Appendix G
Multi-Criteria Integrated Resource Assessment (MIRA) for the 2009 Kansas City Ozone Designation Process

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Introduction

Multi-Criteria Integrated Resource Assessment (MIRA) is a new approach to environmental policy decision analysis developed by EPA Region III. Its purpose is to facilitate decision analysis through an improved understanding and interconnection between both the scientific data and the societal values that are present in all environmental policy questions. The MIRA process consists of nine major steps:

1. Define decision criteria;
2. Select the "problem set," which is the set of elements that are to be ranked using MIRA (e.g., the decision options or pollutant sources);
3. Gather the data needed for each criterion;
4. Index the data;
5. Weight the criteria;
6. Create an initial "decision set," which is a problem set whose elements are ranked on the basis of the data and criteria weighting;
7. Create many different decision sets for the initial problem set and modify that problem set if appropriate as learning occurs and additional options are discovered (iteration);
8. Conduct stakeholder deliberation; and
9. Make the final decision.

In the case of the Kansas City ozone designation process, the decision criteria and problem set are defined by the 2000 EPA guidance memo that describes the 11 criteria EPA has determined important for an ozone nonattainment designation. In Table G-1, the MIRA analysis KDHE has used and EPA criteria guidance are outlined with a direct comparison of how the two relate to each other.

Table G-1. Comparison of the 11 EPA guidance criteria and the KDHE MIRA analytical criteria.

EPA Guidance Memo (March 2000)	MIRA Analysis
1. Emissions and air quality in adjacent areas	1. VOC/NO_x (point, nonpoint, mobile) emissions and air quality estimates in all adjacent counties
2. Population density/urbanization	2. Population density/population in MSA
3. Air quality monitoring data	3. Air quality monitoring data for counties with monitors
4. Emission sources	4. VOC/NO_x (point, nonpoint, mobile) emissions for all areas
5. Traffic/commuting patterns	5. MSA, VMT, commute connectivity
6. Expected growth	6. VMT and population growth estimates
7. Meteorology	7. Meteorology considered in data for AQ modeling and in transport analysis
8. Geography/topography	8. Geography and topography considered in data for AQ modeling
9. Jurisdictional boundaries	9. County, MSA
10. Level of emissions controls	10. Control margin
11. Regional emissions reductions	11. NO_x SIP call modeling (relative reduction factors)

Using the MIRA tool, KDHE gathered the data needed for each criterion. The tool then allows for the indexing and weighting of the datasets, and finally leads to a learning process that informs the final decision of whether a county should be designated attainment or nonattainment.

Inputs

KDHE obtained the latest MIRA tool used for national ozone designations from EPA Region III. KDHE also obtained the last MIRA evaluation performed by EPA Region VII during the 2003 designation process. With these two previous ozone evaluations, KDHE updated the tool for the new ozone standard and prepared various decision sets to evaluate the 11 criteria in the 2000 EPA designation guidance. These various decision sets were then used as a learning process to help form the ozone nonattainment recommendation for the Kansas counties within the Kansas City MSA.

The primary weighting criteria the KDHE used in the final analysis are found in Table G-2. Secondary weighting are found in Table G-3. KDHE believes that this final weighting set is most applicable to the ozone designation for the Kansas City area. KDHE added the commute connectivity as one of the primary weighting criteria, while removing the NO_x SIP call criteria, which did not apply to Kansas.

Table G-2. Primary weighting criteria for KDHE's decision set.

Primary Level	Weight
AQ monitoring data	0.25
Emissions	0.30
Commute connectivity	0.10
Jurisdictional boundaries	0.15
Population	0.20

Several of the primary datasets have secondary weightings used to help form the final decision. For example, the air quality level includes as secondary weighting categories magnitude, uncertainty and attainment/nonattainment. The emissions and population categories also have secondary weightings. All of the weightings can be found in the MIRA spreadsheet. One of the notable weightings that deserve further discussion includes the secondary air quality weightings. Within this dataset the Department decided to put 85% of the weight on the magnitude of monitored values, 10% on the uncertainty of monitored values, and 5% on the attainment/nonattainment weighting. The Department believes this is justified because putting a high weight on just the nonattainment bright line of 76 ppb makes a very large impact on the ranking of monitors/counties that might only differ in their respective design values by 1 ppb. This became very apparent during the analysis when a new set of monitoring data became available, and certain monitors went from attainment to nonattainment. Uncertainty in air quality was also an issue with several counties not having monitors and relying upon krieged data. Therefore, the Department decided that the magnitudes of the monitored design values were much more

important weighting criteria than those relating to uncertainty or attainment/nonattainment.

Table G-3. Secondary weighting criteria for KDHE's decision set.

AIR QUALITY	Weight	Jurisdiction	Weight
Magnitude	0.85	CBSA or CMSA's	1
Uncertainty	0.1		
Attn / NonAttn	0.05		
EMISSIONS	**Weight**	**Magnitude**	**Weight**
Magnitude	0.7	NOx Emissions	0.6
Control Margin	0	VOC Emissions	0.4
Growth	0.3		
NOx Emissions	**Weight**	**VOC Emissions**	**Weight**
Total Emissions	0.5	Total Emissions	0.5
Emissions Density	0.5	Emissions Density	0.5
NOX Total Emissions	**Weight**	**VOC Total Emissions**	**Weight**
Point	0.33	Point	0.33
Area	0.33	Area	0.34
Mobile	0.34	Mobile	0.33
NOx Emissions Density	**Weight**	**VOC Emissions Density**	**Weight**
Point	0.25	Point	0.25
Area	0.4	Area	0.4
Mobile	0.35	Mobile	0.35
GROWTH	**Weight**	**Population**	**Weight**
VMT Growth	0.4	Total Population	0.5
Pop. Growth	0.6	Population Density	0.5

The commute connectivity was also an addition to the MIRA tool that did not exist in the versions of MIRA obtained from EPA. The commute connectivity category gives an indication of how many workers living in counties outside the current five-county maintenance area commute into these five counties on a daily basis. This category is an indication of the commuting patterns that connect surrounding counties to the current maintenance area. KDHE believes it is important to look at this connectivity, along with the total VMT in each individual county, and has therefore assigned a primary weighting of 10% to this category.

Another change the Department made to the EPA version of the MIRA tool was the transport of pollutants. The original tool was designed and implemented for counties included in the NO_x SIP call and OTAG transport regions. The State of Kansas is not subject to the NO_x SIP call nor is it in the OTAG region, thus the Department devised a more appropriate local transport metric for this designation analysis and did not include a regional transport calculation. For the local transport metric, the Department used the back trajectories for three starting times on days with ozone concentration > 75 ppb from Rocky Creek, the monitor with the highest design value in the Kansas City area. From the back trajectories was taken the count of the trajectories crossing each county in the MSA plus Douglas County, weighting this count by both the total emissions and distance from the county centroid to Rocky Creek monitor. A county close to Rocky Creek with very

few trajectories crossing it during high ozone days will have a very low local transport factor, while a county with many trajectories will have a higher transport factor, varying with both distance from the monitor and the ratio of emissions in that county to the total MSA emissions. These local transport metric values are then used to enhance the total emissions from a county by a factor from 1 to 2, depending on the value of the transport metric for the respective county being evaluated.

The remaining inputs used for MIRA were updated with the latest available data, such as population, VMT, emissions, etc. These county-level data can be found directly in the MIRA tool under the inputs tab. Ozone monitoring data was assigned to each county. If two or more ozone monitors existed in a county, the highest monitored reading in that county was assigned. For those counties without an ozone monitor, a krieged monitoring value was derived at the county centroid and assigned to the county. The ozone monitoring data assigned to each county is found in Table G-4. Krieged air quality values are highlighted yellow in the table.

Table G-4. MIRA inputs: County air quality monitoring assigned values.

County	2008 Air Quality	2007 Air Quality	2006 Air Quality	2005 Air Quality
	Annual 4th highest 8 hr ozone concentration (ppb)			
Douglas (KS)	64	73	81	73
Franklin (KS)	63	71	78	74
Johnson (KS)	62	71	76	81
Leavenworth (KS)	64	80	74	77
Linn (KS)	63	70	79	75
Miami (KS)	63	70	77	78
Wyandotte (KS)	61	73	81	79
Bates (MO)	64	71	78	78
Caldwell (MO)	66	72	87	78
Cass (MO)	66	72	78	81
Clay (MO)	69	89	87	87
Clinton (MO)	70	83	85	87
Jackson (MO)	65	74	85	82
Lafayette (MO)	64	71	85	79
Platte (MO)	66	83	80	86
Ray (MO)	65	71	89	79

Results

Table G-5 contains the ranking of the counties when applying the final criteria KDHE chose as described above. The rankings are in order from most to least nonattainment, and also include bins which give the reviewer an indication of which counties group together in the rankings. From the results, KDHE believes there is a clear break between Wyandotte County and the remaining Kansas counties included in this analysis. Douglas and Leavenworth are very close in the rankings but for differing reasons. Douglas is

ranked slightly higher than Leavenworth based on its connectivity and greater potential for local emissions transport during high ozone days in Kansas City, while Leavenworth is where it is in the ranking mainly because it's a downwind county receiving emissions and ozone from the Kansas City metropolitan area. Clearly all Kansas counties in bins 1-5 should be included as nonattainment counties.

Table G-5. Ranking of nonattainment based on selected MIRA weighting criteria.

	County *Ranked most to least nonattainment*	**Criteria Sum**	**Bin**
1	Jackson (MO)	5.89	1
2	Clay (MO)	5.70	2
3	Johnson (KS)	5.59	2
4	Platte (MO)	4.94	4
5	Wyandotte (KS)	4.77	5
6	Cass (MO)	4.26	7
7	Clinton (MO)	4.04	7
8	Douglas (KS)	3.99	7
9	Leavenworth (KS)	3.95	8
10	Lafayette (MO)	3.63	9
11	Miami (KS)	3.63	9
12	Ray (MO)	3.34	9
13	Franklin (KS)	3.29	10
14	Caldwell (MO)	3.19	10
15	Linn (KS)	3.08	10
16	Bates (MO)	3.02	10

Many different scenarios were evaluated while performing the analysis within the MIRA tool. Many of these different analyses are included in the "Preferences" tab within the tool. Everything from 100% weightings of primary level criteria to various secondary level weightings were evaluated. During the analyses the air quality became one of the more interesting datasets to evaluate, as the addition of the 2008 ozone data changed both the magnitude and nonattainment readings for several ozone monitors.

Summary

MIRA has been used to help inform the process of determining which counties in the Kansas City metro area should be designated nonattainment for the new ozone standard. KDHE gathered and developed both inputs and new criteria for use in the existing EPA MIRA tool. KDHE reviewed many different weighting criteria before finalizing on the current weighting criteria used as part of the nonattainment designation. The final decision on which Kansas counties would be included in the Kansas City nonattainment designation relied heavily upon the learning process gained through the use of the MIRA tool. KDHE believes the chosen weighting criteria contain and address EPA's 11 criteria in a fair and transparent way.