persist, the cause or causes of the delay, and the measures taken or to be taken by CIG to prevent or minimize the delay and the schedule by which those measures will be implemented. CIG shall adopt all reasonable measures to avoid or minimize such delays.

29. Failure by CIG to substantially comply with the notice requirements of Paragraph 28, as specified above, shall render this Section voidable by the United States, as to the specific event for which CIG has failed to comply with such notice requirement. If so voided, it shall be of no effect as to the particular event involved.

30. The United States shall notify CIG in writing regarding its claim of a delay or impediment to performance within 45 Days of receipt of the Force Majeure notice provided under Paragraph 28.

31. If the United States agrees that the delay or impediment to performance has been or will be caused by circumstances beyond the control of CIG, including any entity controlled or contracted by it, and that CIG could not have prevented the delay by the exercise of due diligence, the Parties shall stipulate to an extension of the required deadline(s) for all requirement(s) affected by the delay by a period equivalent to the delay actually caused by such circumstances, or such other period as may be appropriate in light of the circumstances. Such stipulation may be filed as a modification to this Consent Decree by agreement of the parties pursuant to the modification procedures established in this Consent Decree. CIG shall not be liable for stipulated penalties for the period of any such delay.

32. If the United States does not agree that the delay or impediment to performance has been or will be caused by circumstances beyond the control of CIG, including any entity controlled or contracted by CIG, the position of the United States on the Force Majeure claim shall become final and binding upon CIG, and CIG shall pay applicable stipulated penalties, unless CIG submits the matter to this Court for resolution by filing a petition for determination with this Court within 10 business Days after receiving the written notification of the United States as set forth in Paragraph 30. Once CIG has submitted such matter to this Court, the United States shall have 20 business Days to file a response to the petition. If CIG submits the matter to this Court for resolution and the Court determines that the delay or impediment to performance has been or will be caused by circumstances beyond the control of CIG, including any entity controlled or contracted by CIG, and that CIG could not have prevented the delay by the exercise of due diligence, CIG shall be excused as to that event(s) and delay (including stipulated

penalties) for all requirements affected by the delay for a period of time equivalent to the delay caused by such circumstances or such other period as may be determined by the Court.

33. CIG shall bear the burden of proving that any delay of any requirement(s) of this Consent Decree was caused by or will be caused by circumstances beyond its control, including any entity controlled or contracted by CIG, and that CIG could not have prevented the delay by the exercise of due diligence. CIG shall also bear the burden of proving the duration and extent of any delay(s) attributable to such circumstances. An extension of one compliance date based on a particular event may, but does not necessarily, result in an extension of a subsequent compliance date or dates. Unanticipated or increased costs or expenses associated with the performance of obligations under this Consent Decree shall not constitute circumstances beyond the control of CIG.

34. As part of the resolution of any matter submitted to this Court under this Section, the Parties by agreement, or this Court by order, may in appropriate circumstances extend or modify the schedule for completion of work under this Consent Decree to account for the delay in the work that occurred as a result of any delay or impediment to performance agreed to by the United States or approved by this Court. CIG shall be liable for stipulated penalties for its failure thereafter to complete the work in accordance with the extended or modified schedule, except to the extent that such schedule is further modified, extended or otherwise affected by a subsequent Force Majeure event under this Section IX.

X. DISPUTE RESOLUTION

35. Unless otherwise expressly provided for in this Consent Decree, the dispute resolution procedures of this Section shall be the exclusive mechanism to resolve disputes arising under or with respect to this Consent Decree.

36. Informal Dispute Resolution. Any dispute subject to Dispute Resolution under this Consent Decree shall first be the subject of informal negotiations. The dispute shall be considered to have arisen when CIG sends the United States a written Notice of Dispute. The Notice of Dispute shall state clearly the matter in dispute. The period of informal negotiations shall not exceed 20 Days from the date the dispute arises, unless that period is modified by written agreement. If the Parties cannot resolve a dispute by informal negotiations, then the position advanced by the United States shall be considered binding unless, within 20 Days after the conclusion of the informal negotiation period, CIG invokes formal dispute resolution procedures as set forth below.

37. Formal Dispute Resolution. CIG may only invoke formal dispute resolution procedures, within the time period provided in the preceding Paragraph, by serving on the United States a written Statement of Position regarding the matter in dispute. The Statement of Position shall include, but may not necessarily be limited to, any factual data, analysis, or opinion supporting CIG's position and any supporting documentation relied upon by CIG.

38. The United States shall serve its Statement of Position within 30 Days of receipt of CIG's Statement of Position. The United States' Statement of Position shall include, but may not necessarily be limited to, any factual data, analysis, or opinion supporting that position and any supporting documentation relied upon by the United States. The United States' Statement of

Position shall become binding on CIG 14 Days from when it is served. During this fourteen-day period, the United States and CIG shall, in good faith, enter into discussions in an attempt to resolve the dispute. If the dispute is not resolved during this time, the United States' Statement of Position shall become binding upon CIG unless CIG files a motion for judicial review of the dispute in accordance with the following Paragraph.

39. CIG may seek judicial review of the dispute by filing with the Court and serving on the United States, in accordance with Section XIV of this Consent Decree (Notices), a motion requesting judicial resolution of the dispute. The motion must be filed within 30 Days of receipt of the United States' Statement of Position pursuant to the preceding Paragraph. The motion shall contain a written statement of CIG's position on the matter in dispute, including any supporting factual data, analysis, opinion, or documentation, and shall set forth the relief requested and any schedule within which the dispute must be resolved for orderly implementation of the Consent Decree.

40. The United States shall respond to CIG's motion within the time period allowed by the Local Rules of this Court. CIG may file a reply memorandum to the extent permitted by the Local Rules.

41. Except as otherwise provided in this Consent Decree, in any dispute brought under this Section X (Dispute Resolution), CIG shall bear the burden of demonstrating that its position complies with this Consent Decree.

42. The invocation of dispute resolution procedures under this Section shall not, by itself, extend, postpone, or affect in any way any obligation of CIG under this Consent Decree, unless and until final resolution of the dispute so provides. Stipulated penalties with respect to

the disputed matter shall continue to accrue from the first day of noncompliance, but payment shall be stayed pending resolution of the dispute. If CIG does not prevail on the disputed issue, stipulated penalties shall be assessed and paid as provided in Section VIII (Stipulated Penalties).

XI. INFORMATION COLLECTION AND RETENTION

43. The United States, and its representatives, including attorneys, contractors, and consultants, shall have the right of entry into the Natural Buttes Facility at all reasonable times, upon presentation of credentials, for the purpose of monitoring compliance with any the provisions of this Consent Decree, including to:

a. monitor the progress of activities required under this Consent Decree;

b. inspect equipment and facilities covered by this Consent Decree; and

c. inspect and copy documents, records, or other information to be maintained in accordance with the terms of this Consent Decree.

44. Until five years after the termination of this Consent Decree, CIG shall retain, and shall instruct its contractors and agents to preserve, all non-identical copies of all documents, records, or other information (including documents, records, or other information in electronic form) in its or its contractors' or agents' possession or control, or that come into its or its contractors' or agents' possession or control, and that relate in any manner to CIG's performance of its obligations under this Consent Decree. This information-retention requirement shall apply regardless of any contrary corporate or institutional policies or procedures. At any time during this information-retention period, upon request by the United States, CIG shall provide copies of any non-privileged documents, records, or other information required to be maintained under this Paragraph.

45. At the conclusion of the information-retention period provided in the preceding Paragraph, CIG shall notify the United States at least 90 Days prior to the destruction of any documents, records, or other information subject to the requirements of the preceding Paragraph and, upon request by the United States, CIG shall deliver the requested non-privileged documents, records, or other information to EPA.

46. CIG may assert that certain documents, records, or other information is privileged under the attorney-client privilege or any other privilege recognized by federal law. If CIG asserts such a privilege, it shall provide the following: (1) the title of the document, record, or information; (2) the date of the document, record, or information; (3) the name and title of each author of the document, record, or information; (4) the name and title of each addressee and recipient; (5) a description of the subject of the document, record, or information; and (6) the privilege asserted by CIG. However, no documents, records, or other information that CIG is explicitly required to create or generate to satisfy a specific requirement of this Consent Decree shall be withheld on the grounds of privilege.

47. CIG may also assert that information required to be provided under this Section is protected as Confidential Business Information ("CBI") under 40 C.F.R. Part 2. As to any information that CIG seeks to protect as CBI, CIG shall follow the procedures set forth in 40 C.F.R. Part 2.

48. This Consent Decree in no way limits or affects any right of entry and inspection, or any right to obtain information, held by the United States pursuant to applicable federal or state laws, regulations, or permits, nor does it limit or affect any duty or obligation of CIG to

maintain documents, records, or other information imposed by applicable federal or state laws, regulations, or permits.

XII. EFFECT OF SETTLEMENT/RESERVATION OF RIGHTS

49. This Consent Decree resolves all civil or administrative claims of the United States for violations alleged in the Complaint through the date of lodging of this Consent Decree.

50. The United States reserves all legal and equitable remedies available to enforce the provisions of this Consent Decree. This Consent Decree shall not be construed to limit the rights of the United States to obtain penalties or injunctive relief under the Act or implementing regulations, or under other federal or state laws, regulations, or permit conditions.

51. This Consent Decree is not a permit, or a modification of any permit, under any federal, State, or local laws or regulations. Nothing in this Consent Decree shall relieve CIG of its obligation to achieve and maintain complete compliance with all applicable federal, State, and local laws, regulations, and permits. CIG's compliance with this Consent Decree shall be no defense to any action commenced pursuant to any such laws, regulations, or permits. The United States does not, by its consent to the entry of this Consent Decree, warrant or aver in any manner that CIG's compliance with any aspect of this Consent Decree will result in compliance with provisions of the Act, or with any other provisions of federal, State, or local laws, regulations, or permits.

52. This Consent Decree does not limit or affect the rights of CIG or of the United States against any third parties, not party to this Consent Decree, nor does it limit the rights of third parties, not party to this Consent Decree, against CIG, except as otherwise provided by law.

53. This Consent Decree shall not be construed to create rights in, or grant any cause of action to, any third party not party to this Consent Decree.

XIII. COSTS

54. The Parties shall bear their own costs of this action, including attorneys' fees, except that the United States shall be entitled to collect the costs (including attorneys' fees) incurred in any action necessary to collect any portion of the civil penalty or any stipulated penalties when due.

XIV. NOTICES

55. Unless otherwise specified herein, whenever notifications, submissions, or communications are required by this Consent Decree, they shall be made in writing and mailed or hand delivered addressed as follows:

As to the DOJ:

Chief, Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611, Ben Franklin Station
Washington, D.C. 20044-7611
Re: DOJ No. 90-5-2-1-07660/2

As to EPA

Assistant Regional Administrator
Office of Enforcement, Compliance, and Environmental Justice
U.S. Environmental Protection Agency, Region 8
1595 Wynkoop Street
Denver, CO 80202-1129

As to CIG:

Colorado Interstate Gas Company
2 North Nevada
Colorado Springs, CO 80903
Attn: Manager, Environmental Compliance

and

Colorado Interstate Gas Company
2 North Nevada
Colorado Springs, CO 80903
Attn: General Counsel

56. Any Party may, by written notice to the other Party, change its designated notice recipient or notice address provided above.

57. Notices submitted pursuant to this Section XIV shall be deemed submitted upon mailing, unless otherwise provided in this Consent Decree or by mutual agreement of the Parties in writing.

XV. SALES OR TRANSFERS OF OWNERSHIP/OPERATOR INTERESTS

58. If CIG proposes to sell or transfer all or part of its ownership or its responsibility as operator of the Natural Buttes Facility, CIG shall advise the buyer or transferee in writing of the existence of this Consent Decree prior to such sale or transfer and shall send a copy of such written notification to the Plaintiff pursuant to Section XIV (Notices) of this Consent Decree at least 60 Days before such proposed sale or transfer; provided, however, that if CIG has completed the obligations required under Paragraph 6 of this Consent Decree CIG need not advise buyer or transferee of the existence of this Consent Decree.

59. Unless CIG has completed the obligations required under Paragraph 6 of this Consent Decree, no sale or transfer of ownership to a buyer or transferee shall take place before the buyer or transferee consents in writing, by a stipulation to be filed with the Court, to: (a) accept all of the obligations, terms, and conditions of this Consent Decree with the exception of the obligations, terms, and conditions contained in Sections V (Civil Penalty/Emission Fee Payment) and VI (Ambient Air Monitoring); (b) accept the jurisdiction of the Court to enforce the terms of this Consent Decree (with the exception of Sections V (Civil Penalty/Emission Fee Payment) and VI (Ambient Air Monitoring)) as to such party; and (c) become a party to this Consent Decree (consistent with the limitations set forth in (a) and (b), above). Notwithstanding such a sale or transfer, CIG shall remain jointly and severally liable with the buyer or transferee unless the Consent Decree is modified or CIG's joint and several liability is restricted in accordance with Paragraph 60.

60. If the United States agrees, the Parties and the buyer or transferee may execute a modification to this Consent Decree, that relieves CIG of its liability under this Consent Decree for, and makes the buyer or transferee liable for, all obligations and liabilities applicable to the purchased or transferred facilities or operator responsibility. Notwithstanding the foregoing, however, CIG may not assign, and may not be released from, obligations under this Consent Decree to pay the civil penalty in accordance with Section V (Civil Penalties/Emission Fee Payment), undertake the project set forth Section VI (Ambient Air Monitoring), pay stipulated penalties with respect to actions occurring prior to the date of transfer of ownership or operator responsibility in accordance with Section VIII (Stipulated Penalties), or maintain documents or provide reports with respect to those obligations in accordance with Sections VII (Reporting

Requirements) and XI (Information Collection and Retention). CIG may propose, and the United States may agree, to restrict the scope of the joint and several liability of any purchaser or transferee for any obligations of this Consent Decree that are not specific to the transferred or purchased facilities or operator responsibility, to the extent such obligations may be adequately separated in an enforceable manner.

XVI. EFFECTIVE DATE

61. Unless otherwise specifically provided herein, the Effective Date of this Consent Decree shall be the date upon which this Consent Decree is entered by the Court.

XVII. RETENTION OF JURISDICTION

62. The Court shall retain jurisdiction over this case until termination of this Consent Decree, for the purpose of resolving disputes arising under this Decree pursuant to Section X (Dispute Resolution) or entering orders modifying this Decree, pursuant to Sections XV (Sales or Transfers of Ownership/Operator Interests) and XVIII (Modification), or effectuating or enforcing compliance with the terms of this Consent Decree.

XVIII. MODIFICATION

63. The terms of this Consent Decree may be modified only by a subsequent written agreement signed by all the Parties. With respect to any modification that constitutes a material change to this Decree, such written agreement shall be filed with the Court and effective only upon the Court's approval. Any disputes concerning modification of this Decree shall be resolved pursuant to Section X (Dispute Resolution) of this Consent Decree.

XIX. TERMINATION

64. This Consent Decree shall be in effect until it is terminated in accordance with the provisions of this Section.

65. Upon completing all obligations of this Consent Decree (with the exception of the semi-annual retesting of engines required under Paragraphs 6.b. and 6.c.), CIG shall serve upon the United States a Request for Termination. The Request for Termination shall certify that CIG has paid the civil penalty and all stipulated penalties, if any, that have accrued, and has fulfilled all other obligations of this Consent Decree.

66. If the United States does not agree that the Consent Decree may be terminated, CIG may invoke Dispute Resolution under Section X (Dispute Resolution) of this Consent Decree. However, CIG shall not seek Dispute Resolution under Section X (Dispute Resolution) of this Consent Decree until 60 Days after service of its Request for Termination.

67. If the United States agrees that the Consent Decree may be terminated, the Parties shall jointly move the Court for termination of the Consent Decree.

XX. PUBLIC PARTICIPATION

68. This Consent Decree shall be lodged with the Court for a period of not less than 30 Days for public notice and comment in accordance with 28 C.F.R. § 50.7. The United States reserves the right to withdraw or withhold its consent if the comments regarding the Consent Decree disclose facts or considerations indicating that the Consent Decree is inappropriate, improper, or inadequate. CIG consents to entry of this Consent Decree without further notice and agrees not to withdraw from or oppose entry of this Consent Decree by the Court or to

challenge any provision of the Consent Decree, unless the United States has notified CIG in writing that it no longer supports entry of the Consent Decree.

XXI. SIGNATORIES/SERVICE

69. Each undersigned representative of CIG and the Assistant Attorney General for the Environment and Natural Resources Division of the Department of Justice certifies that he or she is fully authorized to enter into the terms and conditions of this Consent Decree and to execute and legally bind the Party he or she represents to the terms and conditions of this document.

70. This Consent Decree may be signed in counterparts, and its validity shall not be challenged on that basis.

71. CIG agrees to accept service of process by mail with respect to all matters arising under or relating to this Consent Decree and to waive the formal service requirements set forth in Rules 4 and 5 of the Federal Rules of Civil Procedure and any applicable Local Rules of this Court including, but not limited to, service of a summons.

XXII. INTEGRATION

72. This Consent Decree constitutes the final, complete, and exclusive agreement and understanding between the Parties with respect to the settlement embodied in the Decree and supersedes all prior agreements and understandings, whether oral or written, concerning the settlement embodied herein. Other than the deliverables that are subsequently submitted and approved pursuant to this Decree, no other document, nor any representation, inducement, agreement, understanding, or promise, constitutes any part of this Decree or the settlement it represents, nor shall it be used in construing the terms of this Decree.

XXIII. FINAL JUDGMENT

73. Upon approval and entry of this Consent Decree by the Court, this Consent Decree shall constitute a final judgment of the Court as to the United States and CIG.

Dated and entered this _____ day of _____, 2009

_____
UNITED STATES DISTRICT JUDGE
District of Utah

THE UNDERSIGNED PARTY enters into this Consent Decree in the matter of *United States v. Colorado Interstate Gas Co.*, subject to the public notice and comment requirements of 28 C.F.R. § 50.7.

FOR COLORADO INTERSTATE GAS COMPANY

Pres. dnt

Date: 6-24-09

Colorado Interstate Gas Company
2 North Nevada
Colorado Springs, CO 80903

THE UNDERSIGNED PARTY enters into this Consent Decree in the matter of *United States v. Colorado Interstate Gas Co.*, subject to the public notice and comment requirements of 28 C.F.R. § 50.7.

FOR PLAINTIFF, UNITED STATES OF AMERICA

Date_____

JOHN C. CRUDEN
Acting Assistant Attorney General
Environment & Natural Resources Division
United States Department of Justice

Date 7/22/09

JAMES D. FREEMAN
Trial Attorney
Environmental Enforcement Section
Environment and Natural Resources Division
United States Department of Justice
1961 Stout Street – 8th Floor
Denver, CO 80294
Telephone (303) 844-1489

BRETT L. TOLMAN
United States Attorney
District of Utah
185 South State Street
Suite #300
Salt Lake City, UT 84111
Phone: (801) 524-5682
Fax: (801) 524-6924

THE UNDERSIGNED PARTY enters into this Consent Decree in the matter of *United States v. Colorado Interstate Gas Co.*, subject to the public notice and comment requirements of 28 C.F.R. § 50.7.

FOR U.S. ENVIRONMENTAL PROTECTION AGENCY

Eddie A. Sierra

Date: 07

EDDIE A. SIERRA
Acting Assistant Regional Administrator
Office of Enforcement, Compliance and
Environmental Justice

THE UNDERSIGNED PARTY enters into this Consent Decree in the matter of *United States v. Colorado Interstate Gas Co.*, subject to the public notice and comment requirements of 28 C.F.R. § 50.7.

FOR U.S. ENVIRONMENTAL PROTECTION AGENCY

Cynthia Giles

Date: 7/17/09

CYNTHIA GILES
Assistant Administrator
Office of Enforcement and Compliance Assurance
U.S. Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF UTAH
NORTHERN DIVISION

UNITED STATES OF AMERICA Plaintiff v. MILLER, DYER & CO., L.L.C. and CHICAGO ENERGY ASSOCIATES and WHITING OIL AND GAS CORPORATION Defendants	)	Civil Action No: 2:09CV332 DAK

CONSENT DECREE

TABLE OF CONTENTS

WHEREAS, Plaintiff, the United States of America, (the "United States") on behalf of the United States Environmental Protection Agency ("EPA"), has simultaneously with the lodging of this Consent Decree filed a Complaint alleging that Miller, Dyer & Co., L.L.C., a Colorado limited liability company ("Miller Dyer" and as more specifically defined below), and Chicago Energy Associates, a Delaware limited liability company ("CEA" and as more specifically defined below), violated requirements of the Clean Air Act (the "Act") and the federal regulations implementing the Act applicable to one existing compressor station referred to herein as the Flat Rock Compressor Station ("the Flat Rock Facility"), one former compressor station referred to herein as the Comet Pipeline Compressor Station ("the Comet Pipeline Facility"), and one existing hydrocarbon dewpoint control facility referred to herein as the Seep Ridge Interconnect Station ("the Seep Ridge Facility") which are located in the Uinta Basin near Vernal, Utah (the "Uinta Basin"), **and** located on Indian country lands in the State of Utah;

WHEREAS, EPA administers the Act's programs for National Emission Standards for Hazardous Air Pollutants ("NESHAP"), New Source Performance Standards ("NSPS"), and federal operating permits under Title V of the Act with respect to facilities located on Indian country lands in Utah;

WHEREAS, Miller Dyer was the previous operator of the Facilities subject to this Consent Decree, and CEA was the previous owner of the Facilities subject to this Consent Decree; Whiting Oil and Gas Corporation, a Delaware corporation ("Whiting" and as more specifically defined below), is the current operator and owner of the Facilities subject to this Consent Decree;

WHEREAS, on June 27, 2007, Miller Dyer disclosed to EPA that: (1) the Flat Rock Facility had the Potential to Emit ("PTE") greater than the major source thresholds of hazardous air pollutants and was subject to the Federal NESHAPs for oil and natural gas production facilities (40 C.F.R. Part 63, Subpart HH) and for reciprocating internal combustion engines (40 C.F.R. Part 63, Subpart ZZZZ); and was subject to the federal operating permit requirements of Title V of the Act; and (2) the Seep Ridge Facility had potential violations of the Federal NSPS for Equipment Leaks of VOC from Onshore Natural Gas Processing Plants (40 C.F.R., Part 60, Subpart KKK). Miller Dyer also conducted a compliance evaluation of its former compressor station, the Comet Pipeline Facility, and disclosed to EPA on August 20, 2007, that the Comet Pipeline Facility, while in service, had a PTE greater than the major source thresholds of hazardous air pollutants and was subject to the Federal NESHAPs for oil and natural gas production facilities (40 C.F.R. Part 63, Subpart HH); and was subject to the federal operating permit requirements of Title V of the Act. Miller Dyer contends that its June 27, 2007 and August 20, 2007 disclosures were pursuant to EPA's policy titled "Incentives for Self-Policing: Discovery, Disclosure, Correction and Prevention of Violations" published at 65 Fed. Reg. 19,618 - 27 (April 11, 2000) (Audit Policy);

WHEREAS, Miller Dyer subsequently submitted an application for a Title V permit for the Flat Rock Facility to EPA and submitted notifications required under 40 C.F.R. Part 63. At the Flat Rock Facility, Miller Dyer has installed control or process equipment to comply with 40 C.F.R. Part 63 Subpart HH; has installed a condenser on the gas dehydration unit with condenser vent stream gasses being routed to the dehydration unit reboiler pilot and with flash tank emissions being routed to an enclosed flare; has installed a catalytic converter on the

reciprocating internal combustion engine to comply with 40 C.F.R. Part 63 Subpart ZZZZ; and has installed the necessary monitoring systems;

WHEREAS, on May 2, 2008, Miller Dyer and CEA plugged and abandoned the Oil Canyon Number 26-1A, API Number 43-04731180 oil and gas well, located in the SW1/4 of SE1/4 of Section 26, Township 14 South, Range 20 E, SLM, Uintah County, Utah;

WHEREAS, on May 30, 2008, Miller Dyer and CEA sold and transferred ownership and operation of the Uinta Basin Facilities to Whiting;

WHEREAS, as of May 31, 2008, Whiting is the owner and operator of the Flat Rock Facility and the Seep Ridge Facility subject to this Consent Decree;

WHEREAS, Miller Dyer, CEA, and Whiting (collectively referred to as "Defendants") do not admit the violations occurred and further do not admit any liability for civil penalties, fines, or injunctive relief to the United States arising out of the transactions or occurrences alleged in the Complaint;

WHEREAS, Miller Dyer, CEA, and Whiting have worked cooperatively with the Plaintiff to settle this matter;

WHEREAS, the United States, Miller Dyer, CEA, and Whiting (the "Parties") recognize, and the Court by entering this Consent Decree finds, that this Consent Decree has been negotiated by the Parties in good faith and at arm's length, will avoid litigation among the Parties, and that this Consent Decree is fair, reasonable, consistent with the goals of the Act and its implementing regulations, and that its entry is in the best interests of the Parties and is in the public interest;

NOW, THEREFORE, before the taking of any testimony, without the adjudication or admission of any issue of fact or law except as provided in Section I (Jurisdiction and Venue), and with the consent of the Parties,

IT IS HEREBY ADJUDGED, ORDERED, AND DECREED as follows:

I. JURISDICTION AND VENUE

1. This Court has jurisdiction over the subject matter of this action and the Parties pursuant to 28 U.S.C. §§ 1331, 1345, and 1355, and Section 113(b) of the Act, 42 U.S.C. § 7413(b). Venue lies in this District pursuant to Section 113(b) of the Act, 42 U.S.C. § 7413(b), and 28 U.S.C. §§ 1391(b) & (c) and 1395(a), because the violations alleged in the Complaint are alleged to have occurred in, and Miller Dyer, CEA, and Whiting conduct business in, this judicial district.

2. The Uinta Basin Facilities are located on Indian country lands in Uintah County, Utah. For purposes of this Consent Decree or any action to enforce this Consent Decree, Miller Dyer, CEA, and Whiting consent to and will not contest the jurisdiction of the Court over this matter. For purposes of this Consent Decree, Miller Dyer, CEA, and Whiting agree that the Complaint states claims upon which relief may be granted pursuant to Section 113 of the Act, 42 U.S.C. §§ 7413.

II. APPLICABILITY

3. The obligations of this Consent Decree apply to and are binding upon the United States and upon Miller Dyer, CEA, and Whiting, as defined herein, and any of their successors and assigns.

4. Miller Dyer, CEA, and Whiting shall ensure that any of their corporate subsidiaries or affiliates that now or in the future may own or operate any of the Uinta Basin Facilities, or other natural gas production or gathering facilities subject to any work or compliance requirements of this Consent Decree, take all necessary and appropriate actions and provide EPA access to facilities, equipment, and information as may be required to enforce this Consent Decree so that Miller Dyer, CEA, and Whiting may fully and timely comply with all requirements applicable to each as set forth in this Consent Decree.

5. In any action to enforce this Consent Decree, Miller Dyer, CEA, and Whiting shall not raise as a defense the failure by any of its officers, directors, employees, agents, contractors, or corporate affiliates or subsidiaries to take any actions necessary to comply with the provisions of this Consent Decree which are applicable to such Party unless or except as provided in Section XIII (Force Majeure).

III. DEFINITIONS

6. Terms used in this Consent Decree that are defined in the Act or in regulations promulgated pursuant to the Act shall have the meanings assigned to them in the Act or such regulations, unless otherwise provided in this Consent Decree. Whenever the terms set forth below are used in this Consent Decree, the following definitions shall apply:

(a) "Clean Air Act" or "Act" shall mean the federal Clean Air Act, 42 U.S.C. § 7401 *et seq.*, as last amended by the Clean Air Act Amendments of 1990, P.L. 101-549, November 15, 1990.

(b) "Code of Federal Regulations" or "C.F.R." unless otherwise noted shall refer to the 2007 codification.

(c) "Consent Decree" or "Decree" shall mean this Consent Decree and all appendices attached hereto (listed in Section XXIX).

(d) "Day" shall mean a calendar day unless expressly stated to be a business day. In computing any period of time under this Consent Decree, where the last day would fall on a Saturday, Sunday, or federal holiday, the period shall run until the close of business of the next business day.

(e) "Miller Dyer" shall mean Miller, Dyer & Co., L.L.C., its subsidiaries, successors, and assigns.

(f) "CEA" shall mean Chicago Energy Associates, its subsidiaries, successors, and assigns.

(g) "EPA" shall mean the United States Environmental Protection Agency and any of its successor departments or agencies.

(h) "HAP" shall mean hazardous air pollutant as provided under Section 112 of the Act.

(i) "Indian country" shall refer to the definition of "Indian Country" at 18 U.S.C. § 1151,[1] including:

1. all land within the limits of any Indian reservation under the jurisdiction of the United States government, notwithstanding the issuance of any patent, and including rights-of-way running through the reservation;

1 Consistent with federal case law, Indian country includes any lands held in trust by the United States for an Indian tribe.

2. all dependent Indian communities within the borders of the United States whether within the original or subsequently acquired territory thereof, and whether within or without the limits of a state; and

3. all Indian allotments, the Indian titles to which have not been extinguished, including rights-of-way running through the same.

(j) "Indian governing body" means the governing body of any tribe, band, or group of Indians subject to the jurisdiction of the United States and recognized by the United States as possessing power of self-government.

(k) "Minor source" means a source that emits or has the potential to emit pollutants regulated under the Clean Air Act in amounts less than the Major stationary source levels specified in 40 C.F.R. § 52.21 or 40 C.F.R. § 63.2, as applicable.

(l) "Non-major" source means a stationary source that is not a "major source" under the applicable provisions of 40 C.F.R. § 63.2 (general provisions), and the applicable source category "major source" definition or 40 C.F.R. § 63.761 (Subpart HH), or § 63.6675 (Subpart ZZZZ).

(m) "Paragraph" shall mean a portion of this Consent Decree identified by an Arabic numeral.

(n) "Performance Optimization Review" shall mean an evaluation of energy efficiency and the potential for product recovery at certain facilities for purposes of conserving natural gas and returning it to the marketplace.

(o) "Plaintiff" shall mean the United States.

(p) "Pneumatic Controller" shall mean a natural gas-driven pneumatic controller.

(q) "RICE" shall mean one or more stationary, natural gas-fired Reciprocating Internal Combustion Engines.

(r) "Section" shall mean a portion of this Consent Decree identified by a Roman numeral.

(s) "Title V Permit" shall mean a permit issued pursuant to the federal operating permit program established by Title V of the Act, 42 U.S.C. §§ 7661 - 7661f, and as implemented by 40 C.F.R. Parts 70 (applicable to states) or 71 (applicable to EPA).

(t) "TPY" shall mean tons per year.

(u) "Uinta Basin Facilities" shall collectively mean the Flat Rock Compressor Station, the Seep Ridge Interconnect Station, and the Comet Pipeline Compressor Station, each of which is/was located in the Uinta Basin near Vernal, Utah, as more specifically described in Appendix A.

(v) "Uinta Basin Properties" shall mean current and future oil and gas lease properties which are operated by Whiting in the area identified on the map shown in Appendix B which are located in Indian country within the Uinta Basin near Vernal, Utah.

(w) "Whiting" shall mean Whiting Oil and Gas Corporation, its subsidiaries, successors, and assigns.

IV. EMISSION REDUCTION REQUIREMENTS

A. DEHYDRATION UNITS

Uinta Basin Existing Major Source

7. The gas dehydration unit located at the Flat Rock Facility is subject to "major source" standards under 40 C.F.R. Part 63, Subpart HH – NESHAPs For Oil and Natural Gas Facilities (hereinafter "Subpart HH").

8. [RESERVED.]

9. By letter dated December 4, 2007, Buys & Associates, on behalf of Miller Dyer, notified EPA that the enclosed flare controlling the flash tank emissions at the Flat Rock Facility had achieved emissions reductions in compliance with the major source requirements of Subpart HH. By this letter, Miller Dyer and/or CEA has provided a written notice to EPA and certified that the condenser vent stream routed to the pilot flame of the dehydration unit reboiler at the Flat Rock Facility was achieving emissions reductions in compliance with the major source requirements of Subpart HH as of May 30, 2008.

10. On and after the date of lodging of this Consent Decree, Whiting shall operate and maintain the gas dehydration unit at the Flat Rock Facility in compliance with applicable Subpart HH major source standards.

11. [RESERVED.]

12. [RESERVED.]

13. [RESERVED.]

14. General Record-Keeping Requirement: Miller Dyer, CEA, and Whiting shall maintain records and information adequate to demonstrate their individual compliance with the

requirements of this Section IV.A.. Whiting shall report the status of its compliance with these requirements in its Annual Report submitted pursuant to Section XI (Reporting Requirements).

B. COMPRESSOR ENGINES

Uinta Basin Existing Major Source

15. The lean burn Reciprocating Internal Combustion Engine ("RICE") currently located at the Flat Rock Facility, as identified in Appendix A, is subject to 40 C.F.R. Part 63, Subpart ZZZZ – NESHAPs for Stationary Reciprocating Internal Combustion Engines as for major sources of HAP emissions (hereinafter "Subpart ZZZZ").

16. [RESERVED.]

17. (a) On and after the date of lodging of this Consent Decree, Whiting shall operate and maintain the RICE and catalytic converter so as to achieve and maintain the destruction efficiencies or emission limits specified in Subpart ZZZZ.

(b) The oxidation catalyst shall meet a limit of 2.0 gram per horsepower hour (g/hp-hr) for carbon monoxide ("CO"), when the RICE is operating at a 90% load or higher.

(c) The RICE shall be operated and maintained so as to meet a limit of 2.0 g/hp-hr for oxides of nitrogen ("NOx"), when the RICE is operating at a 90% load or higher.

18. By letter dated March 14, 2008, Buys & Associates, on behalf of Miller Dyer, notified EPA that the Flat Rock Facility was achieving emissions reductions as required to comply with the requirements of Subpart ZZZZ.

19. General Record-Keeping Requirement: Miller Dyer, CEA, and Whiting shall maintain records and information adequate to demonstrate their individual compliance with the

requirements of this Section IV.B. Whiting shall report the status of its compliance with these requirements in its Annual Reports submitted pursuant to Section XI (Reporting Requirements).

C. NATURAL GAS LIQUID STORAGE TANKS

Uinta Basin Existing Non-Major Facility

20. (a) Subject to Paragraph 20(b) below, Whiting shall, within 180 Days after the Effective Date of this Consent Decree, install, operate, and maintain a low pressure separator upstream of the two 400-barrel capacity atmospheric natural gas liquid storage tanks located at the Seep Ridge Interconnect Station ("the Seep Ridge Facility") and maintain a maximum operating pressure within such separator of 20 psig. Off-gasses from the low pressure separator are to be used as fuel in the on-site generator.

(b) Whiting may, based on future operating needs, cease to operate and physically remove the hydrocarbon dewpoint skid from the Seep Ridge Facility. If the hydrocarbon dewpoint skid is removed prior to 180 Days after the Effective Date of this Consent Decree, Whiting shall not be required to install the low pressure separator as specified in Paragraph 20(a). Further, if the hydrocarbon dewpoint skid is removed after installation of the low pressure separator, Whiting shall no longer be required to operate the low pressure separator.

21. General Record-Keeping Requirement: Whiting shall maintain records and information adequate to demonstrate its compliance with the requirements of this Section IV.C (Natural Gas Liquid Storage Tanks), and shall report the status of its compliance with these requirements upon request by EPA.

D. HYDROCARBON DEWPOINT SKIDS

Uinta Basin Existing Non-Major Facility

22. The hydrocarbon dewpoint skid located at the Seep Ridge Facility is subject to NSPS for Equipment Leaks of VOC from Onshore Natural Gas Processing Plants under 40 C.F.R., Part 60, Subpart KKK (hereinafter "Subpart KKK").

23. On or before the date of lodging of this Consent Decree, Miller Dyer, CEA and/or Whiting shall have implemented the Subpart KKK standards applicable to the hydrocarbon dewpoint skid at the Seep Ridge Facility.

24. (a) By no later than 30 Days after the date of lodging of this Consent Decree, Whiting shall provide a written notice to EPA and certify that the Seep Ridge Facility is in compliance with Subpart KKK. The 30 Days may be extended with written EPA approval.

(b) If Whiting physically removes the hydrocarbon dewpoint skid from the Seep Ridge Facility pu rsuant to Paragraph 20(b), compliance with Subpart KKK standards applicable to the hydrocarbon dewpoint skid shall no longer be required.

(c) By no later than 60 Days after the date of lodging of this Consent Decree, Whiting shall submit a request for an applicability determination to EPA Region 8 regarding the applicability of the Risk Management Plan requirements under the Chemical Accident Prevention provisions of 40 C.F.R. Part 68 with respect to the hydrocarbon liquids stored as a result of the dew-point skid processes at the Seep Ridge Facility.

(d) Within 60 Days after receiving EPA's determination pursuant to this Paragraph, Whiting shall, if found to be applicable, submit a Risk Management Plan to EPA for such affected facility.

25. General Record-Keeping Requirement: Miller Dyer, CEA, and Whiting shall maintain records and information adequate to demonstrate their individual compliance with the

requirements of this Section IV.D (Hydrocarbon Dewpoint Skids), and shall report the status of their compliance with these requirements upon request by EPA.

E. PNEUMATIC CONTROLLERS

Existing High-Bleed Pneumatic Controllers

26. Pneumatic Controller Survey: By no later than 6 months after the date of lodging of this Consent Decree, Whiting shall complete a survey of the Uinta Basin Facilities, as identified in Appendix A, to identify and develop an approximate tally of the high-bleed Pneumatic Controllers in use at the Uinta Basin Facilities. By no later than 60 Days thereafter, Whiting shall report the findings of the Pneumatic Controller survey to EPA. For purposes of this Consent Decree, a "high-bleed" Pneumatic Controller is any Pneumatic Controller that has the capacity to bleed in excess of six standard cubic feet of natural gas per hour (52,560 scf/year) in normal operation.

27. Retrofits: By no later than 1 year after the date of lodging of this Consent Decree, Whiting shall retrofit or replace high-bleed Pneumatic Controllers, identified pursuant to the survey conducted under Paragraph 26, with "low-bleed" Pneumatic Controllers unless it is not technically or operationally feasible to retrofit or replace particular high-bleed Pneumatic Controllers. If Whiting is not able to retrofit or replace any particular high-bleed Pneumatic Controllers, Whiting shall identify each such Pneumatic Controller and document why each such Pneumatic Controller was not retrofitted or replaced with a low-bleed Pneumatic Controller. The 1 year may be extended with written EPA approval.

New Construction

28. Beginning on the date of lodging of this Consent Decree, and continuing for the life of this Consent Decree, Whiting shall install and operate low or no-bleed Pneumatic Controllers at all newly constructed facilities located on Uinta Basin Properties, as identified in Appendix B. Whiting need not, however, install low or no-bleed Pneumatic Controllers at sites for which Whiting can demonstrate that the use of low or no-bleed Pneumatic Controllers would not be technically or operationally feasible.

29. General Record-Keeping Requirement: Whiting shall maintain records and information adequate to demonstrate its compliance with the requirements of this Section IV.E (Pneumatic Controllers), and shall report the status of its compliance with these requirements upon request by EPA.

V. FUTURE DEVELOPMENT

A. DEHYDRATION UNITS

30. (a) For Dehydration Units constructed at compressor stations and oil and/or natural gas production facilities located on Uinta Basin Properties after the lodging of this Consent Decree, such Dehydration Units shall be subject to and comply with emission limitations and emission reduction controls to the extent applicable under Subpart HH.

(b) Uncontrolled VOC emissions from a Dehydration Unit shall be determined by using GRI GLYCalc version 4.0 or higher. When conducting the analysis, the following data shall be used:

i. results of a recent extended gas analysis from a representative field-specific sample of the stream entering the natural gas dehydrator contactor tower; and

ii. the maximum lean glycol recirculation rate for the glycol circulation pump in use. If redundant pumps are used, the following conditions shall apply:

(A) the evaluation is performed using the maximum circulation rate of the largest volume pump;

(B) only one pump may operate at any one time (if the maximum circulation rate for the pump in use is not included in the GRI GLYCalc User Manual then documentation must be provided to EPA upon request); and

(C) the average operational parameters including wet gas temperature and pressure, dry gas water content, glycol flash separator temperature and pressure, stripping gas source and rate, and average daily gas production. The average daily gas production for wells not completed prior to twelve months before the Effective Date of this Consent Decree shall be estimated based on best engineering judgment considering existing wells in the area, and for wells completed at least twelve months prior to the Effective Date of this Consent Decree shall be determined based on actual gas production

for the Twelve Month period prior to the month of the Effective Date of this Consent Decree, as reported to the Utah Division of Oil and Gas and Mining (DOGM) or equivalent agency with jurisdiction.

(c) By no later than the due date of the next annual compliance certification date or 180 Days after startup, whichever is later, Whiting shall provide written notice to EPA and certify that each control/control system, if required to be installed pursuant to this Paragraph, is achieving emissions reductions sufficient that those Dehydration Units are in compliance with applicable requirements of Subpart HH. The 180 Days may be extended with written EPA approval.

B. RICE UNITS OF 500 HORSEPOWER OR GREATER

31. Beginning on the date of lodging of this Consent Decree, and continuing for so long as this Consent Decree is in effect, any RICE unit with an on-site nameplate rating of 500 horsepower ("hp") or greater located on Uinta Basin Properties shall be subject to and comply with emission limitations and emission reduction controls to the extent applicable under Subpart ZZZZ.

32. [RESERVED.]

33. [RESERVED.]

34. (a) As applicable, each RICE unit subject to Paragraph 31 shall comply with the following:

i. Each RICE unit shall be operated and maintained to achieve the destruction efficiency and/or the emission limits specified in Subpart ZZZZ.

ii. By no later than 180 Days following the installation of a new catalyst controlled RICE, an initial emissions test of such catalyst to demonstrate compliance with the destruction efficiency and/or the emission limits specified in Paragraph 34(a)(i) must be performed, using either EPA approved reference methods or portable analyzers in accordance with the Test Protocol set forth in Appendix D.

iii. If the catalyst fails to meet the destruction efficiency and/or the emission limits specified in Subpart ZZZZ, Whiting shall take appropriate steps to correct such non-compliance and retest the catalytic converter within 30 Days after the receipt of the initial test report. Whiting shall submit a report to EPA no later than 60 Days after each retest. The retest report shall include a summary of the steps taken to comply and the retest results. The 60 Days may be extended with written EPA approval.

iv. Upon successful demonstration that the catalyst has met the destruction efficiency and/or the emission limits specified in Subpart ZZZZ, Whiting shall thereafter test the catalytic converter emission control efficiency on a semi-annual calendar-year basis using either EPA approved reference methods or a portable analyzer in accordance with the Test Protocol set forth in Appendix D. The semi-annual test date may be extended with written EPA approval.

(b) For each RICE unit with a nameplate rating of 500 hp or greater and subject to Paragraph 31 herein, Whiting shall submit a test report to EPA within 90 Days after each initial emission test is performed. The report shall contain the emission test results and the following information applicable to each RICE:

i. RICE make, model, nameplate hp rating, location, serial number, installation date and manufacturer emission data;

ii. catalyst make, model, installation date and manufacturer emission data;

iii. initial emission test results including date and times of test runs, name(s) of employee(s) or contractor(s) who conducted the test; performance data in compliance with 40 C.F.R.§ 63.6620 and with the applicable provisions of Subpart ZZZZ Tables 3 and 4;

iv. a certification pursuant to Paragraph 52 of the information contained in the report in accordance with Section XI (Reporting Requirements).

v. Whiting shall include all subsequent test results in the Annual Report submitted pursuant to Section XI (Reporting Requirements), as well as the information gathered pursuant to the preceding Paragraph 34(a)(iv), and shall maintain at the facility a catalyst maintenance log (e.g., date of last catalyst replacement, number of engine operating hours since last catalyst or O_2 sensor replacement, and date and description of any catalyst activities).

35. [RESERVED.]

36. [RESERVED.]

C. **GENERAL RECORD-KEEPING REQUIREMENT**

37. Whiting shall maintain records and information adequate to demonstrate its compliance with the requirements of this Section and shall report the status of its compliance with these requirements in its Annual Reports submitted pursuant to Section XI (Reporting Requirements).

VI. PERFORMANCE OPTIMIZATION REVIEW

38. Within one year after the Effective Date of this Consent Decree, Whiting shall complete a Performance Optimization Review ("POR") to increase energy efficiency and

enhance product recovery at two Uinta Basin Facilities in accordance with the Scope of Work ("SOW") attached as Appendix E. The POR shall be performed by third-party consultants acceptable to EPA. Whiting will notify EPA of the proposed third-party consultant at least 30 Days prior to initiating the POR.

39. The seope of the POR is expressly limited to the following activities, as set forth in the POR SOW:

(a) Pressure Relief Devices - repair or replace components, as appropriate, to specifically reduce product losses;

(b) Production Separators - identify optimal pressures and temperatures, and reset as needed;

(c) Dehydrators - evaluate for use of electric pumps to reduce product losses;

(d) Internal Combustion Engines - evaluate maintenance practices and planned shutdown procedures to minimize product losses from blow down and the use of starter gas;

(e) Flare and Vent Systems - evaluate flare and vent system components and associated operating procedures to reduce the loss of product, where possible;

(f) Operating Pressures - review and optimize, where possible; and

(g) Component Inspections and Repairs - perform component inspections using OVA, TVA, or other EPA-approved leak detection field equipment and repair or replace leaking components, as appropriate, to enhance product recovery.

40. POR Reports. Within 60 Days of completion of the POR, Whiting shall submit a POR Report to EPA for the Uinta Basin which shall include:

(a) the contractor(s) used to conduct the POR;

(b) the name, location and original construction date of each of the compressor stations at which the POR was completed;

(c) a general description of the components by type and service that were inspected, how they were inspected, a summary and description of any repairs made, an estimate of natural gas conserved as a result of the repairs to the extent quantifiable, and the repair cost;

(d) a general description of the pressure relief devices that were inspected, how they were inspected, a summary description of any repairs made, an estimate of natural gas conserved as a result of the repairs to the extent quantifiable, and the repair cost;

(e) a description of the review of production separators, identification of those for which optimal pressures and temperatures were calculated and how that was done; a comparison of those values to prior separator operating conditions, a summary of the adjustments to pressures or temperatures that were made, an estimate of the amount of natural gas conserved as a result, and the cost if significant, to adjust pressures and temperatures;

(f) a description of the evaluation of dehydrators for the use of electric pumps; a summary of the projects identified as a result of such review for possible future implementation by Whiting on a voluntary basis; if sufficient data exists to prepare an estimate, an estimate of the amount of natural gas potentially conserved if such projects were implemented, and the cost to implement such projects;

(g) a description of the review of RICE shutdown procedures to reduce blow down and the use of starter gas; a summary of any changes that were made based on such

review; an estimate of product losses avoided as a result of any changes made, if reasonably capable of estimation; and the cost to implement such changes;

(h) a description of the review of flare and vent systems, a summary of the repairs made, if any; an estimate of the amount of natural gas conserved as a result of repairs made, and the cost to implement such repairs; and

(i) a description of how operating pressures were evaluated and, where possible, optimized; an estimate of the amount of natural gas conserved as a result of such evaluation, and an estimate of the cost, if non-negligible, to optimize operating pressures.

41. Within 120 Days of completion of the POR, Whiting may identify in writing to EPA, any areas of non-compliance with the Act (including federal implementing regulations) that are discovered during the POR. Under this Paragraph, for other than PSD/NSR, Whiting shall include in its written submission: (1) a certification pursuant to Paragraph 52 that it has subsequently complied with all applicable statutory and regulatory requirements, or it shall propose a schedule for coming into compliance; (2) a description of the corrective measures taken, or proposed to be taken; and (3) a proposed calculation of Whiting's economic benefit, if any, pursuant to the EPA Stationary Source Civil Penalty Policy and BEN Model. EPA will review Whiting's certifications, and/or proposed schedule for compliance, corrective measures, and economic benefit calculation(s), and will respond with written concurrence or comments. In the event that EPA does not approve of the proposed corrective measures or economic benefit calculation(s), each, as applicable, will respond with written comments. Should EPA still not agree with the economic benefit calculation(s), EPA's independent economic benefit calculations shall be final and payable. At EPA's discretion, the Parties will address any PSD/NSR violations

as a new and separate enforcement action. Whiting's release from liability as specified in Section XVI (Effect of Settlement/Reservation of Rights) for the areas of non-compliance identified and corrected pursuant to this Section VI will take effect upon the Plaintiff's written concurrence with Whiting's certification and its payment in full of any economic benefit indicated pursuant to this Paragraph. Any areas of non-compliance discovered by EPA and any disclosures by Whiting beyond this specific 120-Day period are not covered by this Paragraph.

VII. AMBIENT AIR MONITORING

42. (a) Miller Dyer and/or CEA shall fund the operation and maintenance of two ambient air quality and meteorological monitoring stations ("Monitoring Stations") located in the Uinta Basin and shall fund the collection and distribution of monitoring data for the two Monitoring Stations. The two Monitoring Stations shall be those installed and utilized pursuant to the Consent Decree in *United States v. Kerr-McGee Corporation* (D. Colo. Civil Action No. 07-cv-01034-WDMMJW). Miller Dyer and/or CEA shall fund the monitoring at the two Monitoring Stations for a consecutive time period to follow the completion of the monitoring period funded in the Kerr-McGee Consent Decree, for a period of one year. Beginning no later than 30 days after lodging of this Consent Decree, Miller Dyer and/or CEA shall enter into a contract for the operation and maintenance of the two Monitoring Stations. Miller Dyer and/or CEA shall select a contractor that is acceptable to EPA. The ambient air quality monitors shall monitor ozone, NOx and $PM_{2.5}$ concentrations. The meteorological stations shall monitor wind speed, wind direction, temperature and solar radiation.

(b) Miller Dyer and/or CEA shall work cooperatively with EPA, the Utah Department of Environmental Quality (UDEQ) and the Ute Indian Tribe of the Uintah and Ouray

Reservation (the "Northern Ute Tribe") regarding the operation and maintenance of the Monitoring Stations. The Monitoring Stations shall meet the methodology and operational requirements of 40 C.F.R. Part 58. Additional guidance for meteorological monitoring is contained in "Quality Assurance Handbook for Air Pollution Measurement Systems," Vol. IV, "Meteorological Measurements." All monitoring data shall be collected in a manner reasonably calculated to meet EPA's quality assurance/quality control ("QA/QC") requirements of 40 C.F.R. Part 58, App. A. Additional guidance is provided in "Quality Assurance Handbook for Air Pollution Measurement Systems."

(c) Miller Dyer and/or CEA shall certify, in accordance with Paragraph 52, that it has met all the requirements of this Section VII. (Ambient Air Monitoring).

(d) EPA, Miller Dyer and CEA intend and contemplate that Miller Dyer and/or CEA will utilize the two air monitoring sites on a turnkey basis, including but not limited to utilizing (i) the site access and rights of surface use for the two air monitoring sites, and (ii) the air monitoring equipment purchased pursuant to the Kerr McGee Consent Decree. In the event that the operational conditions in (i) and (ii) are not met, Miller Dyer and CEA, may demonstrate compliance with this provision by asserting and establishing a Force Majeure claim pursuant to Paragraphs 64 through 70.

VIII. LIMITS ON POTENTIAL TO EMIT

43. The requirements established in Sections IV.A and V.A (Dehydration Units), Sections IV.B and V.B (Compressor Engines/RICE), and IV.C (Natural Gas Liquid Storage Tanks) under this Consent Decree shall be considered "federally enforceable" and, as applicable,

"legally and practicably enforceable" for purposes of calculating the potential to emit ("PTE") of a source or facility as may be applicable under the Act and any implementing federal regulations.

44. The PTE for emissions of pollutants regulated under the Act from Dehydration Units at any facility in the Uinta Basin Properties shall be limited by the requirements set forth in Sections IV.A and V.A (Dehydration Units), and shall be federally enforceable on that basis.

45. The PTE for emissions of pollutants regulated under the Act for all RICE identified in Sections IV.B and V.B at any facility in the Uinta Basin Properties shall be limited by the requirements set forth therein, and shall be federally enforceable on that basis.

IX. TITLE V OPERATING PERMITS

46. As of the date of lodging of this Consent Decree, a complete Title V permit application has been submitted to EPA for the Flat Rock Facility. The United States agrees that the Flat Rock Facility shall be authorized to operate in accordance with the terms of this Consent Decree until such time as EPA has issued the Title V permit for the facility and this Consent Degree is terminated in whole or in part.

X. CIVIL PENALTY

47. Within 30 Days after the Effective Date of this Consent Decree, Miller Dyer or CEA shall pay to the Plaintiff a total civil penalty pursuant to Section 113 of the Act, 42 U.S.C. § 7413, in the amount of $142,000. Miller Dyer or CEA shall pay interest on any overdue civil penalty at the rate specified in 28 U.S.C. § 1961; however, in the case of overdue payments, interest shall accrue from the date of entry until the date of payment.

48. Federal Payment Instructions: Miller Dyer or CEA shall make payment by Electronic Funds Transfer ("EFT") to the United States Department of Justice ("DOJ"), in

accordance with current EFT procedures, referencing the United States Attorney's Office ("USAO") File Number and DOJ Case Number 90-5-2-1-09383. Payment shall be made in accordance with instructions provided by the USAO for the District of Utah, Northern Division. Any funds received after 11:00 a.m. (EST/EDT) shall be credited on the next business Day. Miller Dyer or CEA shall provide notice of payment, referencing the USAO File Number, DOJ Case Number 90-5-2-09383 and the civil case name and case number, to DOJ, EPA, and to Whiting, as provided in Section XIX (Notices).

49. No amount of the civil penalty to be paid by Miller Dyer or CEA shall be used to reduce its federal tax obligations.

XI. REPORTING REQUIREMENTS

50. Miller Dyer, CEA, and Whiting, as applicable, shall submit the following reports:

(a) In compliance with any specific deadline requirement of this Consent Decree, Miller Dyer, CEA, and Whiting shall submit initial performance test results, retest reports, initial status reports, progress reports, final reports, and notices (this Paragraph is not a cumulative requirement) as applicable to each Party.

(b) **By no later than March 1 of each year,** Whiting shall submit an Annual Report for the preceding calendar year to EPA. Whiting shall provide a paper and electronic copy of each Annual Report to EPA. The Annual Report shall: (i) describe all work or other activities that Whiting performed on and after May 31, 2008 pursuant to any requirement of this Consent Decree during the applicable reporting period; (ii) transmit any specific (non-annual) reports required of Whiting and which are to be included in an Annual Report; (iii) describe Whiting's compliance status on and after May 31, 2008; and (iv) describe any non-compliance

with the requirements of this Consent Decree applicable to Whiting and explain the likely cause(s) of the violation(s) and the remedial steps taken, or to be taken, to prevent or minimize such violation(s).

(c) **Within 10 Days** of the date Miller Dyer, CEA, and/or Whiting, as applicable, first becomes aware of any violation(s), or potential violation(s), or has reason to believe that it may violate, any requirement of this Consent Decree, Miller Dyer, CEA, and/or Whiting, as applicable, shall notify EPA of such violation(s), and its likely duration, in writing, with an explanation of the likely cause of such violation(s) and the remedial steps taken, or to be taken, to prevent or minimize such violation(s) should it occur. If the cause of a violation cannot be fully explained at the time the notification is due, Miller Dyer, CEA, and/or Whiting, as applicable, shall state this in the 10-Day notice, investigate the cause of each such violation in the event that it occurs, and **within 30 Days** of the date that Miller Dyer, CEA, and/or Whiting, as applicable, determine(s) such cause, submit a full written explanation of the cause of the violation. Nothing in this Paragraph relieves Miller Dyer, CEA, and/or Whiting of their obligation to provide the notice required by Section XIII (Force Majeure).

51. All reports shall be submitted to the persons designated in Section XIX (Notices) of this Consent Decree.

52. Each Annual Report submitted by Whiting shall be signed by a Responsible Official. All other reports or submissions may be signed by a delegated employee representative, unless otherwise required by applicable statute or regulation. All reports and submissions shall include the following certification:

> I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in

> accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete.

53. The reporting requirements of this Section shall continue until termination of this Consent Decree; however, upon written agreement by EPA where a Consent Decree reporting requirement is added to a final Title V permit or other non-Title V permit such that the permit meets or exceeds such Consent Decree reporting requirement, Whiting may fulfill that Consent Decree reporting requirement by notifying EPA that the required report has been provided pursuant to a permit requirement, and by identifying the relevant permit in Whiting's Annual Reports, submitted pursuant to this Section XI (Reporting Requirements).

54. Any information provided pursuant to this Consent Decree may be used by the United States in any proceeding to enforce the provisions of this Consent Decree and as otherwise permitted by law, except as provided in Section XVI (Effect of Settlement/Reservation of Rights) and/or for disclosures made pursuant to Paragraph 41 of this Consent Decree.

XII. STIPULATED PENALTIES

55. Miller Dyer, CEA, and Whiting shall be liable for stipulated penalties to the United States for violations of this Consent Decree as specified below, unless excused under Section XIII (Force Majeure), or reduced or waived by the Plaintiff pursuant to Paragraph 60 of this Consent Decree. A violation includes failing to perform any obligation required by the terms of this Consent Decree, including any work plan or schedule approved under this Consent Decree, according to all applicable requirements of this Consent Decree and within the specified time schedules established by or approved under this Consent Decree.

(a) **Dehydration Units (Sections IV.A and V.A).**

	Violation	Stipulated Penalty	Responsible Party
1.	For failure to install and/or operate controls as required by Paragraphs 10 and 30 per unit per Day.	For each unit: $1000 per Day for the first 30 Days of noncompliance, $1500 per Day from the 31st to 60th Day of noncompliance, and $2000 per Day thereafter.	Whiting
2.	For failure to maintain records and information as required by Paragraph 14.	For each unit: $200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1000 per Day thereafter.	Miller Dyer, CEA and/or Whiting, as applicable
3.	For failure to maintain records and information as required by Paragraph 37.	For each unit: $200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1000 per Day thereafter.	Whiting

(b) **Compressor Engines (Sections IV.B and V.B).**

	Violation	Stipulated Penalty	Responsible Party
1.	For failure to maintain records and information as required by Paragraph 19.	For each unit: $200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1000 per Day thereafter.	Miller Dyer, CEA and/or Whiting, as applicable
2.	For failure to comply with Subpart ZZZZ as required by Paragraphs 17, 31, and 34.	For each engine: $1000 per Day for the first 30 Days of noncompliance, $1500 per Day from the 31st to 60th Day of noncompliance, and $2000 per Day thereafter.	Whiting
3.	For failure to conduct initial performance test on the RICE emission controls as required by Paragraph 34(a)(ii).	For each engine: $500 per Day for the first 30 Days of noncompliance, $1000 per Day from the 31st to 60th Day of noncompliance, and $1500 per Day thereafter.	Whiting
4.	For failure to submit reports as required by Paragraph 34.	For each report: $200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1000 per Day thereafter.	Whiting

(c) **Natural Gas Liquid Storage Tanks (Section IV.C)**

	Violation	Stipulated Penalty	Responsible Party
1.	For failure to install a low pressure separator as required by Paragraph 20.	$100 per Day for the first 30 Days of noncompliance; $250 per Day from the 31st to 60th Day of noncompliance, and $500 per Day thereafter.	Whiting
2.	For failure to maintain records and information as required by Paragraph 21.	$200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1000 per Day thereafter.	Whiting

(d) **Hydrocarbon Dewpont Skids (Section IV.D)**

	Violation	Stipulated Penalty	Responsible Party

	Violation	Stipulated Penalty	Responsible Party
1.	For failure to implement the Subpart KKK standards applicable to the hydrocarbon dewpoint skid at the Seep Ridge Facility as required by Paragraph 23.	$100 per Day for the first 30 Days of noncompliance; $250 per Day from the 31st to 60th Day of noncompliance, and $500 per Day thereafter.	Miller Dyer, CEA and/or Whiting, as applicable
2.	For failure to submit the notice as required by Paragraph 24(a).	$200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1000 per Day thereafter.	Whiting
3.	For failure to submit a request for an applicability determination as required by Paragraph 24(b).	$200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1000 per Day thereafter.	Whiting
4.	For failure to submit a Risk Management Plan, if applicable, pursuant to Paragraph 24(c).	$200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1000 per Day thereafter.	Whiting
5.	For failure to maintain records and information as required by Paragraph 25.	$200 per Day for the first 30 Days of noncompliance, $500 per Day from the 31st to 60th Day of noncompliance, and $1000 per Day thereafter.	Miller Dyer, CEA and/or Whiting, as applicable

(e) **Pneumatic Controllers (Section IV.E)**

	Violation	Stipulated Penalty	Responsible Party
1.	For failure to complete the Survey and submit a Report on existing high-bleed Pneumatic Controllers, as required by Paragraph 26.	$200 per Day for the first 30 Days of noncompliance; $500 per Day from the 31st to 60th Day of noncompliance, and $1000 per Day thereafter.	Whiting
2.	For failure to retrofit high-bleed Pneumatic Controllers as required by Paragraph 27.	For each device that is not retrofitted: $100 per Day for the first 30 Days of noncompliance; $250 per Day from the 31st to 60th Day of noncompliance, and $500 per Day thereafter.	Whiting

(f) **Ambient Air Monitoring (Section VII.)**

	Violation	Stipulated Penalty	Responsible Party
1.	For failure to fund, operate, maintain and certify the Monitoring Stations as required by Paragraph 42.	$200 per Day for the first 30 Days of noncompliance; $500 per Day from the 31st to 60th Day of noncompliance, and $1000 per Day thereafter.	Miller Dyer and/or CEA

56. Late Payment of Civil Penalty: If Miller Dyer and/or CEA fails to pay the civil penalty required to be paid under Section X (Civil Penalty) of this Consent Decree when due,

Miller Dyer and/or CEA shall pay a stipulated penalty of $1,000 per Day for each Day that the payment is late.

57. Stipulated penalties under this Section shall begin to accrue on the Day after performance is due or on the Day a violation occurs, whichever is applicable, and shall continue to accrue until performance is satisfactorily completed or until the violation ceases. Stipulated penalties shall accrue simultaneously for separate violations of this Consent Decree.

58. Dyer, CEA, and/or Whiting, as applicable, shall pay any stipulated penalty within 30 Days of receipt of written demand of the United States and shall continue to make such payments every 30 Days thereafter until the violation(s) no longer continue, unless Miller Dyer, CEA, and/or Whiting, as applicable, elects within 20 Days of receipt of written demand from the United States to dispute the accrual of stipulated penalties in accordance with the provisions in Section XIV (Dispute Resolution) of this Consent Decree.

59. All stipulated penalties shall be paid in accordance with the payment instructions set forth in Paragraph 48.

60. The United States may, in the unreviewable exercise of its discretion, reduce or waive stipulated penalties otherwise due under this Consent Decree.

61. Stipulated penalties shall continue to accrue as provided in Paragraph 57 during any dispute, with interest on accrued stipulated penalties payable and calculated by the Secretary of Treasury, pursuant to 28 U.S.C. § 1961, but need not be paid until the following:

(a) If the dispute is resolved by agreement or by a decision of the Plaintiff pursuant to Section XIV (Dispute Resolution) of this Consent Decree that is not appealed to the Court, Miller Dyer, CEA, and/or Whiting, as applicable, shall pay accrued stipulated penalties

and accrued interest agreed or determined to be owing within 30 Days of the effective date of such agreement or the receipt of Plaintiff's decision.

(b) If the dispute is appealed to the Court, and the Plaintiff prevails in whole or in part, Miller Dyer, CEA, and/or Whiting, as applicable, shall pay all accrued stipulated penalties determined by the Court to be owing, together with accrued interest, within 60 Days of receiving the Court's decision or order, except as provided in Subparagraph (c), below.

(c) If either Party appeals the Court's decision, Miller Dyer, CEA, and/or Whiting, as applicable, shall pay all accrued penalties determined by the appellate court to be owing, together with accrued interest, within 15 Days of receiving the final appellate court decision.

62. Miller Dyer, CEA, and Whiting shall not deduct stipulated penalties paid under this Section XII in calculating its federal or state income tax.

63. Subject to the provisions of Section XVI (Effect of Settlement/Reservation of Rights), the stipulated penalties provided for in this Consent Decree shall be in addition to any other rights, remedies, or sanctions available to the United States for Miller Dyer, CEA's, and/or Whiting's violation of this Consent Decree or applicable law. Where a violation of this Consent Decree is also a violation of the Act or regulatory requirements of the Act, Miller Dyer, CEA, and/or Whiting shall be allowed a dollar-for-dollar credit, for any stipulated penalties paid, against any statutory penalties imposed for such violation.

XIII. FORCE MAJEURE

64. If any event occurs which causes or may cause a delay or impediment to performance in complying with any provision of this Consent Decree (*e.g.*, would require

operation in an unsafe manner), and which Miller Dyer, CEA, and/or Whiting believes qualifies as an event of *Force Majeure*, Miller Dyer, CEA, and/or Whiting, as applicable, shall notify the Plaintiff in writing as soon as practicable, but in any event within 45 Days of when Miller Dyer, CEA, and/or Whiting, as applicable, first knew of the event or should have known of the event by the exercise of reasonable diligence. In this notice Miller Dyer, CEA, and/or Whiting, as applicable, shall specifically reference this Paragraph of this Consent Decree and describe the anticipated length of time the delay may persist, the cause or causes of the delay, the measures taken and/or to be taken to prevent or minimize the delay and the schedule by which those measures will be implemented. Miller Dyer, CEA, and/or Whiting, as applicable, shall adopt all reasonable measures to avoid or minimize such delays.

65. Failure by Miller Dyer, CEA, and/or Whiting to substantially comply with the notice requirements of Paragraph 64, as specified above, shall render this Section voidable by the Plaintiff, as to the specific event for which Miller Dyer, CEA, and/or Whiting has failed to comply with such notice requirement. If so voided, this Section shall be of no effect as to the particular event and Party involved.

66. The Plaintiff shall notify Miller Dyer, CEA, and/or Whiting, as applicable, in writing regarding its agreement or disagreement with any claim of a Force Majeure event within 45 Days of receipt of each Force Majeure notice provided under Paragraph 64.

67. If the Plaintiff agrees that the delay or impediment to performance has been or will be caused by circumstances beyond the control of Miller Dyer, CEA, and/or Whiting, as applicable, including any entity controlled or contracted by it, and that the delay could not have been prevented by the exercise of reasonable diligence, the Plaintiff and the indicated Party shall

stipulate to an extension of the required deadline(s) for all requirement(s) affected by the delay by a period equivalent to the delay actually caused by such circumstances, or such other period as may be appropriate in light of the circumstances. Such stipulation may be filed as a modification to this Consent Decree by agreement of the Parties pursuant to the modification procedures established in this Consent Decree. Miller Dyer, CEA, and/or Whiting shall not be liable for stipulated penalties for the period of any such delay.

68. If the Plaintiff does not agree that the delay or impediment to performance has been or will be caused by circumstances beyond the control of Miller Dyer, CEA, and/or Whiting, as applicable, including any entity controlled or contracted by it, the position of the Plaintiff on the Force Majeure claim shall become final and binding, and Miller Dyer, CEA, and/or Whiting, as applicable, shall pay the applicable stipulated penalties, unless Miller Dyer, CEA, and/or Whiting, as applicable, submits the matter to the Court for resolution by filing a petition for determination with the Court within 20 business Days after receiving the written notification of the Plaintiff as set forth in Paragraph 64. Once Miller Dyer, CEA, and/or Whiting has submitted such matter to the Court, the Plaintiff shall have 20 business Days to file a response to the petition. If Miller Dyer, CEA, and/or Whiting submits the matter to the Court for resolution and the Court determines that the delay or impediment to performance has been or will be caused by circumstances beyond the control of Miller Dyer, CEA, and/or Whiting, including any entity controlled or contracted by such Party, and that it could not have prevented the delay by the exercise of reasonable diligence, Miller Dyer, CEA, and/or Whiting, as applicable, shall be excused as to such event(s) and delay (including stipulated penalties) for all

requirements affected by the delay for a period of time equivalent to the delay caused by such circumstances or such other period as may be determined by the Court.

69. Miller Dyer, CEA, and/or Whiting, as applicable, shall bear the burden of proving that any delay of any requirement(s) of this Consent Decree was (were) caused by or will be caused by circumstances beyond its control, including any entity controlled or contracted by it, and that it could not have prevented the delay by the exercise of reasonable diligence. Miller Dyer, CEA, and/or Whiting, as applicable, shall also bear the burden of proving the duration and extent of any delay(s) attributable to such circumstances. An extension of one compliance date based on a particular event may, but does not necessarily, result in an extension of a subsequent compliance date or dates. Unanticipated or increased costs or expenses associated with the performance of obligations under this Consent Decree shall not constitute circumstances beyond the control of Miller Dyer, CEA, and/or Whiting, as applicable.

70. As part of the resolution of any matter submitted to the Court under this Section, the applicable Parties by agreement, or this Court by order, may in appropriate circumstances extend or modify the schedule for completion of work under this Consent Decree to account for the delay in the work that occurred as a result of any delay or impediment to performance on which an agreement by the Plaintiff or approval by the Court is based. Miller Dyer, CEA, and/or Whiting, as applicable, shall be liable for stipulated penalties for its failure thereafter to complete the work in accordance with the extended or modified schedule, except to the extent that such schedule is further modified, extended or otherwise affected by a subsequent Force Majeure event under this Section XIII.

XIV. DISPUTE RESOLUTION

71. Unless otherwise expressly provided for in this Consent Decree, the dispute resolution procedures of this Section shall be the exclusive mechanism to resolve disputes arising under or with respect to this Consent Decree.

72. Informal Dispute Resolution: Any dispute subject to Dispute Resolution under this Consent Decree shall first be the subject of informal negotiations. The dispute shall be considered to have arisen when Miller Dyer, CEA, and/or Whiting sends the Plaintiff a written Notice of Dispute. Such Notice of Dispute shall state clearly the matter in dispute. The period of informal negotiations shall not exceed 20 Days from the date the dispute arises, unless that period is modified by written agreement. If the applicable Parties cannot resolve a dispute by informal negotiations, then the position advanced by the Plaintiff shall be considered binding unless, within 20 Days after the conclusion of the informal negotiation period, Miller Dyer, CEA, and/or Whiting, as applicable, invoke(s) formal dispute resolution procedures as set forth below.

73. Formal Dispute Resolution: Miller Dyer, CEA, and/or Whiting may only invoke formal dispute resolution procedures, within the time period provided in the preceding Paragraph, by serving on the Plaintiff a written Statement of Position regarding the matter in dispute. The Statement of Position shall include, but may not necessarily be limited to, any factual data, analysis, or opinion supporting Miller Dyer, CEA, and/or Whiting's position and any supporting documentation relied upon by Miller Dyer, CEA, and/or Whiting.

74. The Plaintiff shall serve its Statement of Position within 30 Days of receipt of Miller Dyer, CEA, and/or Whiting's Statement of Position. The Plaintiff's Statement of Position shall include, but may not necessarily be limited to, any factual data, analysis, or opinion

supporting that position and any supporting documentation relied upon by the Plaintiff. The Plaintiff's Statement of Position shall be binding on Miller Dyer, CEA, and/or Whiting, as applicable, unless Miller Dyer, CEA, and/or Whiting, as applicable, file(s) a motion for judicial review of the dispute in accordance with Paragraph 75.

75. Miller Dyer, CEA, and/or Whiting may seek judicial review of the dispute by filing with the Court and serving on the Plaintiff, in accordance with Section XIX of this Consent Decree (Notices), a motion requesting judicial resolution of the dispute. The motion must be filed within 30 Days of receipt of the Plaintiff's Statement of Position pursuant to the preceding Paragraph. The motion shall contain a written statement of Miller Dyer, CEA, and/or Whiting's position on the matter in dispute, including any supporting factual data, analysis, opinion, or documentation, and shall set forth the relief requested and any schedule within which the dispute must be resolved for orderly implementation of the Consent Decree.

76. The Plaintiff shall respond to any motion requesting judicial resolution of the dispute within the time period allowed by the Local Rules of the Court. Miller Dyer, CEA, and/or Whiting, as applicable, may file a reply memorandum, to the extent permitted by the Local Rules and allowed by the Court.

77. Except as otherwise provided in this Consent Decree, in any dispute brought under Paragraph 75, Miller Dyer, CEA, and/or Whiting, as applicable, shall bear the burden of demonstrating that its position complies with this Consent Decree.

78. The invocation of dispute resolution procedures under this Section shall not, by itself, extend, postpone, or affect in any way any obligation under this Consent Decree, unless and until final resolution of the dispute so provides. Stipulated penalties with respect to the

disputed matter shall continue to accrue from the first Day of alleged noncompliance, but payment shall be stayed pending resolution of the dispute as provided in Paragraph 61. If Miller Dyer, CEA, and/or Whiting, as applicable, do not prevail on the disputed issue, stipulated penalties shall be assessed against and paid by the applicable Party as provided in Section XII (Stipulated Penalties).

XV. INFORMATION COLLECTION AND RETENTION

79. The United States, and its representatives, including attorneys, contractors, and consultants, shall have the right of entry into any facility covered by this Consent Decree at all reasonable times, upon presentation of proper credentials, for the purpose of monitoring compliance with any provision of this Consent Decree, including to:

(a) monitor the progress of activities required under this Consent Decree;

(b) inspect equipment and facilities covered by this Consent Decree; and

(c) inspect and copy documents, records, or other information to be maintained in accordance with the terms of this Consent Decree.

80. Miller Dyer, CEA, and/or Whiting, as applicable, shall be entitled to: (1) splits of samples, where feasible, and (2) copies of any sampling and analytical results, documentary evidence and data obtained by the United States pursuant to Paragraph 79 of this Consent Decree.

81. Miller Dyer, CEA, and Whiting shall retain, and shall instruct their contractors and agents to retain, for a period of five (5) years after each record is generated or created by each of them copies of all records, test results, or monitoring information required of each Party pursuant to this Consent Decree. Records of monitoring information also includes calibration

and maintenance records, original strip-chart recordings for continuous monitoring, and copies of all reports required by the Consent Decree or applicable regulations. Such documents, records, or other information may be kept in electronic form. This information-retention requirement shall apply regardless of any contrary corporate or institutional policies or procedures. At any time during this information-retention period, upon request by the United States, Miller Dyer, CEA, and Whiting shall provide copies of any non-privileged documents, records, or other information required to be maintained by each Party under this Paragraph.

82. [Reserved.]

83. Miller Dyer, CEA, and/or Whiting may assert that certain documents, records, or other information is privileged under the attorney-client privilege or any other privilege recognized by federal and/or state law. If Miller Dyer, CEA, or Whiting asserts such a privilege, it shall provide the following: (1) the title of the document, record, or information; (2) the date of the document, record, or information; (3) the name and title of each author of the document, record, or information; (4) the name and title of each addressee and recipient; (5) a description of the subject of the document, record, or information; and (6) the privilege asserted. However, no final documents, records or other information that Miller Dyer, CEA, or Whiting is explicitly required to create or generate to satisfy a specific requirement of this Consent Decree shall be withheld on the grounds of privilege.

84. Miller Dyer, CEA, and/or Whiting may also assert that information required to be provided under this Section is protected as Confidential Business Information ("CBI") under 40 C.F.R. Part 2. As to any information that Miller Dyer, CEA, and/or Whiting seeks to protect as CBI, Miller Dyer, CEA, and/or Whiting shall follow the procedures set forth in 40 C.F.R. Part 2.

Decree shall relieve Miller Dyer, CEA, and/or Whiting of its obligation to achieve and maintain full compliance with all applicable federal, State, and local laws, regulations, and permits. The United States does not, by its consent to the entry of this Consent Decree, warrant or aver in any manner that Miller Dyer, CEA, and/or Whiting's compliance with any aspect of this Consent Decree will result in compliance with other provisions of the Act or its implementing regulations or with any other provisions of federal, State, or local laws, regulations, or permits.

89. This Consent Decree does not limit or affect the rights of CEA, Miller Dyer, Whiting, or the United States against any third parties, not party to this Consent Decree, nor does it limit the rights of third parties, not party to this Consent Decree, against Miller Dyer, CEA, or Whiting, except as provided herein or as otherwise provided by law.

90. This Consent Decree shall not be construed to create any rights in, or grant any cause of action to, any third party not a party to this Consent Decree.

XVII. EMISSION REDUCTION CREDIT GENERATION

91. Miller Dyer, CEA, and/or Whiting shall not generate or use any NOx, CO or VOC emission reductions that result from any projects conducted pursuant to this Consent Decree as credits or offsets in any PSD, major non-attainment and/or minor New Source Review ("NSR") permit or permit proceeding. The foregoing notwithstanding, Miller Dyer, CEA, and/or Whiting, as applicable, may conduct projects pursuant to this Consent Decree that create more emission reductions of NOx, CO or VOCs than are required for these pollutants by the underlying applicable requirement(s). In such instances, Miller Dyer, CEA, and/or Whiting, as applicable, may retain a portion of the achieved emissions reductions for use as credits or offsets. All other emission sources of NOx, CO or VOCs, and any netting associated with other

pollutants, are outside the scope of these netting limitations and are subject to PSD/NSR applicability as implemented by the appropriate permitting authority or EPA. Use of emission reductions in netting and as offsets in any PSD, major non-attainment and/or minor NSR permit or permit proceeding pursuant to the limitations herein shall be further limited by the applicable regulations, and by the PSD, major non-attainment, and/or minor NSR permit(s) in question, as applicable.

XVIII. COSTS

92. The Parties shall bear their own costs of this action, including attorneys' fees, except that the United States shall be entitled to collect the costs (including reasonable attorneys' fees) incurred in any action in which it is the prevailing party and which is necessary to collect any portion of the civil penalty or any stipulated penalties if due.

XIX. NOTICES

93. Unless otherwise specified herein, whenever notifications, submissions, or communications are required by this Consent Decree, they shall be made in writing and mailed or hand delivered addressed as follows:

As to the United States:

Chief, Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611, Ben Franklin Station
Washington, D.C. 20044-7611
Re: DOJ No. 90-5-2-1-08656
and

Director, Air Enforcement Division
Office of Enforcement and Compliance Assurance
U.S. Environmental Protection Agency
Ariel Rios Building [2242A]
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

and

Assistant Regional Administrator
Office of Enforcement, Compliance, and Environmental Justice
U.S. Environmental Protection Agency, Region 8
1595 Wynkoop Street
Denver, CO 80202-1129

As to Miller Dyer and CEA:

John L. Dyer
Miller Dyer & Co. LLC
475 Seventeenth Street, Suite 1200
Denver, CO 80202

As to Whiting:

James T. Brown
Senior Vice President
Whiting Oil and Gas Corporation
1700 Broadway, Suite 2300
Denver, CO 80290-2300

94. Any Party may, by written notice to the other Parties, change its designated notice recipient or notice address provided above.

95. Notices submitted by mail pursuant to this Section XIX shall be deemed submitted upon mailing, unless otherwise provided in this Consent Decree or by mutual agreement of the Parties in writing.

XX. SALES OR TRANSFERS OF OWNERSHIP/OPERATOR INTERESTS

96. [RESERVED.]

97. Miller Dyer and CEA shall be solely liable for, and may not assign, transfer, or be released from, the following obligations under this Consent Decree:

(a) Fund, operate, maintain and certify the Monitoring Stations in accordance with Section VII (Ambient Air Monitoring).

(b) Payment of the civil penalty in accordance with Section X (Civil Penalty),

(c) Payment of any stipulated penalties in accordance with Section XII (Stipulated Penalties) which are based on Miller Dyer and/or CEA's failure to comply or timely comply with obligations under this Consent Decree, and

(d) Maintain documents and/or provide reports with respect to applicable obligations of this Consent Decree in accordance with Sections XI (Reporting Requirements) and XV (Information Collection and Retention).

98. If Whiting proposes to sell or transfer all or part of its ownership in any of the Uinta Basin Facilities or if Whiting proposes to transfer its responsibility as operator of any of the Uinta Basin Facilities, except for individual wells or groups of wells and associated wellhead facilities, to any entity unrelated to Whiting, Whiting shall advise the Third Party in writing of the existence of this Consent Decree prior to such sale or transfer and shall send a copy of such

written notification to the United States pursuant to Section XIX (Notices) of this Consent Decree at least 30 Days before such proposed sale or transfer.

99. No sale or transfer of ownership or operational authority to a Third Party shall take place before the Third Party consents in writing, by a stipulation to be filed with the Court, to: (a) accept all of the obligations, terms and conditions of this Consent Decree applicable to Uinta Basin Facilities, exclusive of wellhead facilities, that are subject to any unperformed or outstanding requirement of this Consent Decree applicable to Whiting; (b) the jurisdiction of the Court to enforce the terms of this Consent Decree as to such party; and (c) become a party to this Consent Decree. Notwithstanding such a sale or transfer to a Third Party, Whiting shall remain jointly and severally liable with the Third Party for performance of those requirements of this Consent Decree applicable to Whiting unless the Consent Decree is modified or Whiting's joint and several liability is restricted in accordance with Paragraph 103.

100. If the United States agrees, Whiting and the Third Party may execute a modification to this Consent Decree that relieves Whiting of its liability under this Consent Decree for, and makes the Third Party liable for, all obligations and liabilities applicable to Whiting for the purchased or transferred facilities and/or operator responsibility. Notwithstanding the foregoing, Whiting may not assign, and may not be released from, obligations under this Consent Decree to pay stipulated penalties with respect to actions occurring subsequent to the Effective Date of this Consent Decree and prior to the date of transfer of ownership or operator responsibility in accordance with Section XII (Stipulated Penalties). Whiting may propose, and the United States may agree, to restrict the scope of the joint and several liability of any purchaser or transferee for any obligations applicable to Whiting

under this Consent Decree that are not specific to the transferred or purchased facilities and/or operator responsibility, to the extent such obligations may be adequately separated in an enforceable manner.

XXI. EFFECTIVE DATE

101. Unless otherwise specifically provided herein, the Effective Date of this Consent Decree shall be the date upon which this Consent Decree is entered by the Court.

XXII. RETENTION OF JURISDICTION

102. The Court shall retain jurisdiction over this case until termination of this Consent Decree, for the purpose of resolving disputes arising under this Decree pursuant to Section XIV (Dispute Resolution) or entering, partially terminating or terminating orders modifying this Decree, pursuant to Sections XX (Sales or Transfers of Ownership/Operator Interests), XXIII (Modification), and XXIV (Termination), or otherwise effectuating, or enforcing compliance with, the terms of this Consent Decree.

XXIII. MODIFICATION

103. The terms of this Consent Decree, including any attached appendices, may be modified only by a subsequent written agreement. Any such agreement shall be signed by the United States and the Party/Parties responsible for performance of the underlying obligation of this Consent Decree sought to be modified. With respect to any modification that constitutes a material change to this Consent Decree, such written agreement shall be filed with the Court and effective only upon the Court's approval. Any modification of a reporting requirement of this Consent Decree shall be deemed a non-material modification/change. Any disputes concerning

modification of this Consent Decree shall be resolved pursuant to Section XIV (Dispute Resolution) of this Consent Decree.

XXIV. TERMINATION

104. This Consent Decree shall remain in effect for a period of five (5) years after the Date of Lodging of this Consent Decree or until otherwise terminated or partially terminated in accordance with the provisions of this Section.

105. CEA, Miller Dyer, and Whiting may serve upon the United States a Request for Termination or Partial Termination of this Consent Decree at any time after the Effective Date. The Request for Termination or Partial Termination shall certify that Miller Dyer, CEA, and/or Whiting, as applicable, has paid any applicable civil penalty and all stipulated penalties, if any, that have accrued, and has fulfilled all other obligations of this Consent Decree applicable to such Party.

106. Where a control requirement, recordkeeping requirement, reporting requirement or other requirement of this Consent Decree is incorporated into a federally enforceable permit, Whiting may serve upon the United States a Request for Partial Termination. Upon approval of such request by the Plaintiff, the filing of a joint stipulation by Plaintiff and Whiting and the Court's approval in accordance with Paragraph 103, the Consent Decree provision in question shall be superseded and terminated by the corresponding permit provision, which shall govern as the applicable requirement.

107. Following receipt by the United States of Miller Dyer, CEA, and/or Whiting's Request for Termination or Partial Termination, the Plaintiff and Miller Dyer, CEA, and/or Whiting, as applicable, shall confer informally concerning the Request for Termination or Partial

Termination and any disagreement as to whether the relevant Party or Parties has/have satisfactorily complied with the requirements for termination or partial termination of this Consent Decree. If the United States agrees that the Consent Decree may be terminated or partially terminated, the Plaintiff and the relevant Party or Parties shall submit, for the Court's approval, a joint stipulation terminating or partially terminating the Consent Decree.

108. If the United States does not agree that the Consent Decree may be terminated or partially terminated, the Party or Parties submitting either the Request for Termination or Partial Termination may immediately appeal the disposition of its Request to the Court.

XXV. PUBLIC PARTICIPATION

109. This Consent Decree shall be lodged with the Court for a period of not less than 30 Days for public notice and comment in accordance with 28 C.F.R. § 50.7. The United States reserves the right to withdraw or withhold its consent if the comments regarding the Consent Decree disclose facts or considerations indicating that the Consent Decree is inappropriate, improper, or inadequate. Miller Dyer, CEA, and Whiting consent to entry of this Consent Decree without further notice and agree not to withdraw from or oppose entry of this Consent Decree by the Court or to challenge any provision of the Consent Decree, unless the United States has notified Miller Dyer, CEA, and Whiting in writing that it no longer supports entry of the Consent Decree.

XXVI. SIGNATORIES/SERVICE

110. Each undersigned representative of Miller Dyer, CEA, Whiting, and the Assistant Attorney General for the Environment and Natural Resources Division of DOJ certifies that he or

she is fully authorized to enter into this Consent Decree and to execute and legally bind the Party he or she represents to the terms and conditions of this document.

111. Miller Dyer, CEA, and Whiting each represent that they have authority to legally obligate their corporate subsidiaries or affiliates to any work or compliance requirements of this Consent Decree and to take all actions necessary to comply with the provisions of this Consent Decree.

112. This Consent Decree may be signed in counterparts, and its validity shall not be challenged on that basis. The Parties agree to accept service of process by mail pursuant to the provisions of Section XIX (Notices) with respect to all matters arising under or relating to this Consent Decree and to waive the formal service requirements set forth in Rules 4 and 5 of the Federal Rules of Civil Procedure and any applicable Local Rules of this Court including, but not limited to, service of a summons. The Parties further agree that Miller Dyer, CEA, and Whiting need not file a responsive pleading to the complaint in this action unless or until the Court expressly declines to enter this Consent Decree as written and acknowledged by the Parties hereto. If the Court so declines to enter this Consent Decree, Miller Dyer, CEA, and Whiting shall have 60 days from the date of such Court Order to answer or otherwise plead or move in response to Plaintiff's Complaint.

XXVII. INTEGRATION

113. This Consent Decree constitutes the final, complete, and exclusive agreement and understanding between the Parties with respect to the settlement of matters addressed in the Decree, and supersedes all prior agreements and understandings, whether oral or written, concerning such matters. Other than the appendices listed in Section XXIX (Appendices), which

are attached to and incorporated in this Consent Decree, and deliverables that are subsequently submitted and approved pursuant to this Decree, no other document, representation, inducement, agreement, understanding, or promise constitutes any part of this Decree or the settlement it memorializes, nor shall evidence of any such document, representation, inducement, agreement, understanding or promise be used in construing the terms of this Consent Decree.

XXVIII. FINAL JUDGMENT

114. Upon approval and entry of this Consent Decree by the Court, this Consent Decree shall constitute a final judgment of the Court as to the United States, Miller Dyer, CEA, and Whiting.

XXIX. APPENDICES

A. Uinta Basin Facilities

B. Uinta Basin Properties

C. Existing Whiting Compressor Stations & Oil and Natural Gas Production Facilities

D. Test Protocol for Portable Analyzers

E. Scope of Work for Performance Optimization Review

F. June 27, 2007, Self-Disclosure Letter

G. August 20, 2007, Self-Disclosure Letter

Dated and entered this 21ST Day of September, 2009.

UNITED STATES DISTRICT JUDGE
District of Utah

FOR PLAINTIFF, UNITED STATES OF AMERICA

Date_____

JOHN C. CRUDEN
Acting Assistant Attorney General
Environment & Natural Resources Division
950 Pennsylvania Avenue, N.W.
Room 2143
Washington, D.C. 20530

Date Mar. 19, 2009

DIANNE M. SHAWLEY
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OF COUNSEL:

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Legal Enforcement Program
Office of Enforcement, Compliance, and Environmental Justice
U.S. Environmental Protection Agency, Region 8
1595 Wynkoop Street
Denver, CO 80202-1129

FOR THE UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY:

Date 3/27/09

CATHERINE R. McCABE
Acting Assistant Administrator
Office of Enforcement and Compliance Assurance
United States Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Date 3/31/09

ADAM M. KUSHNER
Director, Office of Civil Enforcement
Office of Enforcement and Compliance Assurance
United States Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

FOR DEFENDANTS,
MILLER, DYER & CO., L.L.C AND CHICAGO ENERGY ASSOCIATES:

Date: 12/3/2008

John E. Dyer, Manager
Miller, Dyer & Co., LLC
475 Seventeenth Street, Suite 1200
Denver, CO 80202
Phone: (303) 292-0949, ext 103
Fax: (303) 292-3901
John@millerdyer.com

Date: 12/3/2008

Miller, Dyer & Co., LLC, Manager
Chicago Energy Associates
By: John E. Dyer
475 Seventeenth Street, Suite 1200
Denver, CO 80202
Phone: (303) 292-0949, ext 103
Fax: (303) 292-3901
John@millerdyer.com

FOR DEFENDANT,
WHITING OIL AND GAS CORPORATION:

JAMES T. BROWN
Senior Vice President

Date: 12/3/08

Monitor Values Report

Geographic Area: Utah
Pollutant: Ozone
Year: 2011
Exceptional Events: Included (if any)

Duration Description=1 HOUR

Duration Description	Site ID	1st Max Value	2nd Max Value	3rd Max Value	4th Max Value	Days > 0.075	Expected Days	Observation Count	Observation Percent	Percent Complete	Days Below 0.075	Event Type	Null Data Reason	State Code	County Code	Site Number	Address	City	County	State	Date Local
1 HOUR	4113	0.081	0.076	0.076	0.075	0	0.00	153	147	96	0	None	1	490030003			140 W.Fishburn Drive, Brigham City, Ut	Brigham City	Box Elder	UT	08
1 HOUR	7805	0.076	0.076	0.073	0.072	0	0.00	153	115	75	0	None	1	490037001			8600 West 24000 North Portage, Utah	Not in a city	Box Elder	UT	08
1 HOUR	8648	0.076	0.072	0.071	0.071	0	0.00	153	153	100	0	None	1	490050004			125 W. Center Street, Logan, Ut	Logan	Cache	UT	08
1 HOUR	6554	0.082	0.077	0.073	0.072	0	0.00	153	149	97	4	None	1	490071003			On Prperty Of Resident At 351 W 2500 E. Price, Utah	Not in a city	Carbon	UT	08
1 HOUR	4276	0.103	0.083	0.082	0.08	0	0.00	153	150	98	3	None	1	490110004			171 West 1370 North, Bountiful, Utah	Bountiful	Davis	UT	08
1 HOUR	6511	0.074	0.072	0.069	0.069	0	0.00	153	151	99	2	None	1	490131001			1/4 Mile South Of Us 40 Off 4500 Wesst Fruitland, Utah	Not in a city	Duchesne	UT	08
1 HOUR	8620	0.135	0.13	0.127	0.126	4	4.60	230	200	87	0	None	1	490137011			6000 South And 10000 West (Myton)	Not in a city	Duchesne	UT	08
1 HOUR	4143	0.098	0.09	0.09	0.087	0	0.00	153	144	94	2	None	1	490350003			5715 S. 1400 E., Salt Lake City	Not in a city	Salt Lake	UT	08
1 HOUR	4271	0.109	0.089	0.087	0.086	0	0.00	153	148	97	1	None	1	490352004			12100 W 1200 S, Lakepoint, Utah	Not in a city	Salt Lake	UT	08
1 HOUR	8402	0.096	0.094	0.087	0.086	0	0.00	153	144	94	9	None	1	490353006			1675 South 600 East, Salt Lake City	Salt Lake City	Salt Lake	UT	08
1 HOUR	8348	0.09	0.074	0.074	0.074	0	0.00	153	151	99	2	None	1	490370101			Canyonlands National Park, Utah	Not in a city	San Juan	UT	08

Get detailed information about this report, including column descriptions, at http://www.epa.gov/airquality/airdata/ad_about_reports.html#mon

AirData reports are produced from a direct query of the AQS Data Mart. The data represent the best and most recent information available to EPA from state agencies. However, some values may be absent due to incomplete reporting, and some values may change due to quality assurance activities. The AQS database is updated daily by state, local, and tribal organizations who own and submit the data. Please contact the appropriate air quality monitoring agency to report any data problems <http://www.epa.gov/airquality/airdata/ad_contacts.html>

Readers are cautioned not to rank order geographic areas based on AirData reports. Air pollution levels measured at a particular monitoring site are not necessarily representative of the air quality for an entire county or urban area.

This report is based on monitor-level summary statistics. Air quality standards for some pollutants (PM2.5 and Pb) allow for combining data from multiple monitors into a site level summary statistic that can be compared to the standard. In those cases, the site-level statistics may differ from the monitor-level statistics upon which this report is based.

Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: July 17, 2012

Monitor Values Report

Geographic Area: Utah
Pollutant: Ozone
Year: 2011
Exceptional Events: Included (if any)

Duration Description=1 HOUR

Duration	Event	1st Max Value	1st Max Hour	2nd Max Value	3rd Max Value	4th Max Value	1st Max Exceedances	Level 1 Exceedances	Level 2 Exceedances	Days with Valid Data	Percent of Days with Valid Data	Required Days	Observations	AQS Site ID	Address	City	County	State	State Code
1 HOUR	4312	0.085	0.084	0.083	0.079	0	0.00	153	151	99	2	None	1	490450003	434 North 50 West, Tooele, Utah	Tooele	Tooele	UT	08
1 HOUR	8554	0.112	0.112	0.111	0.096	0	0.00	153	150	98	1	None	1	490471002	Dinosaur National Monument	Not in a city	Uintah	UT	08
1 HOUR	6126	0.14	0.13	0.109	0.107	2	2.00	229	224	98	3	None	1	490472002	2 Miles West Of Redwash Atop Deadman'S Bench	Not in a city	Uintah	UT	08
1 HOUR	6162	0.149	0.147	0.136	0.126	5	5.00	230	225	98	4	None	1	490472003	2 Miles South Of Ouray And South Of The White And Green River Confluence	Not in a city	Uintah	UT	08
1 HOUR	7063	0.091	0.089	0.084	0.075	0	0.00	153	153	100	0	None	1	490477022	Whiterocks & County Road	Not in a city	Uintah	UT	08
1 HOUR	8070	0.084	0.075	0.075	0.075	0	0.00	153	143	93	2	None	2	490490002	1355 North 200 West Provo Ut	Provo	Utah	UT	08
1 HOUR	2120	0.073	0.072	0.071	0.071	0	0.00	153	59	39	0	None	1	490495008	10865 N. 6000 West, Highland, Utah	Not in a city	Utah	UT	08
1 HOUR	4139	0.117	0.083	0.082	0.08	0	0.00	153	152	99	1	None	1	490495010	312 W 2050 North, Spanish Fork, Utah	Spanish Fork	Utah	UT	08
1 HOUR	4321	0.08	0.078	0.077	0.074	0	0.00	153	150	98	3	None	1	490530006	1215 North Lava Flow Drive, Santa Clara, Utah	Not in a city	Washington	UT	08
1 HOUR	8668	0.084	0.08	0.078	0.075	0	0.00	153	151	99	2	None	1	490530130	Zion National Park, Utah	Not in a city	Washington	UT	08

Get detailed information about this report, including column descriptions, at http://www.epa.gov/airquality/airdata/ad_about_reports.html#mon

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Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: July 17, 2012

Monitor Values Report

Geographic Area: Utah
Pollutant: Ozone
Year: 2011
Exceptional Events: Included (if any)

Duration Description=1 HOUR

[illegible]	[illegible]	First Max	Second Max	Third Max	Fourth Max	[illegible]	Est Exc	Required Days	Valid Days	[illegible]	[illegible]	[illegible]	Monitor Number	Site ID	[illegible]	City	[illegible]	[illegible]	EPA Region
1 HOUR	8117	0.094	0.084	0.084	0.083	0	0.00	153	144	94	2	None	1	490570002	228 32nd Street, Ogden, Utah	Ogden	Weber	UT	08
1 HOUR	4347	0.091	0.086	0.085	0.085	0	0.00	153	153	100	0	None	1	490571003	425 W 2550 North, Ogden, Utah	Not in a city	Weber	UT	08

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Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: July 17, 2012

Monitor Values Report

Geographic Area: Utah
Pollutant: Ozone
Year: 2011
Exceptional Events: Included (if any)

Duration Description=8-HR RUN AVG BEGIN HOUR

Duration Description	Observ. Count	1st Max. Value	2nd Max. Value	3rd Max. Value	4th Max. Value	Exceed. Count	Exceed. Rate	Valid Days	Req. Days	Pct. Complete	Null Data Count	Site ID	Address	City	County	State	Region
8-HR RUN AVG BEGIN HOUR	4154	0.066	0.065	0.065	0.063	0	0.00	153	145	95	0 None	1	490030003	140 W.Fishburn Drive, Brigham City, Ut	Brigham City	Box Elder	UT	08
8-HR RUN AVG BEGIN HOUR	7811	0.07	0.067	0.067	0.066	0	0.00	153	114	75	0 None	1	490037001	8600 West 24000 North Portage, Utah	Not in a city	Box Elder	UT	08
8-HR RUN AVG BEGIN HOUR	8730	0.066	0.066	0.065	0.063	0	0.00	153	153	100	0 None	1	490050004	125 W. Center Street, Logan, Ut	Logan	Cache	UT	08
8-HR RUN AVG BEGIN HOUR	6539	0.073	0.07	0.068	0.067	0	0.00	153	147	96	0 None	1	490071003	On Prperty Of Resident At 351 W 2500 E. Price, Utah	Not in a city	Carbon	UT	08
8-HR RUN AVG BEGIN HOUR	4312	0.082	0.071	0.068	0.068	1	1.00	153	148	97	0 None	1	490110004	171 West 1370 North, Bountiful, Utah	Bountiful	Davis	UT	08
8-HR RUN AVG BEGIN HOUR	6524	0.071	0.066	0.066	0.065	0	0.00	153	150	98	0 None	1	490131001	1/4 Mile South Of Us 40 Off 4500 Wesst Fruitland, Utah	Not in a city	Duchesne	UT	08
8-HR RUN AVG BEGIN HOUR	8733	0.124	0.121	0.119	0.111	19	21.50	267	236	88	0 None	1	490137011	6000 South And 10000 West (Myton)	Not in a city	Duchesne	UT	08
8-HR RUN AVG BEGIN HOUR	4176	0.083	0.076	0.075	0.074	2	2.20	153	142	93	0 None	1	490350003	5715 S. 1400 E., Salt Lake City	Not in a city	Salt Lake	UT	08

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Generated: July 17, 2012

Monitor Values Report

Geographic Area: Utah
Pollutant: Ozone
Year: 2011
Exceptional Events: Included (if any)

Duration Description=8-HR RUN AVG BEGIN HOUR

Duration Description	Obs	[illegible]	[illegible]	[illegible]	Fourth Max	Actual Exc	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Exc Events	[illegible]	[illegible]	Address	[illegible]	County	State	EPA Region
8-HR RUN AVG BEGIN HOUR	4299	0.081	0.078	0.077	0.073	3	3.10	153	148	97	0	None	1	490352004	12100 W 1200 S, Lakepoint, Utah	Not in a city	Salt Lake	UT	08
8-HR RUN AVG BEGIN HOUR	8438	0.083	0.078	0.076	0.075	3	3.20	153	144	94	0	None	1	490353006	1675 South 600 East, Salt Lake City	Salt Lake City	Salt Lake	UT	08
8-HR RUN AVG BEGIN HOUR	8360	0.073	0.072	0.071	0.069	0	0.00	153	150	98	0	None	1	490370101	Canyonlands National Park, Utah	Not in a city	San Juan	UT	08
8-HR RUN AVG BEGIN HOUR	4341	0.076	0.075	0.071	0.071	1	1.00	153	150	98	0	None	1	490450003	434 North 50 West, Tooele, Utah	Tooele	Tooele	UT	08
8-HR RUN AVG BEGIN HOUR	8529	0.106	0.106	0.103	0.09	8	8.10	267	263	99	0	None	1	490471002	Dinosaur National Monument	Not in a city	Uintah	UT	08
8-HR RUN AVG BEGIN HOUR	6251	0.125	0.119	0.108	0.1	21	21.50	268	262	98	0	None	1	490472002	2 Miles West Of Redwash Atop Deadman'S Bench	Not in a city	Uintah	UT	08
8-HR RUN AVG BEGIN HOUR	6254	0.139	0.139	0.133	0.116	22	22.60	268	261	97	0	None	1	490472003	2 Miles South Of Ouray And South Of The White And Green River Confluence	Not in a city	Uintah	UT	08
8-HR RUN AVG BEGIN HOUR	7142	0.083	0.077	0.07	0.068	2	3.10	267	172	64	0	None	1	490477022	Whiterocks & County Road	Not in a city	Uintah	UT	08

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Generated: July 17, 2012

Monitor Values Report

Geographic Area: Utah
Pollutant: Ozone
Year: 2011
Exceptional Events: Included (if any)

Duration Description=8-HR RUN AVG BEGIN HOUR

Duration Description	Num Obs	99th Percentile	2nd Max Value	3rd Max Value	4th Max Value	Num Exceedances	Exceedance Rate	Required Days	Valid Days	Percent Complete	Null Data Code	Monitoring Agency	AQS Site ID	Local Site Name	City Name	County Name	State Code	State Name
8-HR RUN AVG BEGIN HOUR	8318	0.068	0.066	0.065	0.065	0	0.00	153	142	93	0	None	2 490490002	1355 North 200 West Provo Ut	Provo	Utah	UT	08
8-HR RUN AVG BEGIN HOUR	2130	0.066	0.064	0.061	0.061	0	0.00	153	58	38	0	None	1 490495008	10865 N. 6000 West, Highland, Utah	Not in a city	Utah	UT	08
8-HR RUN AVG BEGIN HOUR	4195	0.069	0.066	0.066	0.065	0	0.00	153	152	99	0	None	1 490495010	312 W. 2050 North, Spanish Fork, Utah	Spanish Fork	Utah	UT	08
8-HR RUN AVG BEGIN HOUR	4304	0.071	0.07	0.069	0.068	0	0.00	153	147	96	0	None	1 490530006	1215 North Lava Flow Drive, Santa Clara, Utah	Not in a city	Washington	UT	08
8-HR RUN AVG BEGIN HOUR	8693	0.073	0.072	0.072	0.072	0	0.00	153	151	99	0	None	1 490530130	Zion National Park, Utah	Not in a city	Washington	UT	08
8-HR RUN AVG BEGIN HOUR	8193	0.08	0.075	0.075	0.074	1	1.10	153	141	92	0	None	1 490570002	228 32nd Street, Ogden, Utah	Ogden	Weber	UT	08
8-HR RUN AVG BEGIN HOUR	4369	0.075	0.075	0.074	0.074	0	0.00	153	151	99	0	None	1 490571003	425 W 2550 North, Ogden, Utah	Not in a city	Weber	UT	08

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Generated: July 17, 2012

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
1595 Wynkoop Street
DENVER, CO 80202-1129
Phone 800-227-8917
http://www.epa.gov/region08

DEC 08 2011

Ref: 8P-AR

The Honorable Gary R. Herbert
Governor of Utah
State Capitol
Salt Lake City, Utah 84114

Dear Governor Herbert:

Thank you for your recommendations dated March 12, 2009, on air quality designations for the revised 2008 National Ambient Air Quality Standards for ozone throughout Utah. I appreciate the information Utah shared with the U.S. Environmental Protection Agency as we move forward to improve ozone air quality. This letter is to notify you of the EPA's preliminary response to Utah's recommendations and to inform you of our approach for completing the designations for the revised ozone standards.

On March 12, 2008, the EPA revised its national ambient air quality standards for ground-level ozone to provide increased protection of public health and the environment. The EPA lowered the primary 8-hour ozone standard from 0.08 parts per million (ppm) to 0.075 ppm to protect against health effects associated with ozone exposure, including a range of serious respiratory illnesses and increased premature death from heart or lung disease. The EPA revised the secondary 8-hour ozone standard, making it identical to the primary standard, to protect against welfare effects, including impacts on sensitive vegetation and forested ecosystems.

History shows us that better health and cleaner air go hand-in-hand with economic growth. Working closely with the states and tribes, the EPA is implementing the standards using a common sense approach that improves air quality and minimizes the burden on state and local governments. As part of this routine process, the EPA is working with the states to identify areas in the country that meet the standards and those that need to take steps to reduce ozone pollution. Within one year after a new or revised air quality standard is established, the Clean Air Act requires the Governor of each state to submit to the EPA a list of all areas in the state, with recommendations for whether each area meets the standard. As a first step in implementing the 2008 ozone standards, the EPA asked states to submit their designation recommendations, including appropriate area boundaries, by March 12, 2009. In September 2009, the EPA announced it was reconsidering the 2008 ozone standards. The EPA later took steps to delay the designation process for the 2008 ozone standards pending outcome of the

reconsideration. However, in September 2011, the Office of Management and Budget returned to the EPA the draft final rule addressing the reconsideration of the 2008 ozone standards. On September 22, 2011, the EPA restarted the implementation effort by issuing a memorandum to clarify for state and local agencies the status of the 2008 ozone standards and to outline plans for moving forward to implement them. The EPA indicated that it would proceed with initial area designations for the 2008 standards, and planned to use the recommendations states made in 2009 as updated by the most current, certified air quality data from 2008-2010. While the EPA did not request that states submit updated designation recommendations, the EPA provided the opportunity for states to do so.

As required by the Clean Air Act, the EPA will designate an area as nonattainment if it is violating the 2008 ozone standards or contributing to a violation of the standards in a nearby area. Consistent with designations for previous ozone standards, the EPA intends to designate an area as unclassifiable/attainment if there are certified, quality-assured air quality monitoring data showing the area is meeting the ozone standards or there are no monitoring data for the area, and the EPA has not made a determination that the area is contributing to a violation in a nearby area.

After considering Utah's March 12, 2009 ozone designation recommendations and other relevant technical information, including 2008-2010 air quality data, the EPA intends to modify Utah's recommended area designation and boundary for Salt Lake and Davis Counties, plus portions of Weber County. Utah recommended nonattainment for those areas in March 2009. However, subsequent 2008-2010 and preliminary 2009-2011 data show attainment with the 2008 ozone standard; therefore, the EPA intends to modify the state's recommendation for those counties to unclassifiable/attainment.

Utah did not provide a recommendation for Indian country. However, there is existing non-regulatory monitoring in Duchesne and Uintah Counties, within the exterior boundaries of the Uintah and Ouray Indian Reservation, that has detected levels of wintertime ozone that exceed the NAAQS beginning in December 2009. For December 2009, January through March of 2010 and January through March of 2011, the non-regulatory monitors recorded ozone levels above the NAAQS. Regulatory monitoring has been conducted in the Uintah Basin since April 2011 but has not yet occurred for three consecutive years. Should regulatory data continue to show violations, a designation of nonattainment could happen as early as 2013. For this reason, we are proposing a designation of unclassifiable for Duchesne and Uintah Counties. The EPA intends to designate all other areas of the state as unclassifiable/attainment.

The EPA will continue to work with state officials regarding the appropriate boundary for the proposed unclassifiable area in Utah. If Utah has additional information that you would like the EPA to consider, please submit it to us by February 29, 2012. The EPA will also make its preliminary designation decisions and supporting documentation available to the general public for review and comment. We will be announcing a 30-day public comment period shortly in the *Federal Register*. After considering additional information we receive, the EPA plans to promulgate final ozone designations in spring of 2012.

The EPA is committed to working with the states and tribes to share the responsibility of reducing ozone air pollution. Current and upcoming federal standards and safeguards, including pollution reduction rules for power plants, vehicles and fuels, will assure steady progress to reduce ozone-forming pollution and will protect public health in communities across the country. We look forward to a continued

dialogue with you and your staff as we work together to implement the 2008 ozone standards. Should you have any questions, please do not hesitate to contact me, or have your staff contact Carl Daly, of my staff, at (303) 312-6416.

Sincerely,

James B. Martin
Regional Administrator

cc: Amanda Smith, Executive Director, UDEQ
Bryce Bird, Director, DAQ

Gina McCarthy, Assistant Administrator for Air and Radiation
Steve Page, Director, Office of Air Quality Planning and Standards

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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DEC 09 2011

Ref: 8P-AR

The Honorable Cary Hayes, Chairman
Ute Mountain Ute Tribe
P.O. Box JJ
Towaoc, CO 81334-0248

Dear Chairman Hayes:

Thank you for the Tribe's March 11, 2009, recommendation on air quality designations for the revised 2008 ozone national ambient air quality standards (NAAQS) on behalf of the Ute Mountain Ute Tribe. The purpose of this letter is to notify you of the U.S. Environmental Protection Agency's preliminary decision to designate an area including the Ute Mountain Ute Reservation as unclassifiable/attainment for the revised 2008 ozone NAAQS, and to inform you of our approach for completing the designations for the revised ozone NAAQS.

On March 12, 2008, the EPA revised its national air quality standards for ground-level ozone to provide increased protection of public health and the environment. The EPA lowered the primary ozone standard from 0.08 to 0.075 parts per million (ppm) to protect against health effects associated with ozone exposure, including a range of serious respiratory illnesses and increased premature death from heart or lung disease. The EPA revised the secondary 8-hour ozone standard, making it identical to the primary standard, to protect against welfare effects, including impacts on sensitive vegetation and forested ecosystems.

Within one year of promulgation of a new or revised NAAQS, the Clean Air Act requires the Governor of each state to submit to the EPA a list of all areas in the state, recommending designations with respect to the new or revised standard. Therefore, states were asked to submit their designation recommendations, including appropriate area boundaries, to the EPA by March 12, 2009, with respect to the revised ozone standards. Although tribes are not required to submit recommendations, we encouraged them to participate in the designations process, and provided them with an opportunity to submit recommendations if they chose to do so. The EPA received a recommendation from the Ute Mountain Ute Tribe on March 11, 2009 for a designation of attainment.

As a first step in implementing the 2008 ozone standards, the EPA asked states and tribes to submit their designation recommendations, including appropriate area boundaries, by March 12, 2009. In September 2009, the EPA announced it was reconsidering the 2008 ozone standards. The Agency later took steps to delay the designation process for the 2008 ozone standards pending the outcome of the reconsideration. However, in September 2011, the Office of Management and Budget returned to the EPA the draft final rule addressing the reconsideration of the 2008 ozone standards. On September 22,

2011, the EPA restarted the implementation effort by issuing a memorandum to clarify for state and local agencies the status of the 2008 ozone standards and to outline plans for moving forward to implement them. This memorandum was also provided to the tribes. In addition, several conference calls were held with the tribes to describe the overall designations process. The EPA indicated that it would proceed with initial area designations for the 2008 standards, and planned to use the recommendations states and tribes made in 2009 as updated by the most current, certified air quality data from 2008-2010. While the EPA did not request that states and tribes submit updated designation recommendations, the Agency provided the opportunity for them to do so.

As required by the Clean Air Act, the EPA will designate an area as nonattainment if it is violating the 2008 ozone standards or contributing to a violation of the standards in a nearby area. Consistent with designations for previous ozone standards, the EPA intends to designate an area as unclassifiable/attainment if there are certified, quality-assured air quality monitoring data showing the area is meeting the ozone standards or there are no monitoring data for the area, and the EPA has not made a determination that the area is contributing to a violation in a nearby area.

After considering the Ute Mountain Ute Tribe's March 14, 2009, ozone designations recommendation and other relevant technical information, including 2008-2010 air quality data, the EPA intends to modify the Tribe's recommended area designation. We intend to designate your reservation as unclassifiable/attainment along with adjacent state areas and consistent with the state's recommendation for nearby state lands. If you have additional information that the EPA should consider, we ask that you submit it to us by February 29, 2012.

Please notify us by February 29, 2012, if you are interested in consulting with us regarding the designations process. When requested, consultation will be conducted in accordance with the *EPA Policy on Consultation and Coordination with Indian Tribes* (www.epa.gov/tribal/consultation/consult-policy.html).

The EPA will also make its preliminary designation decisions and supporting documentation available to the general public for review and comment. We will be announcing a 30-day public comment period shortly in the *Federal Register*. After considering additional information, the Agency plans to promulgate final ozone designations in spring 2012.

We are committed to working with the states and tribes to share the responsibility of reducing ozone air pollution. Current and upcoming federal standards and safeguards, including pollution reduction rules for power plants, vehicles and fuels, will assure steady progress to reduce smog-forming pollution and will protect public health in communities across the country.

We look forward to working with you and your staff to develop area designations under the 2008 ozone NAAQS in a timely manner. If your tribe is interested in consultation or participating in further discussions or meetings with the EPA officials about the designations process, please do not hesitate to contact me or Carl Daly, of my staff, at (303) 312-6416 or [redacted].

Sincerely,

James B. Martin
Regional Administrator

cc: Scott Clow, Environmental Director

Gina McCarthy, Assistant Administrator for Air and Radiation
Steve D. Page, Director, Office of Air Quality Planning and Standards

to accept restrictive emission limits at dozens of existing and future units, which will ensure ongoing compliance with all applicable CAA laws and regulations.

The D.C. Circuit offers a constructive view of how a district court should assess whether a proposed settlement is in the public interest:

> The court should also bear in mind the flexibility of the public interest inquiry: the court's function is not to determine whether the resulting array of rights and liabilities "is the one that will best serve society," but only to confirm that the resulting settlement is "'within the reaches of the public interest.'"

United States v. Microsoft Corp., 56 F.3d 1448, 1460 (D.C. Cir. 1995), citing United States v. Western Elec. Co., 900 F.2d 283 (D.C. Cir. 1990) (additional citations omitted). This settlement with the Defendants serves the public interest and the goals of each of the environmental programs at issue, and easily meets the Microsoft standard.

B. The Comments Do Not Provide A Basis to Disapprove the Consent Decree.

The United States received one set of comments on the proposed Consent Decree from a citizen's group, Southern Utah Wilderness Alliance ("SUWA"). The group's comments were directed to the Assistant Attorney General, Environment and Natural Resources Division, U.S. Department of Justice, by letter dated May 29, 2009, Attachment # 1 to this Memorandum (cited herein as "SUWA Ltr., pg. __, ¶__").

The comments submitted by SUWA are very narrow in scope. SUWA does not object to entry of the consent decree, but suggests a change to the monitoring project that is being funded in part by this settlement. SUWA focuses on the Ambient Air Monitoring provisions of the Consent Decree in Section VII, paragraph 42.(a) through (d), which provides in part:

> "Miller Dyer and/or CEA shall fund the operation and maintenance of two ambient air quality and meteorological monitoring stations ("Monitoring Stations") located in the Uinta Basin and shall fund the collection and distribution

> of monitoring data for the two Monitoring Stations. The two Monitoring Stations shall be those installed and utilized pursuant to the Consent Decree in *United States v. Kerr-McGee Corporation* (D. Colo. Civil Action No. 07-cv-01034-WDMMJW)."

As part of the previous settlement with Kerr-McGee, that defendant purchased and installed two air monitors in the Uinta Basin, and began collecting data from the monitors. The purpose of that project in the Kerr-McGee settlement was to start to analyze the air emissions in an area with extensive oil and natural gas production and development. It is EPA's intention to try and use this data to measure and determine whether emissions of ozone, NOx, and particulate matter 2.5 microns in diameter or smaller ("PM2.5") are in fact increasing in the area. On July 23, 2009, the United States lodged another Consent Decree which obligates defendant Colorado Interstate Gas Company ("CIG") to fund the continued collection of data from these same monitors for an additional two years of operation following the monitoring performed under this consent decree by Miller-Dyer and/or CEA. (See, United States v. Colorado Interstate Gas Company, No. 09-CV-00649 (D. Utah, filed July 23, 2009)). The two settlements with Colorado Interstate Gas and these defendants fund the continued gathering of that air data, to give a better picture over a longer period of time of general trends in air emissions in this area. The co-located meteorological stations will monitor wind speed, wind direction, temperature, and solar radiation.

SUWA suggests that Section VII of the Consent Decree be amended to add, "an assurance that all monitoring data collected at the two monitoring stations may be used immediately for determining compliance with national ambient air quality standards ("NAAQS") for ozone and $PM_{2.5}$ in accordance with 40 C.F.R. Part 50, Appendices N and P." (SUWA Ltr., pg. 2, ¶4). In support of its recommendation, SUWA points to recent air quality monitoring in

Vernal, Utah in the Uinta Basin, which recorded significant levels of $PM_{2.5}$. SUWA also notes the high levels of ozone reported last year in this area by the National Park Service, and expresses concern regarding the area's compliance with the NAAQs for these pollutants. EPA believes that the data previously collected by Kerr-McGee, and which will continue to be collected by the Defendants using these existing monitors, is reliable and of good quality and will be useful in assisting regulators to gauge the impact of future oil and natural gas exploration and development in the Uinta Basin. It is EPA's intention to fund the continued operation of the Kerr-McGee project monitors to collect at least three years of continuous air quality data. Kerr-McGee has successfully begun operation of the two monitoring stations and the Defendants in this settlement will fund one year of operation of the two monitors pursuant to Section VII of the Decree. This data will be reported to EPA's national database, Air Quality System ("AQS") at http://www.epa.gov/ttn/airs/airsaqs/ and thus will be available to SUWA and other members of the public on a monthly basis. [2]

The air monitoring under these consent decrees was not designed for a specific regulatory purpose such as determining compliance with the NAAQS. However, the data collected will be extremely useful to determine trends in emissions in the area. EPA would have to re-negotiate this settlement and the Colorado Interstate Gas settlement to make the necessary changes to allow data collected to be used to determine NAAQS compliance. As this was not the intent of the parties to this settlement, which is part of a reasonable resolution of the United States'

[2] See, http://www.epa.gov/ttn/airs/airsaqs/ and follow the link to "Obtaining AQS Data." the two monitoring stations installed by Kerr-McGee, and continuously operated by the Defendants and CIG are identified as #490472002 and #490472003.

claims, the consent decree should be entered notwithstanding the comment. The consent decree obligation now is only to continue the funding of existing monitors, purchased and erected through the previous Kerr-McGee settlement.

In summary, SUWA makes no assertions that the settlement is in any way legally deficient and does not object to the entry of the Decree. In fact, the special project air monitoring under this Decree, as with other enhanced injunctive relief requirements in this settlement, goes beyond the injunctive relief required to address the claims alleged in the United States' Complaint. These additional monitoring requirements were negotiated by the Parties in good faith as part of a comprehensive resolution of this enforcement case. The purpose of the monitoring is to gather ambient air emissions data in the Uinta Basin. And although SUWA has a valid concern that the potential degradation of air quality in the region warrants the specialized air monitoring to determine compliance with the NAAQS, the United States disagrees with SUWA that the appropriate way to address its concerns regarding the determination of NAAQS compliance is by bringing these Defendants back to the table, reopening and renegotiating the terms of the Consent Decree, nor is there a legal requirement to do so. Moreover, such an extreme measure will significantly delay the environmental benefits of this settlement.

The only issue before the Court is whether the Consent Decree is fair, reasonable, and in the public interest. Absent a showing by SUWA that this Consent Decree fails to meet this legal standard for Court approval and entry, there is no basis for reopening and renegotiating the agreement.

IV. Conclusion

This settlement with the Defendants is one of several such comprehensive settlements with members of the oil and natural gas exploration and production industry. The injunctive

relief required here will not only resolve the alleged CAA violations, it will minimize emissions, promote energy efficiency, and maximize the recovery of natural gas. The comments received do not provide a basis for rejection or modification of the Decree. Entry of the Decree is supported by case law which requires deference to EPA's discretion in interpreting and applying highly technical regulations, and to the sophistication of the parties who negotiated in good faith to achieve an expeditious resolution of the United States' claims. For all the reasons set forth above, this Court should sign and enter the proposed Consent Decree.

FOR PLAINTIFF, UNITED STATES OF AMERICA

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/s/
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JAN - 7 2011

Ref: 8EPR-N

Juan Palma, State Director
Bureau of Land Management
Utah State Office
P.O. Box 45155
Salt Lake City, Utah 84145-0155

Re: Comments on the Gasco Uinta Basin
Natural Gas Development Project Draft EIS
CEQ # 20100386

Dear Mr. Palma:

The U.S. Environmental Protection Agency (EPA) Region 8 has reviewed the Gasco Energy, Inc. Uinta Basin Natural Gas Development Project (Gasco) Draft Environmental Impact Statement (EIS) prepared by the Bureau of Land Management (BLM). Gasco Energy, Inc. proposes to develop oil and natural gas in the Monument Butte-Red Wash and West Tavaputs Exploration and Development Areas in Uintah and Duchesne Counties, Utah. Our comments are provided for your consideration pursuant to our responsibilities and authorities under Section 102(2)(C) of the National Environmental Policy Act (NEPA), 42 U.S.C. Section 4332(2)(C), and Section 309 of the Clean Air Act (CAA), 42 U.S.C. Section 7609.

At the outset, I want to acknowledge the recent efforts of BLM Utah in working to achieve improved environmental protection for air quality and water quality while managing fossil fuel resource development on federal lands. EPA supports BLM's initiative in development of a statewide air management strategy. BLM's Air Resource Management (ARM) Strategy would provide a regional photochemical model that could be used to streamline air quality analyses during the NEPA process for all BLM oil and gas projects in Utah and set a framework for defining appropriate mitigation levels across the state. BLM Utah also recently published IM No. UT 2010-055 - Protection of Ground Water Associated with Oil and Gas Leasing, Exploration and Development, an impressive step in enhancing BLM's existing process for the continued protection of all usable groundwater zones.

Based upon our discussions with BLM, it is clear to us that we share common concerns regarding protection of air quality and water quality in the Uinta Basin. Under our CAA Section 309 review responsibilities, however, our review and rating of the proposed action must be based upon information contained in the Draft EIS. We would like to work with you in addressing the concerns expressed in this letter, as you proceed with the NEPA process for the proposed project.

PROJECT BACKGROUND

Five alternatives for development in the 206,826 acre Gasco project area are analyzed in the Draft EIS. Under Alternative A, the BLM Preferred Alternative, Gasco would drill 1,491 new natural gas production wells to depths of 5,000 to 20,000 feet. Wells would be drilled from individual well pads, with a maximum surface density of one well pad per 40 acres and at a rate of 100 wells per year. The Preferred Alternative includes construction of associated facilities such as access roads and pipelines, as well as construction of a water evaporation facility (WEF), consisting of 30 basins on 214 acres, to dispose of produced water. Other alternatives analyzed in the Draft EIS include: Alternative B, Reduced Development, with 1,114 new gas production wells developed in a phased manner and special exclusions for sensitive areas; Alternative C, Full Development, with 1,887 new gas production wells; Alternative D, No Action, under which 368 separately approved wells would be developed; and Alternative E, Directional Drilling, which has all the components of the Reduced Development Alternative, but wells would be directionally drilled from only 328 well pads. All alternatives include a WEF and other associated facilities in proportion to the number of wells and well pads.

EPA ISSUES OF CONCERN

Based on EPA's review of the Draft EIS, we have identified four primary concerns with the project: air quality impacts; the characterization of and potential for impacts to groundwater resources; impacts to impaired surface waters; and the development and analysis of alternatives. More importantly, EPA has also identified inadequacies in the Draft EIS that hinder a complete assessment of potential environmental impacts.

Air Quality

Evaporation Pond VOC and HAP Emissions

EPA is concerned that the emissions inventories used for all project-related modeling (near-field, far-field, and ozone) do not include volatile organic compound (VOC) emissions from the WEF. The produced water found in many gas operations can contain substantial levels of various VOCs, including those that when emitted are classified as hazardous air pollutants (HAPs). Given the large size of the proposed produced water disposal facility, there is potential for substantial emissions of VOCs from the evaporation ponds. The EIS should provide an estimate of the VOC content of the evaporation basins and an emissions inventory that indicates the level of VOCs emitted from the WEF, as well as disclose the potential impact on HAP and ozone concentrations in the project area.

Near-field Modeling

Modeling for the new one-hour near-field nitrogen dioxide (NO_2) National Ambient Air Quality Standard (NAAQS) (finalized on April 12, 2010) was not included in the Draft EIS. The explanation presented in the Draft EIS that gas development would not impact one-hour NO_2 because of its temporary nature is not valid because this is a one-hour standard. The lack of one-

hour NO_2 modeling constitutes an inadequacy in the Draft EIS, particularly because modeling results are necessary to plan adequate mitigation to reduce any predicted adverse impacts. Moreover, as discussed above, near-field modeling conducted for the Draft EIS also does not include HAP emissions. An accurate prediction of potential HAP impacts from the proposed project is necessary to protect those living, working, or recreating in or near the project area. In particular, we note that the Pariette Wetlands (a popular recreational destination) and the community of Ouray are approximately five miles and ten miles, respectively, from the proposed WEF.

Ozone

Measured ambient concentrations of ozone in the Uinta Basin during the period of January through March 2010 reached levels that are considerably above the NAAQS of 75 ppb for an eight-hour average, which was promulgated by EPA in 2008. EPA has proposed to lower the primary 8-hour ozone NAAQS to a level between 60 – 70 ppb and to establish a distinct cumulative, seasonal "secondary" standard; regardless of the outcome of this decision, it is clear that the measured values are a concern for public health. EPA appreciates that BLM acknowledged the measured wintertime ozone concentrations in Section 3.2.3 – Existing Air Quality. However, further information should be provided in the EIS to fully consider the potential impacts to wintertime ozone from the proposed action. Although current modeling capabilities do not allow for prediction of wintertime ozone concentrations, the wintertime ozone issues should be addressed qualitatively in light of the significant predicted project impacts with the knowledge gained from the modeling, monitoring and potential mitigation scenarios.

The project incremental increase with the Applicant Committed Environmental Protection Measures (ACEPMs) has been modeled at 1.3 ppb, which is considered a significant project-specific contribution given the recent ozone monitored exceedances in the Uinta Basin. We believe there are additional control strategies that could be utilized to effectively reduce NO_x and VOC emissions, which may include selection of a produced water disposal alternative that avoids or reduces use of surface evaporation pits.

Water Resources

Groundwater

Groundwater resources in the project area have not been adequately characterized in the Draft EIS to enable an assessment of the potential for impact to groundwater quality. All groundwater that has not been exempted through the aquifer exemption process and meets the definition of underground source of drinking water (USDW) at 40 C.F.R. § 144.3 is protected under the Safe Drinking Water Act. The brief description of the three principle aquifers in the project area indicates that there may be USDWs in the area of Gasco's proposed development; in particular, the Draft EIS notes that the Uinta-Animas aquifer contains freshwater in some areas. However, very little information is provided in the document regarding the location or depth of USDWs. In order to accurately assess the potential impacts of the proposed project, the EIS must provide substantially more detail characterizing groundwater resources, including

delineating the depth of all USDWs in the project area, and providing the quality of these aquifers in terms of total dissolved solids for each specific zone. EPA considers surface impoundment of produced water from oil and gas development as a potentially significant risk to groundwater and surface water. Therefore, adequate groundwater characterization is of special concern for the area underlying the proposed site of the evaporation pond complex.

Although there are no Sole Source Aquifers or Utah Drinking Water Source Protection Zones underlying the project area that would be at risk from the activities proposed, EPA is concerned that there still may be potential to impact public or private water supplies. The EIS should provide available location and other information regarding Public Water Supply wells or springs or private (domestic or stock) water wells or springs in the project area. This includes Tribal wells and springs and should include the alluvium along the Green River.

EPA disagrees with the determination in the Draft EIS that impacts to groundwater need not be discussed because they are "effectively eliminated, reduced, or mitigated" (pg. 4-264). The potential for significant impacts to water resources exists during all project stages, including drilling, well pad construction, production, hydraulic fracturing, produced water disposal, and freshwater withdrawal. EPA does not believe that deferring a detailed groundwater evaluation to the site-specific well reviews provides a complete analysis of potential cumulative environmental impacts to the aquifers. Further, we believe that the potential for groundwater impacts from leaks or spills from the WEF should be addressed in the EIS.

EPA is pleased to see the discussion of "suggested" or "encouraged" mitigation measures which the approving officer could require at the time of Application for Permit to Drill (APD) approval (pg. 4-264) and the discussion of protective drilling practices (Sections 2.2.2.3 and 2.2.2.4). These measures, if fully implemented, would provide effective mitigation of, for example, potential migration of production fluids away from the production zone during well drilling, completion, and production. However, it is unclear to what extent such mitigation will occur. Mitigation measures to protect groundwater should be clearly described in the EIS and required in the Record of Decision (ROD). Monitoring is also critical to document impacts during oil and gas development. A complete monitoring plan and program to track surface water or groundwater impacts as drilling and production operations occur should be included in the EIS.

Surface Water Quality

EPA considers impacts to surface water from runoff a substantial concern for the proposed project. Runoff of sediments, salts and selenium is the most substantial water quality concern in the Gasco project area as noted in the Draft EIS. Pariette Draw and Nine Mile Creek were listed on Utah's most recent 303(d) list of impaired waters, finalized in 2006, and both would receive increased loading of sediments, salts and selenium from this proposed project. A Total Maximum Daily Load (TMDL) was approved by EPA for Pariette Draw on September 28, 2010 that specifically calculates the reductions in total dissolved solids, selenium, and boron in the watershed that are necessary in order for surface water standards to be met. Increased loading of sediments to Pariette Draw would occur under all alternatives, although the use of

directional drilling would reduce runoff through a reduced number a well-pads. In addition to well-pads, loading would result from the construction of the evaporative ponds, which appear to be located within the Pariette Draw watershed, and from new roads and pipelines. Since the proposed project was not captured in the TMDL, any increase in sediment loading to Pariette Draw would represent a load that exceeds the TMDL and would be an unacceptable impact to surface water quality. Our recommendations for monitoring and mitigation to detect and prevent unacceptable impacts are described in the enclosed detailed comments.

Development and Analysis of Alternatives

Water Evaporation Facility

Significant environmental impacts are likely to be associated with disposal of produced water in the proposed WEF. EPA's concerns include the impact of potential WEF leaks on water quality, potential impacts to migratory birds and other wildlife from contact with the evaporation basins, and air quality impacts from VOC emissions. These potential impacts were not addressed in detail in the Draft EIS.

Over the past several years, EPA and the BLM Vernal Office have actively worked together to increase the number of underground injection permits and reduce the number of evaporation ponds in the Uinta Basin. Nonetheless, all five alternatives analyzed in the Draft EIS include surface evaporation as the means of disposal of produced water. The Draft EIS considered, but did not fully analyze, subsurface water disposal. No other alternative water management method or combinations of methods were considered or analyzed in the Draft EIS. Based on our preliminary review of available data, there appear to be reasonably available alternate disposal methods, including subsurface injection or treatment and reuse/recycling, which should be fully analyzed in order to reduce the potentially significant environmental impacts of the WEF. The decision to avoid surface evaporation disposal may resolve many of EPA's concerns regarding potential impacts to air quality, water quality, and wildlife from on-site produced water surface impoundments.

Additional data are available to better assess the feasibility of underground injection, including logs and driller's reports for over 100 production wells previously drilled in the project area. EPA's preliminary review of data logs suggests to us that underground injection could be a viable option in several zones of the Green River formation as well as the deeper Sego and Castlegate formations. Cross sections of the subsurface geology in the project area should be provided in the EIS to support conclusions of the feasibility of underground injection. The EIS should also consider water treatment options that would allow for reuse or recycling of produced water, an environmentally beneficial disposal method. Treated water could be reused in drilling or production operations in the Gasco field or recycled for a variety of uses, including waterflood for enhanced oil recovery, in other nearby fields. Treatment could also potentially allow for surface discharge.

Directional Drilling

BLM's Preferred Alternative proposes development of natural gas resources with each well drilled from an individual well pad; however, according to the analysis in the Draft EIS, implementation of directional drilling could reduce surface disturbance by approximately 60 percent if implemented as described in Alternative E and result in greatly reduced impacts to nearly all resources of concern. Minimizing surface disturbance is critical in the arid Uinta Basin, where reclamation is frequently difficult. Impacts of disturbed soils can include: erosion and sediment runoff impacts to surface water resources; impacts to local air quality from fugitive dust; dust impacts to vegetation and cultural resources (including the rock art of Nine-Mile Canyon); both direct and indirect impacts to the Uinta Basin Hookless Cactus, a federally listed threatened species; and long distance transport of fugitive dust out of the basin, which may contribute to dust on snow events in the mountains. The Draft EIS clearly indicates that resource impacts associated with surface disturbance are proportionate to the number of well pads. EPA therefore believes that directional drilling should be utilized to the maximum extent possible in the Uinta Basin project area. We recommend that BLM reconsider selection of Alternative E as the Preferred Alternative, or develop a new alternative that maximizes the valuable resource protection provided by directional drilling while maintaining reasonable cost and desirable development level.

Cumulative Impacts

The Reasonably Foreseeable Development (RFD) scenario used in the cumulative impact assessment for Gasco appears to undercount planned and projected development in the Uinta Basin. The RFD scenario appears to be based on the Vernal Resource Management Plan (RMP), which was finalized in 2008. However, based on information provided for NEPA projects currently undergoing scoping or review for oil and gas projects on federal lands managed by the BLM, U.S. Forest Service, and Bureau of Indian Affairs (BIA), it appears that more than three times as many oil and gas wells are now anticipated in the basin than were considered during RMP development. The Greater Natural Buttes Draft EIS (released for comment by BLM July 16, 2010) included 21,293 wells in its RFD, significantly higher than the 6,400 quantified in the Gasco Draft EIS. The under-accounting of RFD may have caused significant underestimation of cumulative air quality impacts, as well as cumulative impacts to all other resources of concern.

EPA'S RATING

The Draft EIS does not adequately analyze the project's potential impacts to air quality, particularly associated with VOC and HAP emissions from the produced water evaporation ponds. Moreover, inadequate characterization of groundwater resources results in an inability to determine whether adverse impacts to groundwater may occur as a result of the proposed action. EPA's review of the Draft EIS has also revealed significant environmental impacts from well-pad construction in the Pariette Draw watershed, which should be avoided, underscoring a need to fully consider the feasibility of directional drilling technology. In accordance with our policies and procedures for reviews under NEPA and CAA Section 309, EPA has rated this Draft EIS as "Inadequate" (3). As with all projects with potential unsatisfactory impacts or inadequate

assessment of such impacts, this proposal is a potential candidate for referral to the Council on Environmental Quality (CEQ). The "3" rating indicates EPA's belief that the Draft EIS does not meet the purposes of NEPA, and thus should be formally revised and made available for public comment in a supplemental or revised Draft EIS. A copy of EPA's rating criteria is enclosed. In addition, the enclosed detailed comments provide further discussion of our concerns regarding air quality and water resources, as well as our comments on climate change, potential impacts to environmental justice communities, tribal coordination, spill prevention, and impacts to wildlife and special status species.

Thank you for the opportunity to comment on this Draft EIS. We reaffirm our commitment to work cooperatively with BLM to address our significant concerns. If you have any questions on our rating or the comments provided in this letter, please contact Larry Svoboda, Region 8 NEPA Compliance and Review Program Director, at 303-312-6004, or Carol Campbell, Assistant Regional Administrator of Ecosystems Protection and Remediation, at 303-312-6340.

Sincerely,

James B. Martin
Regional Administrator

Enclosures: Detailed Comments
EPA's Rating System Criteria

cc: Daniel Picard, U&O Agency Superintendent, BIA
The Honorable Richard Jenks Jr., Chairman, Ute Indian Tribe
Bill Stringer, Green River District Manager, BLM

EPA'S DETAILED COMMENTS FOR THE GASCO DRAFT EIS

Consideration of Directional Drilling

EPA recommends that additional consideration be given to use of directional drilling in the EIS. We believe that directional drilling is a technologically and economically feasible alternative, which is being used extensively in nearby fields and throughout the world. It is recognized that directional drilling is more costly to implement than vertical drilling, however, it does not appear that the estimates of economic feasibility of the alternatives in the EIS have fully considered the many cost savings associated with construction of directionally drilled wells. Decreased construction of roads and well-pads and less time associated with moving the drill rig are among the factors that can offset many of the costs of directional drilling itself.

The need for utilization of directional drilling for Gasco is underscored by the challenges of reclamation in the project area, and the environmental impacts associated with surface disturbance. A total of 97,706 acres in the project area (47 percent) have soil characteristics that restrict reclamation. The Draft EIS acknowledges that it generally takes at least 10 years to reclaim a site following disturbance; other recent Uinta Basin EISs have indicated significantly longer time periods, up to 100 years, for revegetation of some plant species (Ashley National Forest South Unit Draft EIS, Greater Natural Buttes Draft EIS). According to the Draft EIS regeneration of biological soil crusts, which serve several critical ecosystem functions including stabilizing soils, could take up to 250 years. Long-term surface disturbance can contribute to regional dust concerns. For example, a recent study found that dust on snow in the Upper Colorado River Basin robs the Colorado River of about five percent of its water each year, enough to supply Los Angeles for 18 months.[1] EPA believes the substantial impacts to air quality, water quality, and threatened plant species from surface disturbance in the Gasco project area necessitates utilization of directional drilling to the maximum extent possible.

According to the Draft EIS (pg. 2-1), Alternative A was selected as the Preferred Alternative "because it best addresses issues raised in scoping about impacts to cultural resources in Nine Mile Canyon while meeting the purpose and need for the project." EPA is confused regarding this selection, and recommends that the EIS include an explanation of Preferred Alternative selection that is more transparent to readers of the EIS. We understand from Table 4-168 that, although Alternative A disturbs 844 acres in the Nine Mile Canyon Special Recreation Management Area (SRMA), none of this disturbance would be below the rim. Other alternatives include a small percentage of disturbance below the rim of Nine Mile Canyon. Utilization of directional drilling would likely allow for access to mineral resources within the Nine Mile Canyon SRMA without disturbance of cultural or other critical resources.

[1] Painter et. al. "Response of Colorado River runoff to dust radiative forcing in snow." *PNAS* 2010 107 (40) 17125-17130.

Air Quality

Ozone

EPA disagrees with the Draft EISs characterization of ozone as able to "only be evaluated on a regional basis" on page 4-16. Although ozone is a regional pollutant, direct project impacts can be isolated from regional models. For this reason, we recommend that the project's incremental contributions to ozone be discussed in Section 4.2 – Air Quality rather than in 4.18 – Cumulative Impacts, to avoid confusion.

Table 1-1 of Appendix J presents emission from the Proposed Action and emissions from the Proposed Action with ACEPMs. EPA appreciates the addition of control emissions to mitigate impacts to the surrounding area by a modeled increment of 0.6 ppb. Please indicate by source category the emissions reductions taken and the number of units used in the modeled emissions inventory. Based on the modeled incremental impact of the Preferred Alternative with ACEPMs of 1.3 ppb, additional mitigation measures may be warranted. For example, additional NO_x reductions could be realized through use of Tier IV engines, which should be available later in 2011, and alternate produced water disposal methods could reduce VOC emissions from the WEF. Onsite air monitoring programs (e.g., O_3, NO_x, VOC, aldehyde), source emission monitoring (i.e., FLIR camera), and emission control recordkeeping should also be considered.

EPA is concerned the Draft EIS does not fully disclose the potential impacts to ozone from the proposed action. The Draft EIS indicates that ozone concentrations in areas impacted by the project will not exceed the 75 ppb ozone standard, but does not disclose the modeled absolute maximum value. It is unclear from the information presented in the Draft EIS and Appendix J whether values of 75 ppb may have been modeled, or how many values approaching or reaching the standard were modeled. The figures provided in Appendix J indicate numerous grid squares in the 73 – 76 ppb range, which is cause for concern. Additionally, given the sparse monitoring data in the project area, the Draft EIS should disclose the absolute modeling results in addition to the non-monitored area analysis.

A 12 km modeling domain was used in the CMAQ modeling. A smaller 4 km nested domain should be used in the project area. The 4 km higher resolution emissions/emissions/topographic information data would likely improve model performance. EPA has consistently expressed this concern with grid resolution over the past several iterations of modeling performed in the Uinta Basin (beginning with the Uinta Basin Air Quality Study, letter to Bill Stringer October 16, 2009, and most recently regarding the GASCO ozone modeling protocol, letter to Jeff Rawson, May 10, 2010). Regarding model performance evaluation, we note that the EPA guidance for determining attainment of the ozone standard is generally intended for use in urban State Implementation Plan applications where a large network of monitors is available to evaluate the model performance and there is reasonable assurance that the baseline monitoring data captures the locations of highest ambient ozone concentrations. The monitoring data are sparse in the Gasco area and so in some instances the guidance may not be applicable. Caution should be used in citing this guidance for NEPA projects in rural areas.

Near-field Modeling Protocol

An explanation is presented in the Draft EIS on page 4-9 as to why modeling for one-hour NO_2 was not performed. EPA does not agree with the determination in the document that the information needed to analyze potential impacts to the NAAQS is lacking. For example, a "detailed plan of the facility" is not required as implied on page 4-9; rather, modeling must only assess a reasonable scenario like that used for near-field dispersion modeling for PM_{10}, $PM_{2.5}$, SO_2 and HAPs. In fact, modeling for one-hour NO_2 has already been performed for oil and gas NEPA projects. The conclusion of one-hour impacts being temporary and not expected to exceed the NAAQS is not substantiated. In many cases, emissions from drill rigs or other nonroad sources are not required to obtain a construction or operating permits and therefore would not have to demonstrate compliance with modeling under permitting rules. We note that the same discussion regarding the one-hour NO_2 standard is repeated in Draft EIS Sections 4.2.1.1.1.1, 4.2.1.2.1.1, and 5.0 (additional note: there appear to be some numbering inconsistencies in the Draft EIS) for development, operations, and cumulative impacts, respectively. We recommend that BLM revise this discussion to be more relevant to each section of the EIS, as the current format is confusing.

The one-hour SO_2 should also be modeled and compared with the new NAAQS for that pollutant, which was finalized in June 2010.

EPA is concerned that meteorological data from Canyonlands National Park was used for dispersion modeling for Gasco. To provide more representative near-field results, meteorological data should be used from stations within the Uinta Basin, such as the Vernal Airport or the Redwash or Ouray monitoring sites. Additionally, please ensure that the background concentrations used for all NAAQS and PSD comparisons utilize the most recent and applicable values available (i.e., ozone and $PM_{2.5}$ data from the Ouray and Redwash sites).

Particulate Matter ($PM_{2.5}$ and PM_{10})

EPA is concerned that near-field modeling for impacts from Gasco operations showed a 24-hour average PM_{10} value of 149.5 $\mu g/m^3$, just below the NAAQS of 150 $\mu g/m^3$, and a predicted PSD Class II increment of 287 percent of the threshold. Although an exceedance of the standard was not modeled, the level of impact predicted indicates a substantial potential for health concerns in the project area. We recommend that additional PM mitigation strategies be employed to reduce these impacts.

The Draft EIS identifies vehicle traffic, and particularly truck traffic associated with the WEF, as the primary source of the PM_{10} emissions, which underscores the need to consider alternate water disposal methods. Due to the large amount of surface disturbance associated with the proposed project and the sensitivity of the soil resource, further efforts to reduce surface disturbance and promote successful reclamation are warranted for Gasco. We recommend that BLM consider installation of a liquids gathering system to reduce truck traffic in the project area. Travel management in the project area should be designed for maximum reduction in soil and vegetation impacts. Access roads and well pads should be sited to avoid highly constrained areas

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC - 4 2008

OFFICE OF
AIR AND RADIATION

MEMORANDUM

SUBJECT: Area Designations for the 2008 Revised Ozone National Ambient Air Quality Standards

FROM: Robert J. Meyers
Principal Deputy Assistant Administrator

TO: Regional Administrators, Regions I-X

This memorandum provides information on the timeline for designating areas for the purpose of implementing the 2008 revised primary and secondary ozone National Ambient Air Quality Standards (NAAQS). In addition, this memorandum identifies important factors states and tribes should consider in making recommendations for area designations. Please share this information with the state and tribal agencies in your Region.

The U.S. Environmental Protection Agency (EPA) revised the ozone NAAQS on March 12, 2008 (73 FR 16436; March 27, 2008). The new primary ozone standard was lowered from 0.08 parts per million (ppm) to a level of 0.075 ppm based on numerous epidemiological studies conducted during the past decade in which many of the health effects associated with ozone exposure were identified. These studies showed health effects at and below the level of the 0.08 ppm standard, which was promulgated in 1997. Prolonged (i.e., 8-hour) exposure to ozone is associated with increased mortality and a range of serious morbidity health effects, including aggravation of a variety of respiratory symptoms and lung impairment, asthma attacks, respiratory hospital admissions and emergency department visits, and cardiovascular problems. In March 2008, EPA also strengthened the secondary ozone standard to provide increased protection against adverse public welfare effects including impacts on vegetation and forested ecosystems. EPA made the secondary standard identical in all respects to the revised primary standard.

Section 107(d) of the Clean Air Act (CAA) governs the process for area designations following the establishment of new or revised NAAQS. Under section 107(d), states are required to submit recommendations on designations for their areas to EPA not later than one year after the promulgation of a new or revised standard. If, after careful consideration of the recommendations, EPA intends to promulgate a designation that deviates from a state recommendation, EPA must notify the state at least 120 days prior to promulgating the final designation, and EPA must provide the state an opportunity to demonstrate why the potential

modification is inappropriate. The CAA requires EPA to complete the designation process within two years of promulgation of a new or revised NAAQS unless the Administrator has insufficient information to make these decisions. In such a case, EPA may take up to an additional year to make the designations. While the language of section 107 specifically addresses states, EPA intends to follow the same process for tribes to the extent practicable, pursuant to section 301(d) of the CAA and the Tribal Authority Rule, or TAR (see 63 FR 7254).

Accordingly, state designation recommendations for the 2008 revised ozone standards should be submitted to the Administrator no later than March 12, 2009. Areas should be identified as attainment, nonattainment, or unclassifiable on the basis of available information. We will notify states by letter no later than November 12, 2009 if we plan to modify a state's recommendation. In order to consider public input in the designation process, we plan to provide a 30-day public comment period immediately following issuance of EPA's response letters to the states and tribes; we anticipate the comment period would conclude in mid-December 2009. If a state or tribe has additional information that they want EPA to consider with respect to a designation recommendation EPA plans to modify, we would request such information be submitted by January 12, 2010. This will ensure that EPA can fully consider any such information as we move forward to issue designations by March 12, 2010. Because the 2008 revised primary and secondary ozone NAAQS are identical, EPA expects that each area will have the same designation and boundary for both standards.

We recommend that states and tribes identify violating areas using the most recent three consecutive years of quality-assured, certified air quality data. In most cases, we expect these to be data from 2005-2007 or 2006-2008 (if these 2006-2008 data have been certified more quickly than is required) that are stored in the EPA Air Quality System (AQS).[1] In general, violations are identified using data from Federal reference method (FRM) and Federal equivalent method (FEM) monitors that are sited and operated in accordance with 40 CFR Part 58. Special Purpose Monitors (SPM) using an FRM or FEM which have operated for more than 24 months are eligible for comparison to the relevant NAAQS, subject to the requirements given in the October 17, 2006 Revision to Ambient Air Monitoring Regulations (71 FR 61236). Procedures for using the air quality data to determine whether a violation has occurred are given in 40 CFR Part 50 Appendix P, as revised on March 27, 2008 (73 FR 16511). We expect to base the final designations in March 2010 on the most recent quality-assured data which would be from 2006-2008 or 2007-2009.

Air quality monitoring data affected by exceptional events may be excluded from use in identifying a violation if they meet the criteria for exclusion, as specified in the Final Rule on the Treatment of Data Influenced by Exceptional Events (72 FR 13560; March 22, 2007). We recently issued a direct final rule to provide schedules for flagging exceptional event data and submitting documentation specifically for ozone data collected from 2005 through 2009 that are used in the designations process for the 2008 ozone NAAQS. (See 73 FR 58042; October 6, 2008). These schedules reflect our interest in assuring that the exceptional events claims can be fully considered by EPA in the final designations.

[1] This information is available on EPA's website at www.epa.gov/ttn/airs/airsaqs/.

Section 107(d)(1) of the CAA defines an area as nonattainment if it is violating the NAAQS or if it is contributing to a violation in a nearby area. Ground-level ozone and ozone precursor emissions are pervasive and readily transported. Therefore, EPA believes it is important to examine ozone-contributing emissions across a relatively broad geographic area. Accordingly, we recommend that the Core Based Statistical Area (CBSA) or Combined Statistical Area (which includes 2 or more adjacent CBSA's) associated with the violating monitor(s) serve as the starting point or "presumptive" boundary for evaluating the geographic boundaries of an ozone nonattainment area. CBSA is a collective term that refers to both metropolitan and micropolitan statistical areas, which are distinguished based on population size.[2] Each CBSA consists of a county or counties containing at least one urban core plus adjacent counties that have a high degree of social and economic integration with the urban core as measured by commuting ties.[3] EPA recommends starting with this presumption because the factors used to establish the CBSAs and CSAs are similar to the factors EPA plans to consider in determining whether a nearby area is contributing to the violation(s) of the standard. EPA used this same conceptual approach in the designations process for the 1997 ozone NAAQS.[4,5] Where a violating monitor is not located in a CBSA or CSA, we recommend that the boundary of the county containing the monitor serve as the starting point for considering the extent of the nonattainment area.

EPA believes that each potential nonattainment area should be evaluated on a case-by-case basis and recognizes that these area-specific analyses conducted by states, tribes, and/or EPA may support nonattainment area boundaries that are larger or smaller than the presumptive area starting point. As a framework for area-specific analyses, we recommend that states and tribes base their boundary recommendations on an evaluation of the 9 factors listed in attachment 2. These factors are consistent with those used in the designations process for the 1997 ozone standard and are factors EPA plans to consider in evaluating and making decisions on the nonattainment area boundaries for the 2008 ozone standards. Additionally, states and tribes may

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[2] The Office of Management and Budget (OMB) delineates CBSAs (metropolitan and micropolitan statistical areas) and CSAs. OMB adopted new standards for defining metropolitan and micropolitan statistical areas on December 27, 2000 (65 FR 82229). A micropolitan statistical area has a population of at least 10,000 but less than 50,000. A metropolitan statistical area has a population of at least 50,000.

[3] For lists of the CBSAs and CSAs and their geographic components see www.census.gov/population/www/metroareas/metrodef.html. EPA recommends using the most recent available updated lists of the statistical areas. The lists are updated annually to reflect the most recent Census Bureau population estimates.

[4] Memorandum from John S. Seitz, Director of Office of Air Quality Planning and Standards to Air Directors, Regions I-X, "Boundary Guidance on Air Quality Designations for the 8-Hour Ozone National Ambient Air Quality Standards," March 23, 2000.

[5] In addition, CAA section 107(d)(4) established the consolidated metropolitan statistical area or metropolitan statistical area as the presumptive boundary for the most polluted areas that were designated nonattainment by operation of law in 1991 for the 1-hour ozone NAAQS.

identify and evaluate other relevant factors or circumstances specific to a particular area.

In addition to nearby areas with sources contributing to nonattainment, ozone concentrations in a local area may be affected by long-range transport of ozone and its precursors (notably nitrogen oxides). In certain parts of the country, such as the eastern United States, ozone is a widespread problem. Where this is the case, the CAA does not require that all contributing areas be designated nonattainment, only the nearby areas. Regional strategies, such as those employed in the Ozone Transport Region and EPA's NO_x SIP Call are needed to address the long-range transport component of ozone nonattainment, while the local component must be addressed through local planning in and around the designated nonattainment area.

This memorandum provides EPA's current views on how boundaries should be determined for ozone designations. The guidance is not binding on states, tribes, the public, or EPA. Issues concerning nonattainment area boundaries will be addressed in EPA's action to designate areas under the 2008 ozone standard. When EPA promulgates designations, those determinations will be binding on states, tribes, the public, and EPA as a matter of law. Ozone nonattainment areas will be classified at the time of designation. The approach EPA will use to classify nonattainment areas under the 2008 revised ozone NAAQS will be established through a separate notice-and-comment rulemaking. Information related to the designations for the 2008 revised ozone NAAQS will be provided on EPA's website at www.epa.gov/ozonedesignations.

Attachment 1 is a timeline of important dates in the designation process for the revised 2008 ozone NAAQS designation process. Attachment 2 provides the list of nine factors that EPA plans to consider in evaluating and making decisions on nonattainment area boundaries.

Staff in EPA's Office of Air Quality Planning and Standards are available for assistance and consultation throughout the designation process. Questions on this guidance may be directed to Carla Oldham at 919-541-3347.

Attachments (2)

cc: Air Division Directors, Regions I-X
Greg Green, OAQPS
Bill Harnett, OAQPS
Brian McLean, OAP
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ATTACHMENT 1

TIMELINE FOR REVISED 2008 OZONE NAAQS DESIGNATION PROCESS*	
Milestone	**Date**
EPA promulgated revised ozone NAAQS	March 12, 2008
State and tribal recommendations due for ozone designations	No later than March 12, 2009
EPA notifies states and tribes concerning any modifications to their recommendations (120-day letters).	No later than November 12, 2009 (120 days prior to final designations)
EPA publishes public notice of state recommendations and EPA's proposed modifications and initiates 30-day public comment period.	Mid-November 2009
End of 30-day public comment period.	Mid-December 2009
States and Tribes submit additional information to demonstrate why an EPA modification is inappropriate.	No later than January 12, 2010
EPA promulgates final ozone designations.	No later than March 12, 2010

* This schedule assumes EPA has sufficient information to promulgate designations within 2 years. In the event EPA determines that insufficient information is available to do so, the designation process could be extended up to one year, but no later than March 12, 2011.

ATTACHMENT 2

Factors EPA Plans to Consider in Determining Nonattainment Area Boundaries in Designations for the 2008 Ozone NAAQS

EPA recommends that the Core Based Statistical Area (CBSA) or Combined Statistical Area (CSA) (which includes 2 or more adjacent CBSA's) serve as the starting point or "presumptive" boundary for considering what should be the geographic boundaries of an ozone nonattainment area.[6] Where a violating monitor is not located in a CBSA or CSA, we recommend that the boundary of the county containing the monitor serve as the presumptive boundary for the nonattainment area. As a framework for area-specific analyses to support nonattainment area boundary recommendations and final boundary determinations, we recommend an evaluation of the 9 factors listed below:

- Air quality data
- Emissions data (location of sources and contribution to ozone concentrations)
- Population density and degree of urbanization (including commercial development)
- Traffic and commuting patterns
- Growth rates and patterns
- Meteorology (weather/transport patterns)
- Geography/topography (mountain ranges or other air basin boundaries)
- Jurisdictional boundaries (e.g., counties, air districts, existing nonattainment areas, Reservations, metropolitan planning organizations (MPOs))
- Level of control of emission sources

Analysis of these factors may support nonattainment boundaries that are either larger or smaller than the presumptive boundary. EPA plans to consider these factors, along with any other relevant information, in determining whether to make modifications to the boundary recommendations from states and tribes. The factors listed above, while generally comprehensive, are not intended to be exhaustive. States and tribes may submit additional information they believe is relevant for EPA to consider. In general, a state's or tribe's demonstration supporting their boundary recommendation for an area should show that: 1) violations are not occurring in nearby portions that are excluded from the recommended area, and 2) the excluded nearby portions do not contain emission sources that contribute meaningfully to the observed violations. While states are not bound to use the approach outlined here, EPA plans to evaluate a state recommendation and determine whether to modify such recommendation based on the above factors and any other information the Agency determines is relevant.

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[6] For lists of the CBSAs and CSAs and their geographic components see www.census.gov/population/www/metroareas/metrodef.html.

Year	Out of Season	# of Days with Ozone averages above 0.060 ppm	Date	Daily Maximum 8-hr average Ozone Concentration (ppm)	County	Site ID	Responsible Agency Code and Name	Land Use	Location	Monitor Type	Monitoring Objective	Elevation (m)
			04/01	0.063	Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
			04/02	0.063	San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
			04/02	0.064	Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
			04/03	0.066	Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
			04/04	0.067	Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
			04/15	0.062	San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
			04/16	0.065	San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
			04/17	0.064	San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
			04/17	0.062	Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
			04/18	0.061	San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
			04/20	0.064	San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
			04/20	0.061	Uintah	490471002	(0745) National Park Service	FOREST	RURAL	NON-REGULATORY	GENERAL/BACKGROUND	1463
			04/21	0.063	San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
			04/29	0.061	San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
			04/29	0.061	Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
			04/30	0.061	Box Elder	490037001	(136) Northwestern Band of Shoshoni Nation of Utah	AGRICULT	RURAL	TRIBAL MONITORS	GENERAL/BACKGROUND	1369
			04/30	0.065	San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
			04/30	0.061	Uintah	490471002	(0745) National Park Service	FOREST	RURAL	NON-REGULATORY	GENERAL/BACKGROUND	1463
			04/30	0.067	Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
2007		0										
			03/20	0.061	Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
			03/25	0.060	San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
			03/25	0.067	Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
			03/26	0.061	San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814

03/27	0.060 San Juan	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/03	0.061 San Juan	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/04	0.060 San Juan	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/07	0.063 Washington	490530130 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/08	0.062 Washington	490530130 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/13	0.064 Davis	490110004 (3113) Utah Department Of Environmental Quality	RESIDENTIAL	SUBURBAN	SLAMS	POPULATION EXPOSURE	1309
04/15	0.063 San Juan	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/15	0.068 Washington	490530130 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/16	0.062 San Juan	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/17	0.060 San Juan	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/18	0.063 Box Elder	490030003 (3113) Utah Department Of Environmental Quality	RESIDENTIAL	SUBURBAN	SLAMS	UNKNOWN	1334
04/19	0.061 Davis	490110004 (3113) Utah Department Of Environmental Quality	RESIDENTIAL	SUBURBAN	SLAMS	POPULATION EXPOSURE	1309
04/19	0.064 San Juan	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/19	0.062 Washington	490530130 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/20	0.067 San Juan	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/20	0.067 Uintah	490470002 (0745) National Park Service	FOREST	RURAL	NON-REGULATORY	GENERAL/BACKGROUND	1463
04/20	0.061 Utah	490494008 (3113) Utah Department Of Environmental Quality	AGRICULTURE	RURAL	SLAMS	HIGHEST CONCENTRATION	1485
04/20	0.061 Utah	490494010 (3113) Utah Department Of Environmental Quality	INDUSTRIAL	SUBURBAN	SLAMS	POPULATION EXPOSURE	1380
04/20	0.071 Washington	490530130 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/21	0.066 San Juan	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/21	0.062 Uintah	490470002 (0745) National Park Service	FOREST	RURAL	NON-REGULATORY	GENERAL/BACKGROUND	1463
04/21	0.069 Washington	490530130 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/22	0.065 San Juan	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/22	0.065 Uintah	490470002 (0745) National Park Service	FOREST	RURAL	NON-REGULATORY	GENERAL/BACKGROUND	1463
04/22	0.069 Washington	490530130 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/23	0.068 San Juan	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/23	0.064 Washington	490530130 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213

04/24	0.060	490370101	(0745)	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/24	0.064	490530130	(0745)	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/25	0.060	490370101	(0745)	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/25	0.061	490471002	(0745)	FOREST	RURAL	NON-REGULATORY	GENERAL/BACKGROUND	1463
04/25	0.062	490530130	(0745) (1113)	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/26	0.060	490030003	(1113)	RESIDENT	SUBURBA	SLAMS	UNKNOWN	1334
04/26	0.061	490352004		INDUSTRI	RURAL	SLAMS	HIGHEST CONCENTRATION	1264
04/26	0.064	490370101	(0745)	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/26	0.061	490471002	(0745) (1113)	FOREST	RURAL	NON-REGULATORY	GENERAL/BACKGROUND	1463
04/26	0.061	490495008	(1113)	AGRICUL	RURAL	SLAMS	HIGHEST CONCENTRATION	485
04/26	0.063	490495010		INDUSTRI	SUBURBA	SLAMS	POPULATION EXPOSURE	1320
04/26	0.061	490530130	(0745) (1113)	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/27	0.067	490030003	(1113)	RESIDENT	SUBURBA	SLAMS	UNKNOWN	1334
04/27	0.067	490110004	(1113)	RESIDENT	SUBURBA	SLAMS	POPULATION EXPOSURE	1309
04/27	0.062	490352004	(1113)	INDUSTRI	RURAL	SLAMS	HIGHEST CONCENTRATION	264
04/27	0.052	490353006		RESIDENT	SUBURBA	SLAMS	UNKNOWN	1300
04/27	0.067	490370101	(0745)	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/27	0.065	490471002	(0745) (1113)	FOREST	RURAL	NON-REGULATORY	GENERAL/BACKGROUND	1463
04/27	0.065	490495008	(1113)	AGRICUL	RURAL	SLAMS	HIGHEST CONCENTRATION	485
04/27	0.063	490495010		INDUSTRI	SUBURBA	SLAMS	POPULATION EXPOSURE	1320
04/27	0.064	490530130	(0745)	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/28	0.060	490471002	(0745)	FOREST	RURAL	NON-REGULATORY	GENERAL/BACKGROUND	1463
04/28	0.065	490530130	(0745)	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/29	0.067	490370101	(0745)	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/29	0.062	490471002	(0745)	FOREST	RURAL	NON-REGULATORY	GENERAL/BACKGROUND	463
04/29	0.060	490530130	(0745)	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/30	0.067	490370101	(0745)	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814

		04/30	0.064 U	490[illegible]002 (0745) National Park Service	FOREST	RURAL	NON-REGULATORY	GENERAL/BACKGROUND	1403
	May	04/30	0.076 W	490030130 (0745) National Park Service	DESERT	RURA	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
2005	Summary								
		03/27	0.064 San	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
		03/06	0.066 San	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
		03/08	0.061 San	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
		03/29	0.060 San	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
		04/01	0.060 San	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
		04/01	0.065 W	490030130 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
		04/02	0.060 W	490030130 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
		04/07	0.060 W	490030130 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
		04/08	0.063 San	490370101 (0745) National Park Service	DESERT	RURA	NON-EPA FEDERA	HIGHEST CONCENTRATION	1814
		04/10	0.063 San	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
		04/10	0.064 W	490030130 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
		04/14	0.064 San	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
		04/14	0.060 W	490030130 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
		04/15	0.066 San	490370101 (0745) National Park Service	DESERT	RURA	NON-EPA FEDERA	HIGHEST CONCENTRATION	1814
		04/15	0.060 U	490490008 (0113) Utah Department Of Environmental Quality	AGRICULT	RURAL	SLAMS	HIGHEST CONCENTRATION	1485
		04/15	0.060 W	490030130 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
		04/18	0.063 W	490570003 (0113) Utah Department Of Environmental Quality	RESIDENT	RURAL	SLAMS	POPULATION EXPOSURE	1334
		04/18	0.061 U	490490002 (0113) Utah Department Of Environmental Quality	COMMER	URBAN AN	SLAMS	POPULATION EXPOSURE	1402
		04/23	0.068 San	490370101 (0745) National Park Service	DESERT	RURA	NON-EPA FEDERA	HIGHEST CONCENTRATION	1814
		04/23	0.072 W	490030130 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
		04/24	0.067 San	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
		04/24	0.060 U	490490002 (0745) National Park Service	FOREST	RURAL	NON-REGULATORY	GENERAL/BACKGROUND	1403
		04/24	0.061 W	490030130 (0745) National Park Service	DESERT	RURA	NON-EPA FEDERA	GENERAL/BACKGROUND	1213
		04/25	0.064 San	490370101 (0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814

		04/26	0.069 Utah	490471002	(0745) National Park Service	FOREST	RURAL	NON-REGULATORY	GENERAL/BACKGROUND	1463
		04/27	0.060 San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
		04/27	0.052 Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
		04/28	0.066 San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
		04/28	0.060 Utah	490471002	(0745) National Park Service	FOREST	RURAL	NON-REGULATORY	GENERAL/BACKGROUND	1463
		04/28	0.065 Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
		04/29	0.067 San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
		04/29	0.066 Utah	490471002	(0745) National Park Service (1113) Utah Department Of	FOREST	RURAL	NON-REGULATORY	GENERAL/BACKGROUND	1463
		04/29	0.051 Utah	490495010	Environmental Quality	INDUSTRI	SUBURBA	SLAMS	POPULATION EXPOSURE	1380
		04/29	0.066 Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
		04/30	0.072 San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
		04/30	0.063 Utah	490471002	(0745) National Park Service (1113) Utah Department Of	FOREST	RURAL	NON-REGULATORY	GENERAL/BACKGROUND	1463
		04/30	0.061 Utah	490495010	Environmental Quality	INDUSTRI	SUBURBA	SLAMS	POPULATION EXPOSURE	1380
	39	04/30	0.078 Washington	490530130	(0745) National Park Service (1113) Utah Department Of	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
		12/17	0.067 Utah	490472002	Environmental Quality (1113) Utah Department Of	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
		12/17	0.065 Utah	490472003	Environmental Quality (1113) Utah Department Of	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		12/18	0.072 Utah	490472002	Environmental Quality (1113) Utah Department Of	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
		12/18	0.067 Utah	490472003	Environmental Quality (1113) Utah Department Of	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		12/19	0.064 Utah	490472002	Environmental Quality (1113) Utah Department Of	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
		12/19	0.063 Utah	490472003	Environmental Quality (1113) Utah Department Of	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		12/20	0.064 Utah	490472002	Environmental Quality (1113) Utah Department Of	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
		12/20	0.063 Utah	490472003	Environmental Quality (1113) Utah Department Of	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		12/21	0.068 Utah	490472002	Environmental Quality (1113) Utah Department Of	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
		12/21	0.065 Utah	490472003	Environmental Quality (1113) Utah Department Of	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		12/22	0.069 Utah	490472002	Environmental Quality (1113) Utah Department Of	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
		12/22	0.068 Utah	490472003	Environmental Quality (1113) Utah Department Of	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		12/23	0.067 Utah	490472002	Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8

		12/23	0.101 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		12/24	0.069 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		12/29	0.062 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
		12/29	0.066 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		12/30	0.061 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
2009	September 20	12/31	0.064 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		01/01	0.065 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
		01/01	0.066 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		01/02	0.072 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
		01/02	0.089 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		01/03	0.082 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
		01/03	0.090 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		01/04	0.069 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
		01/04	0.073 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		01/05	0.073 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
		01/05	0.076 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		01/06	0.079 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
		01/06	0.081 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		01/10	0.064 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
		01/10	0.067 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		01/11	0.073 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
		01/11	0.068 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		01/12	0.077 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
		01/12	0.075 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		01/13	0.084 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
		01/13	0.091 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
		01/14	0.085 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8

01/14	0.111 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
01/15	0.098 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
01/15	0.092 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
01/16	0.093 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
01/16	0.094 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
01/17	0.099 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
01/17	0.122 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
01/18	0.088 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
01/18	0.114 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
01/19	0.080 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
01/19	0.093 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
01/20	0.067 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
01/20	0.081 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
01/21	0.073 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
01/24	0.061 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
01/25	0.064 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
01/26	0.067 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
01/27	0.062 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
01/27	0.065 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
01/28	0.064 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
01/28	0.077 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
01/29	0.065 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
01/31	0.064 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/01	0.060 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/03	0.063 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/04	0.070 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/04	0.078 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8

02/05	0.082 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/05	0.093 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/06	0.082 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/06	0.100 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/07	0.080 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/07	0.103 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/08	0.092 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/09	0.062 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/09	0.074 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/10	0.072 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/10	0.087 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/11	0.091 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/11	0.098 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/12	0.085 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/12	0.111 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/13	0.085 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/13	0.122 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/14	0.076 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/14	0.102 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/15	0.070 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/15	0.089 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/16	0.084 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/17	0.078 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/17	0.092 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/18	0.087 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/18	0.108 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/19	0.085 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8

02/19	0.103 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/20	0.080 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/20	0.075 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/22	0.061 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/22	0.063 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/23	0.067 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/23	0.073 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/24	0.078 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/24	0.085 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/25	0.098 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/25	0.116 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/26	0.094 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/26	0.113 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/27	0.103 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/27	0.106 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
02/28	0.088 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
02/28	0.123 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
03/01	0.085 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
03/01	0.111 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
03/02	0.079 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
03/02	0.096 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
03/03	0.105 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
03/03	0.111 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
03/04	0.091 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
03/04	0.117 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
03/05	0.060 Utah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
03/05	0.067 Utah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8

03/06	0.069	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
03/06	0.088	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
03/07	0.068	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
03/07	0.073	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
03/08	0.064	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
03/09	0.064	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
03/09	0.060	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
03/12	0.061	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
03/17	0.063	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
03/25	0.062	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
03/30	0.060	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
03/31	0.063	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/03	0.060	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/04	0.062	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/08	0.062	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/09	0.061	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/12	0.063	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/12	0.061	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/13	0.060	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/13	0.062	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/14	0.068	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/14	0.060	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
04/14	0.060	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
04/14	0.070	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
04/15	0.068	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
04/15	0.067	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
04/15	0.067	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8

			04/15	0.073 Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
			04/16	0.063 San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
			04/16	0.062 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
			04/16	0.069 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
			04/16	0.060 Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
			04/17	0.063 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
			04/17	0.065 Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
			04/18	0.061 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
			04/18	0.066 Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
			04/19	0.060 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
			04/19	0.063 Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
			04/21	0.060 San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
			04/22	0.062 Uintah	490472002	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1701.8
			04/22	0.064 Uintah	490472003	(1113) Utah Department Of Environmental Quality	DESERT	RURAL	SPECIAL PURPOSE	GENERAL/BACKGROUND	1466.8
			04/26	0.060 Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
			04/27	0.061 San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
			04/27	0.067 Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
			04/28	0.060 San Juan	490370101	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	HIGHEST CONCENTRATION	1814
2012	Early May	146	04/28	0.064 Washington	490530130	(0745) National Park Service	DESERT	RURAL	NON-EPA FEDERAL	GENERAL/BACKGROUND	1213
2012	Other Summer	0									

3.0 The Decision

The BLM has determined that the analysis contained in the Final EIS is adequate for the purposes of reaching an informed decision regarding the Greater Natural Buttes project. This ROD applies only to the BLM-administered Federal lands and mineral leases within the GNBPA.

The decision is hereby made to allow oil and natural gas drilling on leased federal lands as described under the Resource Protection Alternative of the Greater Natural Buttes Final EIS, subject to the attached conditions of approval (COAs), hereafter referred to as the Selected Alternative. The Selected Alternative was designed to utilize directional drilling within the GNBPA to reduce surface impacts relative to the Proposed Action to a maximum of 1 pad per 40 acres (maximum of 16 well pads per section) for total new surface disturbance of 8,147 acres (approximately 5 percent of the GNBPA). The available locations for new wells pads are programmatically depicted in the Selected Alternative map (**Appendix A**, **Map A-1**).

Under the Selected Alternative, KMG and other operators may drill 3,675 new wellbores at an average rate of approximately 358 wells per year, using up to 15 drilling rigs operating over a period of 10 years. The estimated productive life of each well will be approximately 30 to 50 years. Of the 3,675 new wellbores, approximately 1,484 will be vertically drilled on new well pads and approximately 634 Mesaverde-only completions will be drilled as deepened recompletions or twinned wells on existing well pads. The remaining 1,557 wellbores will be directionally drilled from new and existing well pads. These 3,675 new wellbores will be in addition to the 1,102 wells to be drilled under the No Action Alternative that were analyzed in prior National Environmental Policy Act (NEPA) documents.

Additional disturbance will occur from the construction of an estimated 594 miles of new access roads, 2 mancamps, 2 compressor stations, 2 water tank batteries, 15 water injection facilities (additional disturbance to well pads), 564 miles of gas gathering pipeline co-located with new or existing roads, 30 miles of new cross-country gas gathering pipeline, 35 miles of buried gas transport pipeline, 458 miles of water gathering pipeline (surface) co-located with new or existing roads, 25 miles of buried water pipeline, and 7 miles of overhead electric power lines.

Two compression sites will be constructed to meet project compression needs within the GNBPA. Each site will require approximately 20 acres for the life of the facility. These facilities will provide a total additional 79,000 horsepower of new compression; approximately half gas fired and half electrically driven.

Water use is estimated to be 2.06 acre-feet per well. An estimated 7,571 acre-feet of fresh water will be required to drill and complete 3,675 wells or approximately 757 acre-feet each year for the projected 10-year drilling period. Recycling efforts will be implemented to reduce water use.

Produced water will be transported via truck to central tank storage facilities and then transported by buried pipeline for disposal in existing evaporation ponds or by underground injection. Average annual produced water is estimated to be approximately 1,385 acre-feet per year. Approximately 353 acre-feet per year (7,500 barrels of water per day [BWPD]) will be disposed in evaporation ponds and 1,032 acre-feet per year (21,900 BWPD) will be disposed by underground injection.

Under the Selected Alternative, the BLM will require, monitor, and enforce the following integral components of the Selected Alternative:

- All features of the Selected Alternative, as described in Section 2.7 of the Final EIS, including but not limited to the following:
  - No well pads will be located where topography, such as steep slopes, would require construction of a well pad for a vertically drilled well that would use major cuts-and-fills.

- No well pads will be located in the viewshed of the White River corridor (line-of-sight from the centerline up to 0.5 mile along both sides of the river), outside of the Indian Trust Lands;
- No well pads will be located in areas within 600 feet of the White River within the Indian Trust Lands;
- No well pads will be located within the 100-year floodplain of the White River and Green River, and 5 miles up major tributaries of the White River, regardless of surface ownership;
- KMG will not create new pads in the cactus core conservation areas without formal consultation, with the exception of 15 quarter-quarter sections within the cactus core conservation areas where new pad construction will be allowed, subject to the following conditions from the U.S. Fish and Wildlife Service (USFWS) Biological Opinion for this project:
  - Where topographically feasible, expansion of existing well pads will take priority in Level 1 cactus core conservation areas;
  - Where feasible, new pads will be placed on or adjacent to existing disturbance (e.g., roads) in the cactus core conservation areas;
  - Where topographically feasible, drill mats or similar devices will be used for new well pad development in the cactus core conservation areas;
  - Due to the high value of Level 1 cactus core conservation areas, KMG will notify the USFWS and work with the BLM (and the Bureau of Indian Affairs [BIA] if on tribal surface) to determine new pad placement that places a priority on avoiding cactus impacts when in these areas; and
  - New well pad development will not occur in cactus core conservation areas located in the northeast corner of the project area (i.e., the population located primarily in T8S R23E and the northern portion of T9S R23E) unless no other location for access to the mineral resource is feasible.

- Applicant-committed environmental protection measures (ACEPMs) and COAs, developed by the BLM and its cooperators during the EIS process in consideration of concerns raised by the public, federal agencies, and affected tribes (**Appendix B**);
- BLM and U.S. Environmental Protection Agency (USEPA)-identified water quality monitoring and mitigating measures, documented in the Long-term Water Resources Monitoring Plan (**Appendix C**);
- ACEPMs and USFWS-identified Reasonable and Prudent Measures and Terms and Conditions documented in the Biological Opinion prepared for this project (**Appendix D**); and
- The following Conservation Measures from the USFWS Biological Opinion:
  - Specific to this project, KMG should avoid any new surface disturbance (including construction of any new wells) in core conservation areas and, if new surface disturbance is unavoidable, should work with the USFWS to minimize impacts in core conservation areas.
  - When results from the applicant-committed enhanced reclamation study (Biological Opinion page 11 bullet 7) become available, KMG, BLM, and BIA should work with the USFWS to incorporate effective techniques into reclamation activities.

7.0 Consultation, Coordination, and Public Involvement

Consultation and coordination for the Greater Natural Buttes project is described in Chapter 6.0 of the Final EIS. A summary of these efforts follows.

7.1 Cooperating Agencies

The following cooperating agencies were given opportunities to review internal drafts and provide feedback during the development of the Draft EIS and Final EIS. Their feedback helped refine the alternatives, the impact analysis, and the associated mitigation.

Uintah County was invited to be a cooperating agency in the EIS process on July 19, 2007. The invitation was accepted and a Cooperating Agency Memorandum of Understanding (MOU) was signed on August 1, 2007. Preliminary drafts of the EIS were provided to Uintah County for review.

The U.S. Army Corps of Engineers reviewed and commented on preliminary drafts of the EIS under the Energy Pilot Office program MOU.

On November 29, 2007, the BIA requested to become a cooperating agency for this EIS. The Uintah and Ouray Agency was invited to be a cooperator in the EIS process on December 21, 2007. The invitation was accepted and a MOU was signed on April 2, 2008. Preliminary drafts of the EIS were provided to the BIA for review.

The USFWS, Utah Field Office reviewed preliminary drafts of the EIS through the Energy Pilot Office program MOU. Consultation under Section 7 of the Endangered Species Act has been conducted, as described in Section 7.4.

7.2 U.S. Environmental Protection Agency Region 8 Coordination

The USEPA contacted the Vernal Field Office during the public comment period for the Draft EIS regarding their concerns with the document. Close coordination was immediately initiated with the USEPA. Multiple conference calls and face-to-face meetings were held to discuss methods to resolve these concerns. A detailed response to the USEPA comments is included in the Final EIS Appendix P: Response to Comments. A brief description of the USEPA's concerns and how their concerns were addressed are as follows.

The USEPA expressed concerns regarding the air quality and water quality impact analysis and mitigation and environmental justice impact analysis. The BLM agreed to prepare a Supplement to the Draft EIS (SDEIS) to update the air quality and environmental justice sections. Grading of the Draft EIS was delayed pending the public comment period of the SDEIS. Preparation of the SDEIS was planned with the USEPA, and internal drafts were reviewed by the USEPA to ensure their concerns were addressed prior to publication of the SDEIS.

To address the air quality concerns, the SDEIS contained updated information regarding National Ambient Air Quality Standards, regional monitoring data, the best available emissions mitigation measures, and impact analysis in relation to those standards and data. The ACEPMs also were updated to include an adaptive management strategy that allows the BLM to adjust future site-specific implementation of the decision based on new air quality data that is being gathered or generated on a Utah-wide basis through the Utah Air Resource Technical Advisory Group and the BLM's Air Resource Management Strategy (ARMS). The ARMS has been designed to develop an ozone action plan to address wintertime ozone formation in the Uinta Basin associated with oil and gas operations through adaptive management. The ARMS consists of the following actions: 1) refine air quality modeling predictions; 2) develop a Uinta Basin ozone action plan; and 3) implement a regional ozone action plan. The first two elements of ARMS are being implemented by the

BLM and other agency stakeholders independent of this ROD. Regional operators may participate in these initial planning steps, thereby having the opportunity to contribute to the outcome of the process. The third element would require specific action by KMG and other oil and gas operators in the Uinta Basin. Until the ARMS is completed, a project-specific adaptive management plan for air quality has been developed and is included as a COA of this project. When the ARMS is completed, currently estimated to be near the end of 2012, site-specific implementation of this project will be adjusted as necessary.

Environmental justice concerns were addressed by updating the analysis in the SDEIS to disclose any potential disproportionate adverse effects to environmental justice communities. The air quality, economic, and traffic impact analyses were specifically revised to ensure accurate and adequate analysis.

Water quality concerns were addressed by creating a water monitoring plan (**Appendix C**). This plan contains an adaptive strategy to track upstream and downstream surface and ground water quality and outlines an adaptive management strategy to respond to water quality degradation.

7.3 National Historic Preservation Act Section 106 Consultation

In the summer and fall of 2008, a Class III (field survey) inventory was conducted on portions of the GNBPA that had not been previously surveyed. Class III block surveys have been completed for the GNBPA and the results of the surveys were sent to the Utah State Historic Preservation Officer in March of 2011. Concurrences were received in April of 2011. Consultation is considered to be closed. For documentation of this process, refer to Attachment 4 of this ROD.

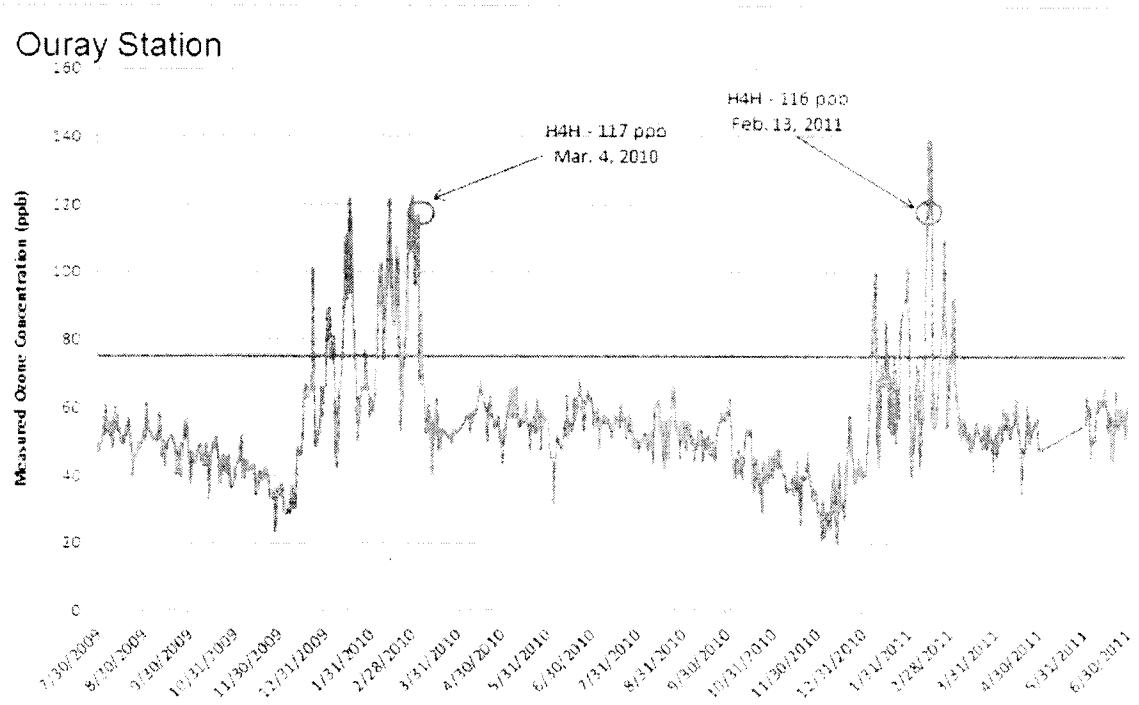
7.4 Government to Government Consultation

The GNBPA is within an area historically used by 12 Native American Tribes, and within close proximity to the Ute Indian Tribe Uintah and Ouray Reservation. These twelve Native American Tribal organizations were invited to formally participate as consulting parties to the EIS on January 9, 2008. Three Tribes responded to the invitation: the Pueblo of Laguna, the Navajo Nation, and the Hopi Tribe. The Pueblo of Laguna and Navajo Nation indicated that the proposed project would have no significant impact on any traditional cultural properties or historic properties of importance to the Tribes. The Navajo Nation requested notification of any unanticipated discoveries unearthed during the course of the project, and the Pueblo of Laguna requested notification in the event any new archaeological sites are discovered and artifacts are recovered. The Hopi Tribe expressed concern with stone cairn sites previously documented in the GNBPA. At the request of the Hopi, the BLM and Director of the Hopi Office of Cultural Preservation visited several of the stone cairn sites in the GNBPA. In August 2009, the BLM prepared a report summarizing the site visit results. No written responses were received from the Hopi. The BLM met with the Hopi in April of 2011 to follow up on the expressed concerns. No further concerns were expressed. Consultation is considered to be closed. For documentation of this process, refer to **Appendix E** of this ROD.

7.5 Section 7 Consultation under the Endangered Species Act

The BLM coordinated with the USFWS throughout the preparation of the EIS through the Energy Policy Act Pilot Office program. Based on an agreement between the BLM and USFWS, the preliminary Final EIS was used as the Biological Assessment (BA) for this project. BLM initiated formal consultation for the Resource Protection Alternative on September 16, 2011, by submitting the BA to the USFWS. The USFWS concluded consultation by signing a Biological Opinion on January 27, 2012. The Biological Opinion is included as **Appendix D** of this ROD.

All Reasonable and Prudent Measures and Terms and Conditions from the Biological Opinion are integral to the Selected Alternative.



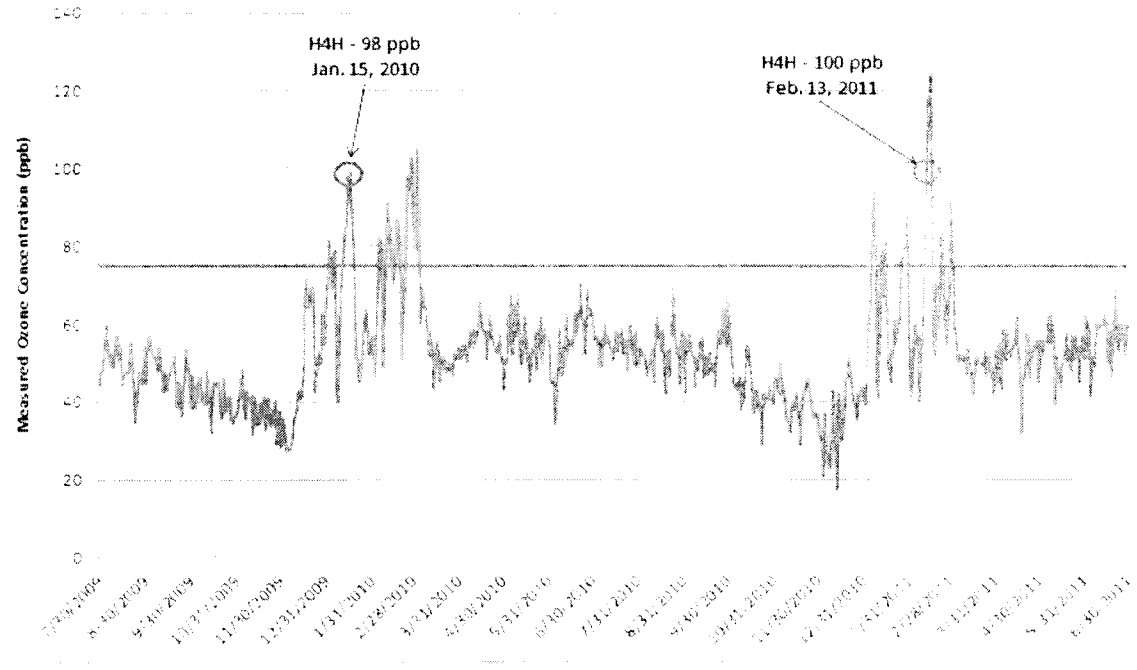


Figure 3.1-2 Ouray and Redwash Ozone Monitoring Data

4.1.1.4 Impacts on Ambient Ozone Levels

The CMAQ modeling system was used to estimate impacts on ambient air ozone levels from the emissions for 2006, representative of the base year operations. Results from that modeling effort were compared to actual monitored levels in the region (though not directly in the GNBPA). A formal Model Performance Evaluation (MPE) was conducted for 2006, which was used to evaluate the performance of the model with actual conditions, and to provide an adjustment of modeled impacts for future development scenarios. The MPE showed that the modeling system meets the USEPA-established criteria for acceptable model accuracy and error statistics at the existing monitoring stations within the modeling domain. The lack of concurrent ***monitored ozone*** data ***for 2006*** prevents validation and calibration of the model results; however, the model does provide a means to compare the relative change in ambient ozone concentration between the project alternatives and baseline air quality.

The CMAQ modeling system was used to model impacts for 2018 for the projected No Action Alternative, the Proposed Action, and the Optimal Recovery Alternative. The results were used to show the expected change in ozone levels at receptors in the region resulting from each of the alternatives as well as the cumulative impact from expected development. The model results showed no impacts above the current ozone standard of 75 ppb for the fourth highest annual level in the Uinta Basin for the No Action Alternative.

As shown in Section 3.1.2 and Figure 3.1-2, ozone levels monitored at the Ouray and Redwash monitoring stations in the Uinta Basin, showed numerous days during the winter of 2009-2010 and again in the winter of 2010-2011 with 8-hour concentrations above 75 ppb, the current ozone level that forms the basis for the standard. However, the 8-hour average ozone levels monitored during both of the summer episodes were below the 75 ppb level, which is consistent with the modeling results. The ability of current photochemical models to replicate winter ozone formation has not been established. Therefore, the comparison of modeled values to isolated winter values is not appropriate.

The No Action Alternative would involve continued development in the GNBPA as disclosed in approved NEPA decision documents. Given a continued level of NO_x and VOC emissions, and the current levels of ozone observed in the winter, there likely would be continued observations of winter ozone concentrations above the NAAQS resulting from this alternative.

4.1.1.5 Summary of GHG Emissions

GHG were estimated using the *Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry* (API 2004) as implemented using the SANGEA™ software tool published by the API. The SANGEA™ software tool is an Excel™ macro that uses the calculation methodologies described in the *Compendium* to calculate GHG emissions using a series of modules for different source types. These modules determine the emissions of CO_2, CH_4, and N_2O as well as the global warming potential (GWP) in CO_2e based on the comparative GWP of each GHG species. For this analysis, the default GWP coefficients for CH_4 (21) and N_2O (310) were used. These coefficients were multiplied by the calculated mass emission rate to determine the GWP.

Indirect GHG emissions include additional emissions that occur upstream of the project as a direct result of the increased activity resulting from the proposed alternatives. Additional annual electricity use for all project alternatives would increase significantly due to the installation of electric compression engines. Total annual electricity consumption was based on additional electric compression. Emission factors for GHG from electricity production vary by region since the means of power production and fuel characteristics vary by region. GHG emissions for electricity consumption for this analysis were based on the Utah-produced factors as provided in SANGEA™. Detailed emission rates by source and pollutant type are provided in **Table 4.1-6**.

4.1.2.3 Impacts at Class I and II Areas – Visibility

The CALPUFF model system was used to evaluate impacts on visibility at the Class I areas and at the listed sensitive Class II areas. **Table 4.1-9** provides results of the CALPUFF visibility analysis for the Proposed Action for both Class I and Class II areas. Only the areas with the highest impacts in each group are presented on this table; impacts for all areas analyzed are provided in **Appendix G**. These data were developed from the Method 6 approach using annual average background visibility conditions. The results showed that there are no days with a contribution to visibility impacts greater than 10 percent in extinction at listed Class I areas, indicating that the Proposed Action would not contribute to an impact on visibility at these sites.

The modeling results at the listed sensitive Class II areas showed project-related impacts above 1.0 dv (eighth highest, Method 6) at Dinosaur National Monument and Flaming Gorge National Recreation Area. The results predicted 102 days greater than 1.0 dv at Flaming Gorge and 32 days greater than 1.0 dv at Dinosaur National Monument. Modeled results for all other Class II areas showed that impacts would be less than 1.0 dv using Method 6.

The Utah BLM has proposed an Air Resource Management Strategy (ARMS), which includes a goal of providing greater certainty and transparency for agencies, project proponents, and the public regarding the conduct and review of air quality and AQRV impact analyses in the NEPA process, and the application of mitigation. Regional visibility impacts will be evaluated by a photochemical grid model through the ARMS, and the BLM will identify reasonable mitigation, control measures, and design features to address adverse air quality or AQRV impacts.

Given the level of emissions from the Proposed Action that would act as precursors to visibility impairment (primarily NO_X and SO_2 emissions, with less effect from PM emissions), it is likely that any mitigation that would reduce ozone levels, if it incorporates NO_X emissions reductions, also would reduce impacts on visibility levels at nearby sensitive areas. Furthermore, mitigation activities that would control particulate emissions from construction (e.g., fugitive emissions from traffic on roadways) also would lead to improvements in visibility at these same areas.

The primary contributors to cumulative impacts on visibility from the regional sources vary with the location of each area evaluated and the nature of the sources that affect receptors in that area. For areas that are already modeled as being impacted for the No Action Alternative, the cumulative effects of the Proposed Action would be greater in some areas and negligible in others.

4.1.2.4 Impacts on Ambient Ozone Levels

Impacts on ambient air ozone were evaluated using the CMAQ model system. As noted above, the modeling system meets the USEPA-established criteria for acceptable model accuracy and error statistics at the existing monitoring stations in the region. Increases in the fourth-highest ozone levels above baseline were modeled at 2.4 ppb for the Proposed Action Alternative ***for the summer months***. No ozone concentrations in excess of the 75 ppb standard were modeled in the GNBPA ***for that period***.

As noted in Section 4.1.1.4, there have been several occurrences of 8-hour ozone levels above 75 ppb during the winter months. Due to limitations of the model, this analysis does not address winter ozone levels. It is anticipated that the Proposed Action would add approximately 2,213 tpy of NO_X and 6,617 tpy of VOC emissions (representing increases of 22 and 4 percent, respectively) to the regional air quality emission levels. Given this level of emissions and the current levels of ozone in the winter, there likely would be an incremental increase in regional ozone levels resulting from the Proposed Action.

5.0 Cumulative Impacts

This chapter provides an analysis of the cumulative effects of past, present, and reasonably foreseeable future actions on various natural and human resources. The following sections identify the time frame for effects, the past, present, and reasonably foreseeable future projects analyzed; and the cumulative impacts for each resource. The primary human influences in the area have been oil and gas development, historic and current gilsonite mining, and livestock grazing. The compilation of these actions provides the basis for estimating future environmental changes that may affect the extent and quality of natural and human resources.

5.1 Time Frame

Based on the project development and operational periods (up to 50 years), and the time frame for vegetation and wildlife habitat recovery in saltbush and sagebrush communities, the overall time frame for the effects of cumulative surface disturbing activities is 75 years. KMG estimates that wells may have productive lives of 30 to 50 years.

5.2 Past, Present, and Reasonably Foreseeable Future Projects

Table 5.2-1 identifies the Cumulative Impact Study Areas (CISAs) for individual resources and resource issues, and the rationale for the selection of each area. Because of the many projects that have recently been approved or are in the approval process, the general cumulative effects area covers three reasonably foreseeable development (RFD) areas: Monument Butte – Red Wash, West Tavaputs Plateau, and East Tavaputs Plateau (**Figure 5.2-1**). This area includes much of the southern half of the Uinta Basin and is managed under the BLM Vernal RMP (BLM 2008c). There is no equivalent resource management guidance for Tribal, state, or private lands. **Figure 5.2-2** shows the locations of past, present, and reasonably foreseeable future actions included in the general cumulative effects area for oil and gas field development projects. **Figure 5.2-3** shows the locations of pipeline and seismic projects in the BLM Vernal Field Office that were considered as part of the cumulative impact analysis for vegetation. **Figure 5.2-4** shows the relationship of pipeline projects and well development projects used for the cumulative impact analysis for wildlife resources.

5.2.1 Oil and Gas

5.2.1.1 Exploration and Production

Oil and gas development in the GNBPA and surrounding region began in the 1950s and 1960s, and rapidly increased in the 1990s. As presented in Chapter 2.0, existing oil and gas development in the GNBPA includes 1,562 well pads and a total existing surface disturbance of 7,766 acres (**Table 2.2-1**). Under the No Action Alternative, an additional 1,102 well pads with a surface disturbance of 4,702 acres remain to be developed as disclosed in existing NEPA decision documents (**Table 2.4-1**). In addition to these existing and approved development activities within the GNBPA, **Table 5.2-2** provides a list of past and present oil and gas development projects, and **Table 5.2-3** presents estimates for reasonably foreseeable oil and gas activity in the general cumulative effects area for the proposed project. The projects listed as reasonably foreseeable include those for which NEPA decision documents are anticipated or in-process but have not yet been completed.

It is assumed that the portion of the projects listed in **Table 5.2-2** that are within the GNBPA are accounted for as part of the existing and approved activities disclosed in **Tables 2.2-1** and **2.4-1**. Therefore, the disturbance outside of the GNBPA is calculated on **Table 5.2-2**.

Table 5.2-2 Surface Disturbance Estimates for Past and Present Projects in the General Cumulative Effects Area

Project Name[1]	Total per Project			Outside the GNBPA			
	Wells (#)	Well Pads (#)[2]	Disturbance (acres)[3]	Fraction (%)	Wells (#)	Well Pads (#)	Disturbance (acres)
KMG Bonanza EA	95	95	877	0	0	0	0
Newfield Castle Peak and Eightmile Flat EIS	973	973	3,701	100	973	973	3,701
Gasco Riverbend EA	49	49	245	100	49	49	245
KMG Love Unit EA	125	125	706	5	6	6	35
Encana North Chapita EA	264	264	1,320	84	222	222	1,109
Enduring Resources Rock House EA	60	24	106	87	52	21	92
RDG Uinta Basin EIS	420	420	2,100	100	420	420	2,100
Enduring Resources West Bonanza EA	133	133	665	75	100	100	499
EOG Chapita Wells-Stagecoach EIS	627	627	1,735	86	539	539	1,492
QEP Greater Deadman Bench EIS	1,239	1,239	4,561	100	1,239	1,239	4,561
Newfield Gusher EA	75	75	375	100	75	75	375
Gasco Wilkin Ridge EA	54	54	270	100	54	54	270
Total Existing and Ongoing	**4,114**	**4,078**	**16,661**		**3,729**	**3,698**	**14,479**

[1] Information in this table was compiled from various notices and NEPA documents for each project.
[2] Number of well pads includes development of new pad locations and expansion of existing pads. If number of pads was not stated, all were assumed to be drilled vertically (i.e., one well per pad).
[3] Where disturbance estimates were not available, total project-related disturbance was estimated by assuming 5 acres per well pad.

Table 5.2-3 Surface Disturbance Estimates for Reasonably Foreseeable Projects in the General Cumulative Effects Area

Project Name[1]	Total per Project			Inside the GNBPA			
	Wells (#)	Well Pads (#)[2]	Disturbance (acres)[3]	Fraction (%)	Wells (#)	Well Pads (#)	Disturbance (acres)
Gasco Uinta Basin EIS	1,538	1,538	10,302	0	0	0	0
EOG North Alger EA	44	44	220	0	0	0	0
XTO River Bend Unit Infill EA	484	266	1,103	15	73	40	165
Enduring Resources Big Pack EA	664	292	1,620	13	86	38	211
XTO Little Canyon EA	510	362	1,882	6	31	22	113
BBC West Tavaputs Plateau EIS	807	538	3,656	0	0	0	0
EOG Greater Chapita Wells Natural Gas Infill Project EIS	7,028	1,679	5,688	14	984	235	796
Enduring Resources Southam Canyon EA	249	152	858	0	0	0	0
Berry Petroleum ANF South Unit EIS	400	400	2,000	0	0	0	0
Newfield Monument Butte EIS	5,750[4]	3,250	15,612	0	0	0	0
XTO Hill Creek EA	144	108	287	0	0	0	0
Total Other Pending Projects	**17,618**	**8,629**	**43,228**		**1,173**	**335**	**1,285**
KMG Greater Natural Buttes EIS (Proposed Action)	3,675	3,675	12,658	100	3,675	3,675	12,658
Grand Total Pending Projects	**21,293**	**12,304**	**55,886**		**4,848**	**4,010**	**13,943**

[1] Information in this table was compiled from various notices and NEPA documents for each project.
[2] Number of well pads includes development of new pad locations and expansion of existing pads. If number of pads was not stated, all wells were assumed to be drilled vertically (i.e., one well per pad).
[3] Where disturbance estimates were not available, total project-related disturbance was estimated by assuming 5 acres of disturbance per well pad.
[4] Of the 5,750 total wells, up to 3,250 would be oil wells and 2,500 would be deep gas wells.

Table P-4 Responses to Public Comments on the SDEIS

Letter Author / Comment Number	Comment	AECOM Response
F201-05	We believe that in order for the adaptive management strategy to adequately address the ongoing ozone concerns in the Uinta Basin it should rely on a combined approach using monitoring data and modeling results. Again, the modeling analysis should be completed sooner than suggested, and on a schedule committed to in the SDEIS, in order to incorporate the modeling results into the final strategy. Finally, as acknowledged in section 4.1.2.5, this adaptive management approach / ozone action plan should be developed more comprehensively and regionally rather than project-by-project. The ozone action plan should be implemented for *all* NEPA decisions within the region. This approach allows the BLM to better address the cumulative effects of oil and gas development on air quality in the region and NPS resources.	The BLM agrees that the ongoing adaptive management of air resources in the Uinta Basin should rely on a combined monitoring/modeling approach, and the recently completed Utah Air Resource Management Strategy (ARMS) is based on that approach. The regional modeling component of the ARMS is currently underway with development of a comprehensive emission inventory. The modeling analysis is anticipated to occur in early 2012. The ARMS is also predicated on a comprehensive and collaborative approach to airshed management that is regional in scope and relies on sound science and public policy. The ARMS will be applied to all future NEPA actions as suggested, and is envisioned as an adaptive strategy that will be modified and improved as we gain knowledge and experience with airshed management in the Uinta Basin. We encourage and expect active participation by the NPS in air resource management on all public lands in Utah and are confident that, with this collaborative approach, both current and future air resource issues can be examined, addressed and solved. Please also refer to Comment F202-02 from USEPA.
USEPA		
F202-01	1. Ozone – Wintertime Concentrations: The EPA appreciates and supports that the Draft Supplement presents the measured wintertime ozone concentrations, including time plots showing the measured ozone concentrations at two monitoring stations in the Uinta Basin for a one-year period from August 2009 to August 2010. We agree that current modeling capabilities do not allow for prediction of wintertime ozone concentrations and are pleased to see that the Draft Supplement addresses qualitatively the wintertime ozone issues, based on anticipated nitrogen oxides (NO_X) and volatile organic compound (VOC) emissions. Measured ambient concentrations of ozone during the past two winters in the Uinta Basin have reached levels that are considerably above the National Ambient Air Quality Standard (NAAQS) of 75 ppb for an eight-hour average, which was promulgated by the EPA in 2008. The EPA has proposed to lower the primary 8-hour ozone NAAQS to a level between 60 – 70 ppb and to establish a distinct cumulative, season "secondary" standard; regardless of the outcome of this decision, it is clear that the measured values are a concern for public health.	Thank you for your comment.

3. THE DECISION

The BLM has determined that the analysis contained in the FEIS is adequate for the purposes of reaching an informed decision regarding the Gasco project. This ROD applies only to the BLM-administered lands and mineral leases.

The decision is hereby made to allow natural gas drilling on leased federal lands, within the analyzed development area depicted in Attachment 1, and as described in the Gasco FEIS Agency Preferred Alternative (Alternative F). Further, future exploration and development activities will be subject to the COAs contained in Attachment 2.

The primary components of the Selected Alternative are described in detail in Section 2.7 of the FEIS and are outlined below. This decision is conceptually depicted in the maps included in Attachment 1. The Selected Alternative was designed to use directional drilling to reduce surface impacts while allowing some strategic vertical drilling to test production potential in areas where formation details are lacking, especially in the southern and western portions of the analyzed development area. The Selected Alternative was also designed to restrict evaporative facility acreage for water disposal, which was a concern of the U.S. Environmental Protection Agency (EPA).

Under the Selected Alternative, Gasco could drill as many as 1,298 new gas production wells from up to 575 pads within the analyzed development area. It is anticipated that Gasco will have to construct up to 198 miles of new roads and 316 miles of new surface or buried water supply and gas gathering pipelines to support their exploration and development activities. Existing compressor facilities will also be expanded by approximately 18,200 horsepower at two gas plants to handle increased production. No new compressor stations will be built.

Under the Selected Alternative, Gasco will be allowed to construct an evaporative facility on BLM-administered land. This facility can be of sufficient capacity to dispose of water from the first 5 years of proposed development to allow time for development of alternative water disposal methods. For the purposes of this decision, it is assumed that the facility will include 12 evaporative basins encompassing approximately 78 acres. After 5 years, the need for the facility would be re-evaluated. The BLM, in consultation with Gasco as appropriate, would determine if the facility should be reclaimed or if it will have to continue to operate. For the purpose of this decision, it is assumed that the facility could remain in operation for the life of the project (an estimated 45 years).

Water disposal needs beyond the capacity of the evaporative facility will be addressed through reduced drilling (based on the limits of the facility) or through alternative water disposal methods. These methods could include treating water for use in waterflood (enhanced oil recovery) operations by other operators, subsurface injection, or other methods. The methods used will depend on the feasibility of alternative disposal methods, as determined through negotiation with providers and other operators and analysis of disposal zones.

Under the Selected Alternative, the BLM will require, monitor, and enforce the following integral components of the Selected Alternative:

- All design features and standard operating procedures of the Selected Alternative, as described in Chapter 2 of the FEIS (unless superseded by the COA). The primary components of this alternative include the following:

station are probably those common to other areas of the western US (combustion and dust). The filter speciation that has been done to date tends to support this conclusion because the dominant chemical species from the filters is carbonaceous mass, which is indicative of wood burning, diesel emissions, or both. It is unlikely that significant transport of $PM_{2.5}$ precursors are occurring during the intense winter inversions under which these elevated $PM_{2.5}$ levels are forming, and as there is extensive snow cover during these episodes fugitive dust is also an unlikely significant contributor.

The BLM does acknowledge that uncertainties remain with speciation of $PM_{2.5}$ in the Uinta Basin, and notes that additional monitoring studies planned for the 2011--2012 winter may provide more conclusive information.

The complete UDAQ $PM_{2.5}$ monitoring data can be found at http://www.airmonitoring.utah.gov/dataarchive/archpm25.htm.

The complete EPA Ouray and Redwash monitoring data can be found at http://www.epa.gov/airexplorer/index.htm.

3.2.3.1.6.2 Ozone Air Monitoring

Active ozone monitoring in the Uinta Basin began in the summer of 2009 at the Ouray and Redwash monitoring sites (the ozone monitors are collocated with the $PM_{2.5}$ monitors). Both sites have recorded numerous exceedences of the 8-hour ozone standard during the winter months (January through March). The maximum 8-hour average recorded to date is 0.123 ppm, well above the current ozone NAAQS of 0.075 ppm. These data have recently been released by EPA. Although the monitors are not currently being operated to CFR standards, and are not considered adequate data to make a NAAQS determination, the data are considered viable and representative of the area. Apparently, high concentrations of ozone are being formed under a "cold pool" process, whereby stagnate air conditions with very low mixing heights form under clear skies with snow-covered ground and abundant sunlight that, combined with area precursor emissions (NO_x and VOCs), create intense episodes of ozone. Based on the first year of monitoring, these episodes occur only during the winter months (January through March). This phenomenon has also been observed in similar types of locations in Wyoming, and has contributed to a proposed nonattainment designation for Sublette County.

The National Park Service also operates an ozone monitor in Dinosaur National Monument during the summer months. No exceedences of the current ozone NAAQS have been recorded at this site.

Winter ozone formation is a newly recognized issue, and the methods of analyzing and managing this problem are still in development. Existing photochemical models are currently unable to replicate winter ozone formation satisfactorily, in part due to the very low mixing heights associated with the unique meteorology of these ambient conditions.

Based on the emission inventories developed for Uintah County, the likely dominant source of ozone precursors at the Ouray and Redwash monitoring sites are oil and gas operations near the monitors. The monitors are located in remote areas where impacts from other human activities are unlikely to be significantly contributing to this ozone formation. Although ozone precursors can be transported large distances, the meteorological conditions under which this cold pool ozone formation is occurring tend to preclude any significant transport. Currently, ozone

4.18.3.1.6 Ozone Impacts

An analysis of potential ozone impacts from Gasco project emissions and cumulative emission sources was performed using the Models-3 CMAQ modeling system, version 4.6, publicly released in October 2006. A detailed discussion of ozone impacts is provided in the Ozone Impact Assessment (Appendix J). Hourly meteorological data were developed for the modeling domain using the MM5 meteorological models to simulate ozone dispersion. In order to simulate ozone formation, it was necessary to develop emissions estimates for all other emission sources (i.e., industrial, electric generation, motor vehicle, biogenic [natural]) in addition to the emissions from the Gasco project. The estimates were developed using the Western Regional Air Partnership (WRAP) emissions databases and were processed into CMAQ-ready files. Details concerning the emission inventories developed for use in the modeling are provided in Appendix J. Emissions inventory development for CMAQ ozone modeling addressed several source categories including: (a) stationary point sources, (b) area sources, (c) on-road mobile sources, (d) non-road mobile sources, (e) biogenic sources and (f) fire sources. Table 4-183 summarizes the cumulative emission inventory used for the ozone impact assessment.

Table 4-183. 12-km Emissions Modeling Domain Grid Totals (average tons/day)

Source Category	2018 Emissions Totals			2006 Emissions Totals		
	CO	NO_x	VOC	CO	NO_x	VOC
Area	211.3	31.1	264.3	93.3	17.5	113.5
NonRoad	574.4	31.4	85.2	775.0	102.8	83.5
Motor Vehicle	1,787.0	70.0	69.0	2,587.9	192.7	143.6
Point	362.8	505.4	120.3	225.2	662.6	50.6
Total Non-O&G	2,935.5	637.9	538.8	3,681.3	975.6	391.2
Piceance Basin O&G	11.0	10.0	42.0	0.2	17.3	59.7
Uinta Basin O&G	29.0	38.0	531.0	23.9	28.8	192.0
SWWY O&G	8.4	22.5	347.5	8.2	22.4	347.4
Other O&G	68.3	94.2	279.1	21.1	33.0	38.7
Total O&G	116.7	164.7	1199.6	53.4	101.5	637.8
Total	**3,052.2**	**802.6**	**1,738.4**	**3,734.7**	**1,077.1**	**1,029.0**

O&G = Oil and gas

Considerable caution must be taken in interpreting the results. In traditional CMAQ ozone modeling applications, the model is applied in regions with sufficient ozone and precursor monitors to judge the adequacy of the model for use in ozone prediction. It must be emphasized that EPA does not determine attainment of the 8-hour ozone standard based on the unmonitored area analysis. Rather, the unmonitored analysis is used as more of a weight of evidence analysis (EPA 2007e).

Using the relative non-monitored area analysis recommended by the EPA, no areas near the project are simulated to exceed the 75 ppb ozone standard with the implementation of the Proposed Action. The maximum predicted incremental impact from the Proposed Action with ACEPMs would be 0.4 ppb (Table 4-184). Gasco's application of ACEPMs would result in a 33% decrease in potential incremental project impacts, reducing potential ozone impacts from

0.6 ppb (without ACEPMs) to 0.4 ppb. For the Proposed Action, the areas of maximum ozone impact are predicted to remain below the 75 ppb ozone standard. Furthermore, no areas currently in attainment of the ozone standard would exceed the standard under the Proposed Action.

Table 4-184. Summary of Proposed Action Maximum Predicted Ozone Impacts (parts per billion)

Proposed Action Maximum Potential Ozone Impact Without ACEPMs	Proposed Action Maximum Potential Ozone Impact With ACEPMs	Difference in Maximum Potential Ozone Impacts as a Result of the Application of ACEPMs	Emission Reductions Associated with the ACEPMs
0.6	0.4	0.2	-853 tpy NO_x -11,249 tpy VOC

Future compliance with the NAAQS for ozone will be dependent on the review EPA is currently conducting on the appropriate concentration for both the primary and secondary standard for ozone. A reduction in the ambient standard for ozone could cause other areas in and near the project to show modeled exceedances of any new standard. Because EPA has not completed its review of the ozone NAAQS, it is premature at this time to speculate on what impact that review will have on compliance with the standard; however, once (or if) a new standard is promulgated, the project will be reviewed for compliance with the new standard under the adaptive management strategy outlined in Section 4.2.1.2.2 and Section 4.18.3.1.7.2.

In a separate analysis, the Independent Petroleum Association of Mountain States (IPAMS), in cooperation with oil and gas operators in the Uinta Basin, the BLM, and other regulatory agencies, conducted the Uinta Basin Air Quality Study (UBAQS). This study was used to estimate changes to air quality and AQRV within the Uinta Basin that may result from future industrial activity, including oil and gas development (IPAMS 2009). Data used as input for the UBAQS consisted of the most complete, accurate, and current emissions and meteorological data available at the time. Emissions data included the WRAP Phases II and III inventories for oil and gas sources in addition to other non-oil and gas emissions sources. Scaling factors, based on expected rates of development, were applied to the baseline emissions 2006 inventory, and "on-the-books" regulations were applied to the uncontrolled 2012 emissions projections to generate the final 2012 emissions projections by county for the six-county focus area of the UBAQS that comprises the Uinta Basin.

The UBAQS model results indicate that average ambient concentrations of criteria pollutants will remain below the NAAQS within the six-county Uinta Basin area. Specifically, the UBAQS results estimate that the Uinta Basin would be in attainment of the eight-hour ozone NAAQS for 2012 (IPAMS 2009). In terms of cumulative effects from the project, the Proposed Action is within the modeled scope of projected development, and as such, would not be expected to violate, or otherwise contribute to any violation, of any applicable air quality standard; nor would it be expected to contribute to any projected future potential exceedance of any applicable air quality standards.

spacing of the wells will vary according to the geologic characteristics of the formation being developed; the densest spacing expected is one well pad per 40 acres.

GASCO Energy, Inc. (GASCO) proposes the following primary components for development under the Proposed Action:

- Up to 1,522 natural gas wells from 1,522 pads over a 15 year development period, 45 year life of project (LOP);
- Up to 10 drilling rigs operating year round;
- Up to 7,825 acres short-term surface disturbance (wells, access roads, pipelines, compressor stations);
- 30 evaporative ponds with a 2,700-hp generator; and
- Approximately 21,325 compression horsepower would be added to the existing system, for a total of 27,940 horsepower (hp) within the Project Area. Table 2-1 shows the summary of the emissions inventory for the Proposed Action.

Table 2-1. GASCO Annual Emissions for the Proposed Action

Pollutant	Project Emissions (tons/year)		Total Emissions [a] (tons/year)
	Well Development	Project Production	
Criteria Pollutants & VOC			
NO_x	1,303	628	1,931
CO	422	380	802
VOC	103	2,241 [c]	2,574 [c]
SO_2	23.2	1.08	24
PM_{10}	4,079	2,887	6,966
$PM_{2.5}$	434	318	752
Hazardous Air Pollutants			
Benzene	0.62	20.5 [c]	21 [c]
Toluene	1.06	42.9 [c]	44 [c]
Ethylbenzene	0.04	2.2 [c]	2.2 [c]
Xylene	0.55	29.7 [c]	30 [c]
n-Hexane	1.21	33	34
Formaldehyde	0.44	11.3	12
Acetaldehyde	3.34×10^{-03}	4.01	4.0
Acrolein	1.04×10^{-03}	1.08	1.1
Methanol	0	786 [c]	786 [c]
1,1,2,2-Tetrachloroethane	0	0.02	2×10^{-02}
1,1,2-Trichloroethane	0	0.02	2×10^{-02}
1,3-Dichloropropene	0	0.01	1×10^{-02}
1,3-Butadiene	1.34×10^{-04}	0.13	0.1
Carbon Tetrachloride	0	0.02	2×10^{-02}
Dichlorobenzene	0	3.10×10^{-03}	3×10^{-03}
Ethylene Dibromide	0	0.02	2×10^{-02}
Methylene Chloride	0	0.01	8×10^{-03}
Naphthalene	0.02	0.04	5×10^{-02}
Vinyl Chloride	0	7.15×10^{-03}	7×10^{-03}
Benzo(b)fluoranthene [b]	0	9.82×10^{-05}	1×10^{-04}
Chrysene [b]	0	3.37×10^{-04}	3×10^{-04}
Total HAPs	4.14	928 [c]	932 [c]

- High-pressure lines would be made of steel and buried.
- All lines will be co-located in access road rights-of-way except where safety or resource concerns or mitigation measures require alternate placement. Pipelines will therefore cause little or no additional surface disturbance.

- All mitigation, monitoring and best management practices in Appendix A of this ROD are also part of the Selected Alternative.

The Selected Alternative also includes the following modifications to Alternative 4:

- A maximum of 356 new wells will be drilled. The Operator's original MDP estimated that up to 400 wells would be needed in a full field development scenario, and this figure was used for cumulative effects analyses in the FEIS. However, since receiving the Operator's proposed MDP 44 new wells have been approved in separate NEPA decisions. Therefore only the remaining 356 wells are included in the Selected Alternative.
- Activities in IRAs require approval from the Secretary of Agriculture prior to implementation. On February 17, 2012, Secretary Vilsak approved a phased approach to the implementation of the project within IRAs. This phased approach would be implemented in the following manner:
  - Phase A would be implemented immediately within the confines of this decision. In this initial phase, development of the following areas would be allowed to occur (subject to the review process in Section 9.0 of this ROD):
    - The portion of the Right Fork Antelope Canyon IRA within Township 6S, Range 4W, Sections 4, 5, 7, 8, and 17.
    - All portions of the Cottonwood IRA that are within the project area.
  - The Secretary's decision re-delegated to the Under Secretary the authority to review and approve subsequent phases of the Berry Petroleum Master Development Plan. This re-delegation would allow development in Phases B and C to proceed once approved by the Under Secretary. No additional NEPA analysis would be required, unless significant changed conditions have occurred on the landscape or new information becomes available, such as changes in management direction or new technology that would allow reduced environmental impact. The new conditions or information will need to be evaluated to see if additional analysis and updating of the FEIS or ROD is required.
  - The Operator has the option of initiating either Phase B or Phase C next, depending upon results of Phase A development or other business considerations.
    - Phase B consists of the remainder of the Right Fork of Antelope Canyon IRA within the project area.
    - Phase C consists of all portions of the Sowers Canyon East IRA within the project area.

temperatures and intense solar radiation increase emissions of ozone precursors and favor the photochemical reactions that form ozone. As a result, ozone is generally known as a summertime air pollutant. However, recent winter ozone levels have exceeded the 8-hour ozone standard in Sublette County in southwestern Wyoming and indicate that ozone can be a year-round air quality issue. High winter ozone has also been observed in the Uintah Basin. In 2010, the 4th highest daily maximum 8-hour ozone values at the Ouray and Redwash monitors in Uintah County were 117 parts per billion (ppb) and 95 ppb, respectively. High 8-hour average ozone values were observed again during the winter of 2011. The mechanisms for ozone formation under wintertime conditions are not well understood, and this is currently an active area of research. Ozone can be transported great distances and therefore contributes to air pollution issues on a regional scale. Primary health effects from ozone exposure range from breathing difficulty to permanent lung damage. Ground-level ozone also contributes to plant and ecosystem damage (EPA 2009).

Under the PSD provisions of the Clean Air Act (CAA), incremental increases of specific pollutant concentrations are limited above a legally defined baseline level. Many national parks and wilderness areas are designated as PSD Class I. The PSD program protects air quality within Class I areas by allowing only slight incremental increases in pollutant concentrations. Areas of the state not designated as PSD Class I are classified as Class II. For Class II areas, greater incremental increases in ambient pollutant concentrations are allowed as a result of controlled growth. The PSD increments for Class I and Class II areas are presented in Table 3-4.

The location of the project in northeastern Utah required the examination of project and cumulative source impacts in southwest Wyoming, western Colorado, and most of Utah. The analysis area includes the area surrounding the proposed Project Area and all or a portion of the Maroon Bells-Snowmass, West Elk, High Uinta, Holy Cross, Raggeds, Hunter Frying Pan, and Flat Tops Wilderness Areas; the Dinosaur and Colorado National Monuments; the Bryce Canyon, Capitol Reef, Canyonlands, Arches, and Black Canyon of the Gunnison National Parks as well as the Flaming Gorge National Recreation Area and the Brown Park National Wildlife Refuge. The Project Area location and all Class I areas within a 300-kilometer (km) radius are shown in Figure 3-6.

3.2.1.3.2 Hazardous Air Pollutants

Hazardous air pollutants (HAPs) are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental impacts. The EPA has classified 187 air pollutants as HAPs. Examples of listed HAPs associated with the oil and gas industry include formaldehyde (HCHO); benzene, toluene, ethylbenzene, isomers of xylene (BTEX) compounds; and normal-hexane (n-hexane).

The CAA requires the EPA to regulate emissions of toxic air pollutants from a published list of industrial sources referred to as "source categories." As required under the CAA, EPA has developed a list of source categories that must meet control technology requirements for these toxic air pollutants. Under Section 112(d) of the CAA, the EPA is required to develop regulations establishing national emission standards for hazardous air

Table 3-15 Effects of Mitigation Measures on Compressor Station Emissions

	Production Emissions per Compressor Station (tons/year)																		
Mitigation Measures	**NOx**	**SO_2**	**CO**	**VOCs**	**PM_{10}**	**$PM_{2.5}$**	**PM filt**	**PM cond**	**PMC**	**PMF**	**EC**	**SOA**	**HCHO**	**Benzene**	**Toluene**	**Ethyl-Benzene**	**Xylene**	**N-Hexane**	**CO_2**	**CH_4**
Without Mitigation	28.24	0.00	29.73	66.72	0.66	0.66	0.01	0.65	0.00	0.00	0.01	0.65	3.80	1.20	0.88	0.03	0.35	1.81	7227.06	90.95
With controls on dehydrators & condensate tanks, secondary control on engines	12.08	0.00	8.63	11.21	0.66	0.66	0.01	0.65	0.00	0.00	0.01	0.65	3.80	0.06	0.04	0.00	0.02	0.09	7227.00	82.57
% Reduction	**57.22**	**0.00**	**70.97**	**83.19**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**95.00**	**95.00**	**94.20**	**95.00**	**95.00**	**0.00**	**9.22**
With controls on dehydrators & condensate tanks, secondary control on engines, three phase separators	12.08	0.00	8.63	10.22	0.66	0.66	0.01	0.65	0.00	0.00	0.01	0.65	3.80	0.04	0.03	0.00	0.01	0.07	7227.00	82.43
% Reduction	**57.22**	**0.00**	**70.97**	**84.68**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**96.47**	**96.51**	**95.89**	**96.32**	**96.17**	**0.00**	**9.37**

Table 3-16 Total Project Emissions during the Peak Emissions Year

	Total Emissions in Peak Emissions Year (tons/year)																			
Mitigation Measures	**NOx**	**SO_2**	**CO**	**VOCs**	**PM_{10}**	**$PM_{2.5}$**	**PM filt**	**PM cond**	**PMC**	**PMF**	**EC**	**SOA**	**HCHO**	**Benzene**	**Toluene**	**Ethyl-Benzene**	**Xylene**	**N-Hexane**	**CO_2**	**CH_4**
Without mitigation	611	1	512	3212	453	58	5	10	395	44	5	10	22	17	185	16	109	53	118503	1134
With mitigation measures except three phase separators	189	1	428	2866	453	58	5	10	395	44	5	19	17	12	182	16	107	47	118503	1043
% Reduction	**69.05**	**0.00**	**16.48**	**10.75**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**22.57**	**28.80**	**1.88**	**0.84**	**1.26**	**12.88**	**0.00**	**7.95**
With mitigation measures including three phase separators	189	1	428	2862	453	58	5	10	395	44	5	10	17	12	182	16	107	46	118503	1043
% Reduction	**69.05**	**0.00**	**16.48**	**10.87**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**22.57**	**29.21**	**1.91**	**0.86**	**1.28**	**13.04**	**0.00**	**8.00**

Submittal #	Comment #	Organization	Last Name	Resource Category	Comment Text	Response to Comment
					from Canyonlands National Park, which is the nearest site where validated data can currently be obtained.	
007	45	EPA	Svoboda	AQ	Regarding the discussion of ozone (section 3.2.2.3.5 under Environmental Consequences?), EPA must object to some of the language used in the Draft EIS. EPA does not agree the "quantitative ozone modeling is not appropriate for this scale of development" as is suggested on pg. 70. The potential for impacts from oil and gas development does not depend upon the number of wells alone. Many factors, including existing ambient air conditions, density of development, pace of development, proximity of sensitive areas, and emission reduction measures implemented during development and production, are relevant to whether a project may have potential for air quality impacts. A 400 well project does have potential to contribute to significant impacts to ambient ozone concentrations. For the South Unit Project, EPA did work with the Forest Service during the scoping phase to recommend appropriate mitigation measures to minimize ozone impacts. Neither EPA nor the Forest Service was aware of the ozone conditions in the Uinta Basin during the scoping phase for this project. At that time, EPA agreed that aggressive mitigation and monitoring to minimize ozone impacts, combined with a qualitative ozone analysis could allow the Forest Service to reasonably conclude that no significant impact would occur due to this particular project. To address EPA's concerns regarding recent elevated measurements of ozone in the Uinta Basin, the Forest Service should strengthen the analysis of ozone impact in the Final EIS. Specifically, a table should be prepared that presents the overall ozone precursor (NOx and VOCs) emission reductions achieved fro the mitigation measures identified in Section	The ozone analysis has been updated taking into consideration your recommendations.

Submittal #	Comment #	Organization	Last Name	Resource Category	Comment Text	Response to Comment
					2.2.5. This table should clearly present, by source category, controlled and uncontrolled emissions. The table should also detail the total project controlled and uncontrolled emissions and associated emission reductions. These emission figures should be presented in a consistent form relevant for comparing to other emission sources, such as tons per year, and be made available for other future project cumulative ozone analysis work. The emissions table summary should be performed for each alternative for comparison purposes. Further, we recommend the Forest Service use the results of this calculation to more clearly explain in the Final EIS why the South Unit Project will not cause significant ozone impacts.	
007	46	EPA	Svoboda	AQ	Given recent ambient concentrations of ozone measured in the project area, which exceed the NAAQS, the EIS should identify the project' contribution to this serious problem.... If the project has potential to significantly contribute to ozone in the Uinta Basin, we recommend that ozone modeling be considered to more accurately quantify predicted contributions before proceeding to the Final EIS.	Following thorough consultation with state and federal agencies including EPA, Photochemical modeling was considered but not selected as an analysis tool for this EIS. However, since ozone is a concern, a conservative and preemptive mitigation and monitoring approach was selected in tandem with qualitative analysis. The EPA was intimately involved in assisting the USFS in developing the details of this approach to ensure it met their satisfaction.
007	47	EPA	Svoboda	AQ	We also note that, while the proposed list of required air quality mitigation measures is already more than commonly applied to oil and gas development projects, there are additional opportunities for VOC and NOx emissions reductions. These potential additional mitigation measures may include: Reducing pace of development; using Tier III or higher drilling rig engines; upgrading pump jack engines to meet all future New Source Performance Standards or electrifying pump jacks; installing a liquids gathering system for produced water and condensate fluids; using a Centralized Automation System to transmit information to a centralized location for monitoring and	Your recommendations have been noted.