WestJumpAQMS Study
Response to Comments by Air Quality Stakeholder Review
Document: Western Regional Air Partnership (WRAP) West-wide Jump-start Air Quality Modeling Study (WestJumpAQMS) Draft Final Report dated August, 2013
http://www.wrapair2.org/pdf/WestJumpAQMS_FinRpt_Draft3_Aug31_2013.pdf
Response-to-Comments Dated September 30, 2013

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Comments from EPA Region 8 Gail Tonnesen, July 26, 2013					
1	EPA R8	--	--	It would be very helpful if you can add the model ozone bias to the day specific source contribution pie charts. If that is not convenient, creating a text table with a summary of the MPE for each of the top ten days would be useful. I would like to see if we can use these results to select which days are included in the RRF and model attainment demonstration.	This is a good suggestion and for new spreadsheet displays for the source category-specific ozone modeling results we will add the observed ozone and model bias (i.e., Appendix I). Unfortunately, we don't have time or budget to go back to spreadsheets already developed and add this, but will when migrating the displays over to a web-based system on the 3SDW.
2	EPA R8	--	--	I'm not sure, but I think I saw some odd results with 24 hour PM2.5 around Salt Lake City, with the highest values to the west. It's possible the model has some summer wind events in the desert and is missing the high winter PM2.5 concentrations.	The WestJumpAQMS modeling platform was not tailored to simulate winter ozone and PM events that requires focused WRF cold pooling modeling that was not done as part of WestJumpAQMS.
3	EPA R8	--	--	Showing the absolute PSAT model results for PM2.5 would be very helpful, and it could help determine MATS is doing any weird distortions to the results.	Additional spreadsheets have been developed to show absolute PSAT results for annual and 10 highest model 24-hour $PM_{2.5}$ concentrations at monitoring sites.
4	EPA R8	--	--	The BC analysis is very interesting, but I think we will need to do this comparison again with the 2011 modeling, if resources are available. For 2011 we have more rural ozone sites in the intermountain west, so we might get a better understanding of the model performance for background/rural sites. It will be interesting to see the AM3 results. Hopefully AM3 will do better at improving background ozone performance on specific days (MOZART seems to be biased high on some days and biased low on other days). But given that AM3 has a large positive bias, it might be necessary to constrain the AM3 BC.	This is a good suggestion for the 3SAQS.
Comments from BLM NOC, Dave Maxwell, September 17, 2013					
1	BLM NOC	--	--	My comments are few. I will leave the air modeling comments to the experts. I focused on the overall organization and flow of the draft final report. Overall, I thought the report was well documented, logically organized, and generally followed our	Comment noted.

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				statement of work. Acronyms were defined and references thorough	
2	BLM NOC	--	--	Obviously, a lot of work over two years was compiled in the report. The graphics were plentiful and informative. The appendices were well documented. I believe managers without significant air quality experience and air quality specialists from stakeholder organizations would gain a lot of information from the document.	Comment noted.
3	BLM NOC	4.2.2	48	Page 48 - Figure 4-3. How recent is the IMPROVE visibility network site map	Figure was downloaded from the website as indicated in the Figure legend in 2012.
4	BLM NOC	4.2.2	49	Page 49 - Figure 4-4. The CASTNet site map is almost 6 years old. Is there a more recent map to include in the report?	Section is discussing ambient data for evaluating the WestJumpAQMS 2008 modeling platform so intent is to display maps representative of the monitoring network in operation in 2008. So map should be ~6 years old and not be updated for the current year.
5	BLM NOC	4.2.2	50	Page 50 - Figure 4-5. How recent is the NADP site map?	Map was downloaded from NADP website as indicated in figure legend in 2012. Intent was to give the reader an indication of the spatial coverage during the 2008 modeling year.
6	BLM NOC	4.2.2	46-50	Glad that the web sites for IMPROVE, CASTNet and NADP were included.	Comment noted.
7	BLM NOC	--	--	Perhaps a list of those that performed the work and prepared the report (with affiliations) could be provided to give credit to where it is due. Just a thought	This is a good comment. We added a section at the end of Chapter 1 that lists the key participants in the three modeling centers (ENVIRON, Alpine and UNC) and at WRAP that performed the work.
Comment from BLM New Mexico State Office, Mary Uhl, September 17, 2013					
1	BLM NMSO	--	--	The draft and appendices look great. I like the interactive appendices; lots of data and I haven't even begun to mine it, but glad it is there. This will be a great resource for all the western air resource managers.	Comment noted.
2	BLM NMSO	1.1	2	p.2, paragraph 3--seems like the second sentence is incomplete	Sentence edited.
3	BLM NMSO	1.2.3	11	p. 11, paragraph 2--"use of a ...resulted" should be "resulting"	Typo corrected.
4	BLM NMSO	1.2.3	11	p. 11, paragraph 2--"combustion so are buoyant" should have a comma after combustion	Typo corrected.
5	BLM NMSO	3.4.1	34	p.34--CDPHE should =Colorado Department of Public Health and Environment	Typo corrected.

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6	BLM NMSO	3.4.1	33	p.33--oil and gas emissions--could mention a bit here about how double-counting of emissions is avoided when inventorying permitted sources and area sources.	Added sentence to text to reflect this thought.
Comment from National Park Service, Air Quality Division, Pat Brewer, September 19, 2013					
1	NPS AQD	--	--	Thank you for the opportunity to comment on the WESTJump report. The source contribution results are very useful for evaluating ozone, PM2.5, haze, and N deposition in the western states. Documentation is thorough. Thank you.	Comment noted.
2	NPS AQD	7.1.1	127-128	Boundary Conditions: on pp 127-128, please explicitly state that the Boundary Conditions for the 4 km modeling remains the area outside the 36 CONUS grid. Please also clarify the source region "Remaining" refers to all US states, east and west, other than UT, WY, CO, NM.	We added a sentence on page 129 reminding the reader that even though results are reported for the 4 km domain, the BCs are along the boundaries of the 36 km CONUS domain.
3	NPS AQD	7.1.1	129	Appendix H_DVO3_4kmDSAD_SrcCat: We did not find ozone results for Class I and Class II sites that were cited in the protocol for the 4 km source apportionment modeling in this pivot table. Can Class I with monitoring data for MATS tool be added to pivot table?	Due to the compressed schedule, we were unable to go back and update the electronic Appendices with these suggestions and still finish the study on time. However, as part of the 3SDW/3SAQS we plan to migrate the electronic Appendices capability to a web-based application at which time we will attempt to implement this and other comments in the display capabilities.
4	NPS AQD	7.1.2	131	Appendix I_10hiO3_4kmDSAD: We can't tell if Class I and II data are included. Is there a crosswalk to identify AQS site numbers for CASTNET and NPS sites? We are particularly interested in Dinosaur and Colorado Monument. MATS tool is not needed for max modeled ozone values in 2008?	The AQS monitoring site list was used for this extraction that should include NPS CASTNet sites in 2008. We will review this list and redo the data extraction if needed. We will also see whether we can develop a cross-walk site name list and even a spatial map of sites as we migrate this display capability to the 3SDW/3SAQS to the web-based application.
5	NPS AQD	--	--	I found map on Colorado's website that helps locate state monitors and includes AQS IDs: http://www.colorado.gov/airquality/aqi_map_ags.aspx. Is it feasible to provide equivalent map for sites included in these Appendices so policy users can visualize locations of sites by AQS ID numbers?	We will generate such maps when we port the spreadsheet displays over to the 3SDW website and also see whether we can implement access to the data at the monitoring site using an interactive map as is done on the WRAP TSS. A related issue is the implementation of a cross-walk station list file between the AIRS ID code and the common names of monitoring sites. We will reach out to the states to obtain such information.
6	NPS AQD	6.3	125	Appendix O_Vis_FLAG_IMPROVE_State: Pivot table demonstrates results for Hopi Pt, AZ. When I tried to import	One potential cause to problem with the spreadsheet not loading data for a new monitoring

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				data for ROMO1, I was unsuccessful. I could change state and site in pivot table, but the Import Data function did not appear to work. I tried copying data from the ROMO1 file into the GRCA1 spreadsheet but the new charts didn't look right. Can you verify that the pivot table is correctly linked to all the spreadsheets? Also Class I areas across US (outside 12 km) are provided in the zip file (and don't add much value) but Class II areas that were cited in the protocol are not included. Can these data be provided	site is not having the right folder directory in Cell B1. Another possibility is that your version of Excel disables macros (see NDDOH Comment#5). We could not reproduce this problem. If we can get a list of the sensitive Class II areas we can add them to the visual displays when they are ported over to the 3SDW website version of the source apportionment display tools.
7	NPS AQD	--	--	We would like the Class I and Class II ozone and vis data to be available to BLM and other users as well as NPS.	Information generated by WestJumpAQMS is available to all on a public website.
8	NPS AQD	--	--	We understand WESTJump is ending so would like to understand options to make data available	The WestJumpAQMS databases and outputs are being transferred to the 3SDW where they will be made available. All WestJumpAQMS data is being shipped to CSU/CIRA who are hosting the 3SDW and the last batch will arrive the first week of October, 2013.
Comments from Colorado Department of Health and Environment, Air Pollution Control Division, Kevin Briggs, September 17, 2013					
1	CDPHE APCD	1.1	2	Page 2, last paragraph, second to the last paragraph. I'm not sure how meaning full this sentence is along with Figure 1-2 since the PM2.5 NAAQS has already been set to 12 ug/m3.	Sentence has been re-worded and Figure 1-2 retained to show that there would be no new $PM_{2.5}$ nonattainment areas in the west U.S. under the new annual $PM_{2.5}$ NAAQS based on 2008-2010 measurements.
2	CDPHE APCD	1.2	4	"reflected" should be "reflecting"	Change made.
3	CDPHE APCD	1.2.2	5	Last sentence, change "will be" to "was" and eliminate "and will be reported on at a later date."	Sentence not changed because CMAQ vs. CAMx model performance comparison will be reported on at a later date. Added "on the 3SDW website" to end of sentence to make this clearer.
4	CDPHE APCD	1.2.3	6	Identified several typos on page 6.	Typos corrected.
5	CDPHE APCD	1.2.3	7	Last sentence on page. This last sentence is a long run on sentence that should be broken down into about three sentences.	Sentence split into two.
6	CDPHE APCD	1.2.6	13	How well does CB05 perform compared to CB06 over the O&G regions of the west?	As shown in the ozone model performance evaluation, in some states there was a slight overestimation of daily maximum 8-hour ozone concentrations over the O&G western states using CB05. Since CB6 is hotter, it increased this over-

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					prediction tendency a little worsening ozone model performance.
7	CDPHE APCD	1.2.7		When will the comparison of CAMx and CMAQ model performance be available?	The comparison of CMAQ and CAMx model performance will be available on the 3SDW website in the Fall 2013.
8	CDPHE APCD	3.1	28	Cross-out on blank page.	Not sure what this comment refers to since no blank page in our document.
9	CDPHE APCD	3.1	29	Could you elaborate further? Does CAMx/CMAQ have an overestimation bias in the WUSA when using CB6?	See CDPHE APCD Comment#6 for elaboration of CB05 and CB6 chemistry ozone model performance issue. Added sentence to note that CB6 is undergoing revisions.
10	CDPHE APCD	3.9	37	Cross-out on blank page.	Again, not sure what this comment refers to since no blank page in our document.
11	CDPHE APCD	4.1	42	Cross-out on blank page.	See comment above..
12	CDPHE APCD	4.2.2	47	Cross-out on blank page.	See comment above..
13	CDPHE APCD	--	--	Great job on WestJump! I thought the WestJump project turned out great and is documented well. Given the amount of data in the Appendices, such as the source apportionment data, it is hard to review all the data without actually digging through and using the data.	Comment noted.
14	CDPHE APCD	--	--	So I guess one of my comments is that a group of people needs to be convened to actually go through all of the model input and output data in fine detail. One of the first steps that could occur is to set up a user workgroup to review and determine what the proper use and how can the data be used. Maybe this workgroup should be part of the 3SDW.	This is a good comment and WRAP will consider it. The WestJumpAQMS project is over September 30, 2013 so such a workgroup would have to be convened under a different project with the 3SDW/3SAQS being the likely project.
15	CDPHE APCD	--	--	One recurring comment that came up during my review was the use of CB05 instead of CB6. Although CB6 doesn't perform well in the E US, it is unclear if CB6 or CB05 performs better in the west, and, especially over the O&G fields. Given that CB6 handles ethane explicitly, it would seem that CB6 parameterization would be the chemical mechanism of choice. Also, at the Western Modeling conference in June in Boulder, there was a general sense that Methane (and ethane) from O&G is so prevalent that these species should be modeled more explicitly rather than as a rate constant in the model. Using CB05 seems to be a step backward.	Ethane is an explicit species in both CB05 and CB6. The CB6 mechanism has been revised to CB6 R2D2 (Revision 2 Development 2) that is exhibiting better ozone model performance than the original CB6 tested in WestJumpAQMS. Excess methane will be added as a species to the CB6 R2D2 mechanism in the next version of CAMx.
Comments from North Dakota Department of Health, Rob White, September 17, 2013					

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1	NDDOH	--	--	We have a few comments on the Westjump Draft Final Report. We didn't have time to review everything in great depth. We focused mostly on the electronic appendices and our State-specific results. We felt that your past presentations and our past review covered much of the material in the report body, which all looked good. We did look somewhat at presentations of State-specific results, such as those on about pages 104 and 125.	Comment noted.
2	NDDOH	App F	--	In Appendix F, I was not certain that I was inputting correctly, but it appeared that there were State contributions that were negative, i.e., below the zero line.	As described in detail in the report in the discussion of Appendix L that also holds for Appendix F, using MATS to obtain source contributions to 24-hour $PM_{2.5}$ Design Values can result in different 98th percentile days in the base case and the base case with the source contributions removed. These different days will have different $PM_{2.5}$ species contributions so that negative contributions may be seen for some $PM_{2.5}$ species when looking at the differences in the 24-hour $PM_{2.5}$ Design Values. Although we haven't seen negative contributions for total $PM_{2.5}$ mass summing all of the species.
3	NDDOH	App L	--	In Appendix L, I believe the appendix is supposed to be presenting 24-hour PM2.5 results, but the labels in the plots say it is annual PM2.5.	Label have been fixed in Appendix L.
4	NDDOH	App N	--	In Appendix N, for the 2nd pie chart, you are prompted to change cells D1-D3, but the cells to change are actually N1-N3.	Appendix N cover page has been updated to reference cells in column N instead of column D.
5	NDDOH	App O	--	I had a problem getting Appendix O to work, but at some point I realized the "Security Warning" on the screen indicated the problem. By default, my version of Excel disables macros, active x content, and something else. I tried enabling those features, and then the "Import Data" button worked. It might be helpful to remind users they have to enable such content to get the import data button to work.	Added note to this effect to Appendix O Appendix description. This may explain difficulty NPS had with Appendix O (see NPS Comment#6).
6	NDDOH	App O	--	The displays in Appendix O are very useful. However, for example, at North Dakota's Lostwood monitoring site, we are aware there is a large contribution from power plants just north of the Canadian border in Saskatchewan. The displays including the 17 states are very useful, but it would help to have more information on the Canadian component. In page 125, it states that the background, which contains the Canadian component, is in cell L10. Knowing that is helpful, but it would	This comment will be passed on to the 3SDW/3SAQS study that is developing a web-based version of source apportionment displays.

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				be more useful if you could display that result in the actual charts. Could you at least put that numerical result in the charts, e.g., near the BC result? I know that the charts are getting quite crowded. It would be even better if a piece of the pie would display the background component, but just displaying the numerical result in the chart would be helpful.	
Comments from Wyoming Department of Environmental Quality, Air Quality Division, Ken Rairigh, September 17, 2013					
1	WDEQ AQD	1.2.3	11	The discussion on layer collapsing indicates the Continental Divide-Creston (CD-C) EIS meteorological modeling was conducted using WRF, which is not correct. The meteorological modeling for CD-C was conducted using the MM5 meteorological model.	Text corrected changing “WRF” to “MM5”.
2	WDEQ AQD	3.12	40	Should the emissions processing category Point Fires (No. 14) include the DEASCO3 inventory? We ask this as the report indicates that DEASCO3 has superseded the use of the SMARTFIRE inventory.	Text corrected changing “SMARTFIRE” to “DEASCO3” and adding comment to last column.
3	WDEQ AQD	3.12	40-41	The discussion of quality assurance/quality control of temporal allocation of emissions sources mentions that hourly-speciated (day-specific) emissions were used in the processing of several emission source categories. Is there a memorandum that discusses the methodology used to speciate these various emissions source categories on an hourly basis, including whether the use of hourly meteorology was used? This information may be beneficial to also be included in Table 3-3, as applicable.	Technical Memorandum No. 13 discusses these types of modeling parameters. The only source categories that used the hourly gridded WRF meteorological data were biogenics (temperature), windblown dust (wind speed) and DEASCO3 fires (PBL height for plume rise). Added text in “Processing Comment” in Table 3-3 indicating which source categories used the WRF hourly meteorological data.
4	WDEQ AQD	6.2.1	121	The labels provided in this pie chart plot (and in many other pie charts plots throughout the report) include labels that are unreadable. Similarly, the color scheme used in these plots includes similar colors with poor contrast (i.e., nearly identical shades of blue colors which are displayed next to each other), which make it difficult to actually understand or to pick out the specific modeled contribution. While it is recognized that there is a very large amount of information and specific data that are being shown or referred to in these plots, the depiction of the modeled contributions are important and should be shown in a manner which clearly displays the information, and is much easier for the reader to discern all of the specific modeled contributions. One possible suggestion would be to group all of the modeled contributions that are represented by labels which overlap and are unreadable, and show those contributions in a	The pie chart in Figure 6-5 has 85 slices so it will necessarily have slices with similar colors and slices with near zero source contributions making the labels overlap and unreadable. Since different sites will have different source categories with near zero concentrations, combining source categories for display cannot be generalized. Because the data are available in the Excel spreadsheet (Appendix E in this case) the user has access to all of the contributions as numbers in the spreadsheet. Furthermore, the user can customize plots using Excel functions to address the sentiments in this comment.

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				separate, but related graphic, which clearly provides the full suite of information being discussed in the report.	
5	WDEQ AQD	7	--	There are many types of graphics which are used in the report to discuss model performance for various pollutants (e.g., daily maximum 8-hour ozone); however, there were no time series plots provided. The time series plots are useful to compare diurnal fluctuations of ozone and other pollutants, and to compare the timing of peak modeled ozone to observations. If such time series plots were produced, please indicate where they are available.	Some time series were generated and examined but did not make it to the final report due to space limitations (see BP Comment#18). Some were presented in the three progress webinars. We will see whether the 3SDW/3SAQS can post such time series on the website since they are now using the WestJumpAQMS 2008 modeling platform.
Comments from BP, Doug Blewitt, September 18, 2013					
1	BP	--	--	The following presents BP comments on the WestJump AQMS Final Draft Report. These comments provide general suggestions that need to be addressed in more detail in future studies. At this point in time, BP does not expect major changes in the report to be made. Rather, these comments are intended to provide technical "lessons learned" regarding the conduct of such a study. Detailed comments are also presented by report section contained in a Word version of the report.	Authors appreciate the recognition that WestJumpAQMS project has limited time and resources to address all comments in the Final Report. Comments will be passed on to the 3SDW/3SAQS for consideration that are using the WestJumpAQMS 2008 modeling platform and developing a new 2011 platform.
2	BP	--	--	One of the major issues of concern is the accuracy of the modeled source receptor relationships developed as a result of this study for specific episodic events. BP has identified concerns with the accuracy of the meteorological modeling and the air quality modeling that should be considered in any future studies	Similar comment was raised by BP during one of the WestJumpAQMS project progress report webinars so we started adding observed values and model bias to new source apportionment spreadsheets so the user can assess the accuracy of the model for the source apportionment results. This approach will be further explored in the 3SDW/3SAQS.
3	BP	--	--	These comments are not intended to diminish the importance of the WestJump results but rather that the conclusions reached need to be placed in proper perspective (relative impacts rather than absolute impacts).	Comment noted. WestJumpAQMS attempted to present both the absolute as well as relative (i.e., through MATS) impacts of the source apportionment modeling results.
4	BP	2	--	The accuracy of meteorological modeling is critical in evaluating source receptor relationships in the CAMx model. The accuracy of the WRF model in identifying source culpability or source apportionment impacts from distant sources at a specific location for a specific episode is critical (short term model performance) and has not been evaluated to the extent that is necessary to draw firm conclusions. Uncertainty in modeled wind direction and wind speed can have a pronounced effect on which sources are actually impacting a given receptor compared	Agree. Since WestJumpAQMS was modeling large source regions (e.g., emissions from entire states) that somewhat mitigates some of these uncertainties as compared to modeling a single source. To evaluate such source-receptor relationships requires atmospheric tracer test field experiment data that is rarely collected. Although it is encouraging that EPA's evaluation of 6 Long Range

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				to what the model is estimating. The more distant the sources, the more uncertainty is introduced into the air quality modeled source apportionment results.	Transport (LRT) models using three tracer test field experiments found CAMx to be consistently the best performing LRT model (http://www.epa.gov/ttn/scram/reports/EPA-454_R-12-003.pdf).
5	BP	2	--	Uncertainties in predicted wind speed, temperature, precipitation and relative humidity can also have a pronounced effect on concentrations and reaction times of secondary pollutants	Comment noted.
6	BP	2	--	In the WestJump AQMS, the performance of the WRF meteorological modeling was consistent with previous applications of WRF. However, it is difficult to determine the accuracy of modeled meteorological parameters for a specific episode which is critical in the analyses of source apportionment results.	The WestJumpAQMS 2008 WRF model evaluation was done monthly by modeling domain, by state and even down to the individual monitoring site for sites in the 4 km IMWD. Performing a WRF evaluation for every episode in 2008 across the western U.S. is an unachievable objective. Perhaps specific episodes can be identified for such an evaluation under the 3SDW/3SAQS.
7	BP	2	--	The undefined uncertainty of the accuracy of WRF is not meant to diminish the importance of the results for the WestJump AQMS study. Instead, it means that results should be viewed in a relative nature rather than an absolute sense.	See response to BP Comment#3.
8	BP	2	--	Because of the importance of source apportionment in regional air quality analyses, it is important that improvements in evaluation of the accuracy of meteorological modeling be undertaken. The accuracy of meteorological modeling must be evaluated on a spatial and temporal basis of individual sites rather than an ensemble of averages of many monitoring locations over longer averaging times.	As noted above, the 2008 WRF simulation was evaluated down to the individual site spatially and by month in addition to ensemble averages over large domains (by state and modeling domain) and on an annual basis.
9	BP	2	--	One of the largest concerns is that the WRF model performance evaluation compared modeled meteorological conditions to actual observations done at a minimum time period of one month. Further, the comparison examined the difference in predicted and observed conditions averaged over a large geographical region.	Although the comment is correct that the WRF evaluation finest temporal scale was monthly it is incorrect on the spatial scale that went down to the individual monitoring site in the 4 km IMWD. It is unclear what temporal time period would be fine enough in this evaluation, weekly, daily, hourly, other?
10	BP	2	--	The Environ report presents a comparison of meteorological performance using a previously developed statistical matrix. Unfortunately, the model evaluation approach compares model performance over a large geographical region (a single state) and averages modeling results over a minimum of one month. Such an evaluation procedure does not address the critical	This comment has already been addressed above.

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				issue of how well the meteorological model performs in simulating flow for a critical air pollution episode at a single location. Establishing the accuracy of such meteorological flow from source regions to receptor regions is critical in defining air quality impacts over large geographical regions.	
11	BP	2	--	The draft report indicates that the mean error in wind direction over the domain was approximately 40 degrees and the bias was 5 degrees. The average error in wind speed was 2 m/s and the bias was -0.5 m/s. These data do not provide any indication regarding the accuracy of WRF for a specific episode.	This comment has already been addressed.
12	BP	2	--	Another concern is the amount of terrain smoothing that was performed when terrain was averaged over a 4, 12 or 36 km grid square. Many of the receptor locations are located in very complex terrain and terrain smoothing may lessen the effects of meteorological conditions in such areas. The report should present information on the amount of terrain smoothing that occurred.	The amount of terrain smoothing used in the WRF modeling is described in the "Topographic Inputs" paragraph in Section 2.2 on page 15 of the Draft Final Report.
13	BP	--	--	When reviewing the source apportionment results for critical episodes, it is recommended that back trajectory analyses also be conducted by the user of the WestJump results to confirm that the actual source region is being represented in the model	Back trajectory follows the path of a single particle within a 3-D wind field backwards in time. It is a useful tool for visualizing potential upwind source regions. However, it can also be misleading because it is following a single air parcel. The 3-D photochemical grid model provides a much more complete description of pollutant transport than a back trajectory, subject to the uncertainties in the meteorological fields discussed previously.
14	BP	3.4.1	34	For Colorado Basins, the permitted O&G 2008 emissions were based on the APEN database[1] rather than projected from the WRAP Phase III 2006 O&G emissions. In addition, the Colorado Department of Health and Development (CDPHE) has determined that not all condensate flash VOC emissions that were assumed to be controlled 95% by flares make it to the flare and some of them are instead vented to the atmosphere. Thus, CDPHE has introduced the concept of a Capture Efficiency (CE) for condensate flare control that assumes only 75% of the condensate Flash VOC emissions are actually controlled by the flare and the other 25% is released directly to the atmosphere.	1. NOAA atmospheric measurements, RAQC reconciliation between VOC receptor modeling and emissions inventory and optical gas imaging cameras have all identified more VOC emissions coming off of condensate tanks than in the old inventory. In addition, inspectors have observed leakage out of thief hatches when condensate tank flashing occurs. Thus, the evidence that in the past some condensate tank flash emissions are vented to the

1 http://www.colorado.gov/cs/Satellite/CDPHE-AP/CBON/1251596800194

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				The CDPHE 75% CE assumption was adopted in the WestJumpAQMS 2008 base case O&G emissions in Colorado. Several issues need to be stated regarding the CDPHE assumptions: 1. There is no data to support the position that 25 % of the flash gas is not reaching the flare. 2. Flare efficiency to control tank flashing is in the range of 98 to 99+ % (based on actual source testing). 3. The regulatory limit of 95% was imposed as a basin average that accounts for some fugitive emissions associated with routing the flash gas to the flare. 4. Recent top down emission estimates suggesting additional fugitive emissions associated with flash gas have large technical uncertainties.	atmosphere on occasion is overwhelming. Whether 25% is the correct number is debatable. 2. WestJumpAQMS followed the recommendations from the CDPHE and assumed a 95% VOC control efficiency from flares. However, it should be noted that the difference between 95% and 99% flare control efficiency would make an approximately 10% difference in flash VOC emissions using a 25% CE value. 3. Comment noted. 4. Comment noted.
15	BP	4	--	It is recommended that model performance be evaluated on an individual site basis as opposed to plotting all monitoring sites on a single graph. Figure 1 is from the Environ CAMx model performance evaluation that was conducted for the API PRB project. This plot presents a time series evaluation, predicted versus observed O3 concentrations and the frequency distribution of predicted and observed O3 concentrations. These results are presented for each individual site. Presenting modeling evaluations in this manner provides a more complete picture of model accuracy. This is important to do for CASTNet O3 monitors as it will identify how well the monitor addresses STE events. Individual monitor performance should also be done for the AIRS network because of differing amounts of NOx influence on O3 formation in both observations and model predictions.	Figure 1 from the BP comments is presented at the end of this Response-to-Comments document. There are thousands of ozone monitoring within the WestJumpAQMS 36/12/4 km domain making evaluation at individual sites problematic. Performing such an analysis for just CASTNet sites in the western U.S. would be a more tractable exercise and in fact some of the state-specific CASTNet scatter plots of predicted and observed daily maximum 8-hour ozone concentrations in Section 4.4 of the Final Report does present ozone model performance at some individual monitors, such as Glacier (MT), Big Basin (NV) and Canyonlands (UT). This comment will be passed on to the 3SDW/3SAQS.
16	BP	4.4	--	In the June 2013 WestJump update slides, the statement is made that the performance of the model for CASTNet sites was adversely influenced by a STE event identified by the model but did not exist in the monitoring data. The converse is also very important. How did the model perform when STE events were measured? BP experience with the API PRB project (conducted by Environ) was that at sites like Gothic, CO, CAMx under predicted the magnitude of STE events.	The commenter is correct that there were instances of modeled STE events that were not observed and vice versa. The MOZART vs. GEOS-Chem BC sensitivity tests went into more details on modeled STE ozone events that was not in the Final Report but was discussed during one of the progress report webinars and presented at the July 2013 Boulder Workshop (http://www.wrapair2.org/pdf/Morris_MOZART-GEOS_WestJumpAQMS_Jul10_2013_Draft1.pdf).

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					We agree that this is an area that deserves more analysis.
17	BP	4.4	--	Also apparent in Figure 1 is that CAMx is under predicting observed O3 at the upper end of the frequency distribution. This is not consistent with the results for WestJump. The model evaluation performed in Figure 1 was performed for 2006 meteorology and the WestJump evaluation was done for 2008 meteorology. An investigation is needed to understand these differences in model performance. One important aspect is to separate the model performance results by site.	The comparison of CAMx model performance for the API 2006 modeling and WestJumpAQMS 2008 modeling is outside of the WestJumpAQMS scope of work.
18	BP	4.5	--	Different model performance statistics were used to evaluate CAMx model performance for PM compared to O3. For PM the model performance was based on fractional bias and fractional error (both expressed as a %). This was done as an average of all monitoring sites in the domain averaged over a month. Model performance evaluated in this context does not describe model accuracy for an episode at a specific monitor.	The comment is incorrect in that fractional bias and error was used to evaluate both ozone (Section 4.4) and PM (section 4.5) model performance. The ozone model performance was also evaluated using the normalized mean bias and error. In the report PM model performance was just presented across the WESTUS domain. We did calculate monthly model performance statistics and generate scatter plots and time series plots for all ozone, PM and related species as follows: • Monthly averaged across all sites in the WESTUS domain (presented in Final Report). • Daily averaged across all sites in the WESTUS domain. • Monthly at each individual site in the WESTUS domain. We considered including these individual site and daily model performance results as an electronic Appendix but they consisted of 6.7 Gb of data and 330,029 individual plots. Distribution of these data via web-site tool would be more appropriate than an Appendix zipped file and will be considered as part of the 3SDW/3SAQS.
19	BP	4,5	--	In addition, this model performance evaluation approach does not provide any information on model performance over the entire frequency distribution of monitoring data. Examining model performance at the upper end of the frequency	Examining 24-hour $PM_{2.5}$ performance for the upper end of the frequency distribution is a good suggestion and will be passed on to the 3SDW/3SAQS. Note that the WestJumpAQMS was

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				distribution is critical because the NAAQS are based on extreme concentrations.	not a NAAQS compliance study.
20	BP	4.5	--	More weight should be given to the fractional bias performance matrix because it indicates if the model is over or under predicting the observations. The fractional error only indicates the absolute value of the error.	We disagree and believe both fractional bias and error should be examined together. You can have poor model performance with low fractional bias due to under- and over-predictions cancelling each out but the error would be high.
21	BP	App B	--	BP recommends that Appendix B be modified so that the total contribution that is controllable through a U.S. regulatory program be identified. This should be expressed as a concentration and a percentage of totals. The following is an illustration for the example given in the report.	The user can modify the spreadsheet to make these types of calculations, as BP did. There are some arguments about what is controllable by U.S. regulations and what isn't. For example, Rx burns are controllable in theory, but if controlled that could increase WF emissions. U.S. controls on mobile sources affect Canada mobile sources, etc. We will leave it up to the user to modify the spreadsheets to make these kinds of custom calculations.
22	BP	WRF	--	BP has previously submitted comments on the WRF model performance evaluation and those comments are still appropriate and are being resubmitted as an appendix to these comments.	The response to these comments are contained in the February 29, 2012 Response-to-Comments document to the draft WRF Application/Evaluation report (http://www.wrapair2.org/pdf/Response-to-Comments_document_for_WestJumpAQMS_2008_Annual_WRF_Draft_Report_February29_2012.pdf).
23	BP	1	--	BP submitted edited versions of Chapters of the draft report that also included comments.	Some of the edits were accepted in the final report. Others were not. Most were fairly minor. Major edits not accepted and comments in the MSWORD files submitted by BP are addressed below.
24	BP	1.1	2	Check this (referring to confirm that the secondary $PM_{2.5}$ NAAQS is at 15 µg/m^3 annual and 35 µg/m^3 24-hour).	We confirmed that these are the secondary $PM_{2.5}$ NAAQS (http://www.epa.gov/pm/2012/decfsoverview.pdf).
25	BP	1.2.2	5	At this point in time, I see no benefit in including information on CMAQ model performance that is not completed. I suggest that we delete all references to CMAQ	The CMAQ work was done as part of the WestJumpAQMS so its mention is retained in the Final Report.
26	BP	1.2.3	9	Add Savage Run in WY (referring to Figure 1-4b).	The NPS generated Figure 1-4b so we cannot update it. Instead added a note to the legend of Figure 1-4b that Savage Run is another sensitive Class II area in WY that needs to be considered.
27	BP	1.2.3	10	Provide names of the Class I Areas (referring to Figure 1-5).	Names for most of the Class I areas have already been provided in Figure 1-4b on the previous page.
28	BP	1.2.9	14	Please provide more details on 3SDW. At a minimum there should be a reference.	3SDW has not gone on-line yet so no reference is available. It should be on-line by the end of 2013

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					and we will make sure that the WestJumpAQMS website has a link to it.
29	BP	2.1	15	The accuracy of meteorological modeling is critical in evaluating source culpability or source apportionment impacts from distance sources at a specific location for a specific episode. Uncertainty in modeled wind direction and wind speed can have a pronounced effect which sources are actually impacting a given receptor compared to what the model is estimating. The more distance the sources the more uncertainty is introduced into the air quality modeled source apportionment results. Uncertainties in predicted wind speed can also have a pronounced effect of concentrations and reaction times of secondary pollutants. In the WestJump AQMS, the performance of the WRF meteorological modeling was consistent with previous applications of WRF. However, it is difficult to determine the accuracy of modeled meteorological parameters for a specific episode which is critical for analyses of source apportionment results. The undefined uncertainty of the accuracy of WRF is not meant to diminish the importance of the results for the WestJumpAQMS study. It means that results should be viewed in a relative nature rather than an absolute sense. Because of the importance of source apportionment analyses in regional air quality analyses, it is important that improvements in evaluation of the accuracy meteorological modeling be undertaken. The accuracy of meteorological modeling must be evaluated on a spatial and temporal basis of individual sites rather than ensemble of averages of many monitoring locations over longer averaging times. When reviewing the source apportionment results, for critical episodes, it is recommended that back trajectory analyses also be conducted to confirm that the actual source region is being represented in the model.	BP comments were inserted as text within the body of the report at the beginning of Chapter 2. While these comments are well-informed opinions and may be correct, the WestJumpAQMS Final Report is intended to be a factual documentation of work completed in the Study. These opinions are noted and appreciated, but no changes to add text related to these opinions were adopted in the Final Report.
30	BP	2.2	15	What was the extent of terrain averaging over the various grid	The level of terrain averaging is defined by the grid

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				sizes? It would be helpful to add a figure on the actual (average) terrain that was used in the modeling. Terrain averaging has the potential for introducing additional error in the WRF simulations by smoothing complex terrain.	cell size, 36, 12 or 4 km. For example, the 4 km grid cell terrain was based on 30 second (~900 m) data. So the terrain heights in each 4 km grid cell were obtained by averaging ~20 30 second terrain heights.
31	BP	2.2	16	Were any data withheld for independent model evaluation? (in regards to observation data used in the WRF FDDA)	No. The intent was to obtain the best WRF solution possible so used all observed meteorological data for the observation nudging.
32	BP	3.0	27	Were lightning emissions considered?	From same page one of the bullets state: "Sea salt and lightning emissions were generated using the 2008 WRF model hourly gridded output."
33	BP	3.1	28	Projected to 2008? (referring to 2006 EC Canada emissions inventory)	No, the 2006 EC Canada emissions were used as is.
34	BP	3.4.1	34	Provide information of scaling factors used for each oil and gas source type. A table listing source type and scaling factor would be helpful for each basin.	More details on the projections of the WRAP Phase III 2006 oil and gas emissions to 2008 is provided in the four Technical Memorandums No. 4a, 4b, 4c and 4d on the WRAP website.
35	BP	3.4.1	34	Provide examples (referring to use of no additional controls when there are no new rules between 2006 and 2008).	See comment above.
36	BP	3.4.1	34	Several issues need to be stated regarding the CDPHE assumptions: 1. There is no data to support the position that 25 % of the flash gas is not reaching the flare. 2. Flare efficiency to control tank flashing is in the range of 98 to 99+ % (based on actual source testing[i]) 3. The regulatory limit of 95 % was imposed as a basin average that accounts for some fugitive emissions associated with routing the flash gas to the flare. 4. Recent top down emission estimates suggesting additional fugitive emissions associated with flash gas have large technical uncertainties.	BP inserted their comments directly in the text in Section 3.4.1. Our responses to these comments are given in BP Comment#14. These opinions were not included in the WestJumpAQMS Final Report that is trying to be a factual documentation of the study.
37	BP	4.2.2	45	I believe that the AQS monitoring network should be shown for the 4 km modeling domain.	Good suggestion. The only 4 km evaluation performed was for the 4 km CARMMS domain. So such figures will be generated as part of the CARMMS.
38	BP	4.2.2	49	Show a map indicating where the CASTNET O3 are located.	Figure 4-4 shows the locations of the CASTNet ozone and PM monitoring sites.
39	BP	4.2.2	50	Is there a reason model performance was not tested for deposition? While not a true observation this comparison is very	The CAMx 4 km modeling results were evaluated across the 4 km CARMMS domain for wet SO4,

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				important.	NO3 and NH4 deposition in Section 4.5.3. Dry deposition is not measured, but estimated using measured concentrations and a deposition model. Since we already evaluate the model predictions against the measured ambient concentrations we felt that the evaluation of the CAMx model against another model that used the ambient concentrations was not necessary.
40	BP	4.2.2	51	Reference other studies that have evaluated ozonesonde data. While these will be for a different year it does show that the modeling system can replicate these observations.	This does not provide information on how well the WestJumpAQMS 2008 CAMx simulation reproduces the 2008 ozonesonde measurements so such references were not included.
41	BP	4.4	55	I believe that it is inappropriate to lump all monitors into a single evaluation. Evaluations should be conducted on a monitoring site specific basis. This is important for both the AQS and CASTNet sites.	Although model evaluation at individual monitors can be useful, the custom of evaluating model performance across all ozone monitors in an airshed has been performed for over 30 years and the ozone model performance goals were developed for an ensemble evaluation. As discussed in BP Comment#18, individual monitor model performance was conducted but due to the number of monitors could not be included in the Final Report.
42	BP	4.5.3	82	I suspect that the under prediction in Feb and May is a result that the model is not representing STE events that were measured. This could also be true for the FRM network.	A sentence was added that the May ozone underestimation across the CASTNet sites may be due in part to failure of the model to fully capture STEs.
43	BP	5.3	96	I assume that the MATS analysis was only conducted for urban areas where there is sufficient monitors. The MATS analysis should be included in an appendix.	MATS analysis is done on a monitor-by-monitor basis so the sufficient number of monitors is one and it doesn't matter whether it is an urban or rural monitor. It is unclear what MATS analysis BP is requesting to be included in an Appendix.
44	BP	5.3.1	98	I assume these are essentially paired in time and space and this should be stated. The maximum contribution was for the same time period as the average DV. (referring to Table5-1a showing upwind state contribution to ozone Design Values in downwind states calculated using MATS).	These are paired in space. The MATS tool that uses the relative changes in the modeling results to scale the current year Design Value in the absence of a state's anthropogenic emissions was used to determine a state's contribution to the DV.
45	BP	5.3.1	98	I assume these are essentially paired in time and space and this should be stated. The maximum contribution was for the same time (referring to Table 5-1b that is like Table 5-1a above only	The AvgDV is the average of the 8-hour ozone DVs from 2006-2008, 2007-2009 and 2008-2010 whereas the MaxDv is the maximum of the same

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				for MaxDV instead of AvgDV).	three DVs. The MATS procedures uses modeling results near the monitor so are paired in space. MATS does not necessary do temporal pairing and since the AvgDV is based on ozone observations from non-model years (e.g., 2006-2007 and 2009-2010) temporal pairing for DVs is impossible.
46	BP	5.3.1	99	We need to place this discussion in perspective of time of impacts from adjacent states to maximum impacts at the receptor state. If these are not for the same time period the conclusions are very different than if they are.	These results are based on Design Value scaling using MATS. Don't understand comment.
47	BP	5.3.1	100	Need to add pairing to figures (referring to Figure 5-2 showing MATS results for four upwind state contributions to downwind states).	What pairing? These are MATS Design Value scaling results. Don't understand comment.
48	BP	5.4	102	Discuss pairing (referring to Appendix B spreadsheet that displays pie charts of ozone contributions at a monitor for the ten highest modeled daily maximum 8-hour ozone days)	The user selects a monitor and the user selects the day for display. The pairing seems pretty clear so no additional discussion is needed.
49	BP	5.4	102	Modify Appendix B to provide this information and add this type of information in the text where appropriate. "The contributions from sources that are controllable from a U.S. regulatory are 4.7 ppb (5.8%) and the non-controllable impacts through a U.S. regulatory program are 75.8 ppb (94.2%)."	Same as BP Comment#21.
50	BP	5.6	106	Need to discuss pairing of these data. i.e. 4th high for different source groups do not occur on the same days.	Added sentence to this paragraph discussing the temporal pairing as suggested.
51	BP	7.1.1	129	Provide date of occurrence in text and spreadsheet. (referring to the source contributions to the current year Design Values (DVCs) from MATS for the six monitoring sites in Figure 7-2).	The DVCs used in MATS are the average of three-years of 8-hour ozone Design Values (DVs) from 2006-2008, 2007-2009 and 2008-2010 (i.e., over 5-years). As a DV is the three-year average of the fourth highest daily maximum 8-hour ozone concentration then each DVC is associated with 5 dates of occurrence from 2006-2010. It would take a lot of work to look up these 5 dates for each monitor and add to spreadsheet and we don't see any benefits from doing this.
52	BP	7.1.2	131	Where is the day specific model performance presented? (referring to Appendix I spreadsheet with examples in Figure 7-3 on page 132).	The day specific model performance is in line 2 of the figure right above the pie chart,

(following Figure was submitted with BP comments)

Figure 1 Model Performance Examples for PRB Analyses