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## Source Category: Asphalt Paving

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### INTRODUCTION

The purpose of this document is to provide a forum for public review and comment on the evaluation of candidate control measures that may be considered by the States in the Midwest Regional Planning Organization (MRPO) to develop strategies for ozone, PM<sub>2.5</sub>, and regional haze State Implementation Plans (SIPs). Additional emission reductions beyond those due to mandatory controls required by the Clean Air Act may be necessary to meet SIP requirements and to demonstrate attainment. This document provides background information on the mandatory control programs and on possible additional control measures.

The candidate control measures identified in this document represent an initial set of possible measures. The MRPO States have not yet determined which measures will be necessary to meet the requirements of the Clean Air Act. As such, the inclusion of a particular measure here should not be interpreted as a commitment or decision by any State to adopt that measure. Other measures will be examined in the near future. Subsequent versions of this document will likely be prepared for evaluation of additional potential control measures.

The evaluation of candidate control measures is presented in a series of "Interim White Papers." Each paper includes a title, summary table, description of the source category, brief regulatory history, discussion of candidate control measures, expected emission reductions, cost effectiveness and basis, timing for implementation, rule development issues, other issues, and a list of supporting references. Table 1 summarizes this information for the asphalt paving category.

### SOURCE CATEGORY DESCRIPTION

Asphalt paving is used to pave, seal, and repair surfaces such as roads, parking lots, drives, walkways, and airport runways. Asphalt concrete is a mixture of asphalt cement, which is a binder, and an aggregate. Asphalt concrete is grouped into three general categories: hot-mix, cutback, and emulsified.

- Hot-mix asphalt is the most commonly used paving asphalt for surfaces of 2 to 6 inches thick. For hot-mix asphalt, the organic components have high molecular weights and low vapor pressures. Therefore, hot-mix asphalt use produces minimal emissions of VOCs
- Cutback asphalt is used in tack and seal operations, in priming roadbeds for hot-mix application, and for paving operations for pavements up to several inches thick. In preparing cutback asphalt, asphalt cement is blended or "cut back" with a diluent, typically from 25 to 45 percent by volume of petroleum distillates, depending on the desired viscosity. Cutback asphalt has the highest diluent content of the three asphalt categories and, as a result, emits the highest levels of VOCs per ton used.
- Emulsified asphalt is used in most of the same applications as cutback asphalts but is a lower emitting alternative to cutback asphalts. Instead of blending asphalt cement with petroleum distillates, emulsified asphalts use a blend of asphalt cement, water and an emulsifying agent, such as soap. Emulsified asphalts have a lower emission potential than cutback asphalts as they contain less or no diluents. However, some may contain up to 12 percent by volume solvents

Asphalt paving operations were estimated to account for about 2 percent of the total anthropogenic VOC emissions in the MRPO region in 2002.

**TABLE 1 – CONTROL MEASURE SUMMARY FOR ASPHALT PAVING**

Control Measure Summary	VOC Emissions (tons/year) in 5-State MRPO Region	
<b>2002 existing measures:</b> CTG Requirements	2002 Base:	48,348
<b>Candidate measure: Adopt SCAQMD 1108.1 VOC content limit for emulsified asphalt</b> <i>Measure ID: SOLV8A</i> <i>Emission Reductions:</i> annual reduction of 40% from 2002 levels emulsified asphalt, no additional reductions for cutback asphalt since it is banned during ozone season <i>Control Cost:</i> Not Available <i>Timing of Implementation:</i> Assuming 2007 effective date of rule, emission reductions are achieved in 2009 <i>Implementation Area:</i> (1) 8-hr ozone nonattainment areas, (2) 8-hr ozone nonattainment areas plus adjacent counties, or (3) all counties	2002 Base: 2009 Reduction: 2009 Remaining:	48,348 <u>-16,106</u> 32,242

Notes: 2009 emission reductions shown are reductions for 2002 base emissions, assuming that control measures are implemented statewide; 2009 emissions are not growth-adjusted.

## REGULATORY HISTORY

Title I regulates criteria pollutants by requiring local governments to adopt State Implementation Plans (SIPs) that set forth their strategy for achieving reductions in the particular criteria pollutant(s) for which they are out of attainment. The SIPs must include reasonably available control technology (RACT) requirements on major sources in nonattainment areas. States must establish RACT levels based on the level of emissions reductions that can reasonably be achieved at a reasonable cost. The Control Technique Guideline (CTG) for the use of cutback asphalt was published in December 1977. The CTG recommended replacing cutback asphalt binders with emulsified asphalt during the ozone season. In 1979, EPA added a specification for emulsified asphalt to the CTG recommendations to limit the content of oil distillate in emulsified asphalt to no higher than 7 percent oil distillate.

The South Coast Air Quality Management District (SCAQMD) Rule 1108.1 contains specifications on the amount and volatility of any petroleum distillate used in emulsified asphalt. The limit is 3 percent for any type of emulsified asphalt. The 3 percent content limit for oil distillate is more stringent than the oil content limits, where specified, in the LADCO states.

Illinois, Indiana, Michigan, Ohio, and Wisconsin have adopted requirements that are variations of the CTG recommendations. Cutback asphalt application is banned during the ozone season. For emulsified asphalts, the requirements in Illinois, Michigan, and Wisconsin do not specify the maximum oil distillate content in emulsified asphalt. Indiana limits the oil distillate to 7 percent. Ohio allows between 3% and 12% oil distillate, dependant on the asphalt mix. A summary of each State's requirements is presented in Attachment 1.

## CANDIDATE CONTROL MEASURES

Since the LADCO states already ban the use of cutback asphalt during the ozone season, no further emission reductions are available for cutback asphalt. Emulsified asphalts may contain up to 12 percent organic solvents by volume. For emulsified asphalt, SCAQMD Rule 1108.1 contains a more stringent VOC content limit (3 percent) than the limits in the LADCO states.

*Measure SOLV8A – Adopt SCAQMD Rule 1108.1 VOC content limit for emulsified asphalt.* This control measure would adopt the SCAQMD Rule 1108.1 limit of 3 percent content limit for oil distillate for slow, medium, and rapid setting emulsified asphalt. This is very similar to the Ohio emulsified asphalt regulation.

## EXPECTED EMISSION REDUCTIONS

We calculated the approximate emission reductions expected from adopting SCAQMD Rule 1108.1 in all LADCO counties in the following manner:

- Obtained 2002 actual emissions from the MRPO's 2002 inventory (Note: States reported asphalt paving emissions using an inconsistent set of SCCs, as shown in Table 2);
- No emission reductions were taken for cutback asphalt application, since its use is banned during the ozone season; no reductions were taken in Ohio since the Ohio regulation is similar to SCAQMD 1108.1;
- Assumed that the average VOC content of emulsified asphalt is 6 percent in 2002 and will be limited to 3 percent in 2009, resulting in a 50% reduction in VOC content limits from baseline levels; also assume that rule penetration will be the EPA default value of 80%, so that the net reduction from baseline levels for emulsified asphalt application is 40%.

Current emissions from asphalt paving operations and the expected emission reductions from the candidate control measure are summarized in Table 2.

**TABLE 2 – COMPARISON OF 2002 VOC EMISSIONS (tpy)  
WITH CANDIDATE CONTROL MEASURE**

			<i>Measure SOLV8A Adopt SCAQMD Rule 1108.1 VOC content limit for emulsified asphalt</i>		
	<b>SCC</b>	<b>Description</b>	<b>2002 Actual Emissions</b>	<b>2009 Emission Reduction</b>	<b>2009 Emission Remaining</b>
IL	2461020000	All Processes	11,557	4,623	6,934
IL	2461021000	Cutback Asphalt	0	0	0
IL	2461022000	Emulsified Asphalt	<u>0</u>	<u>0</u>	0
		Subtotal for Illinois	11,557	4,623	6,934
IN	2461020000	All Processes	0	0	0
IN	2461021000	Cutback Asphalt	0	0	0
IN	2461022000	Emulsified Asphalt	<u>25,355</u>	<u>10,142</u>	15,213
		Subtotal for Indiana	25,355	10,142	15,213
MI	2461020000	All Processes	0	0	0
MI	2461021000	Cutback Asphalt	200	0	200
MI	2461022000	Emulsified Asphalt	<u>2,016</u>	<u>806</u>	1,210
		Subtotal for Michigan	2,216	806	1,410
OH	2461020000	All Processes	0	0	0
OH	2461021000	Cutback Asphalt	3,589	0	3,589
OH	2461022000	Emulsified Asphalt	<u>0</u>	<u>0</u>	0
		Subtotal for Ohio	3,589	0	3,589
WI	2461020000	All Processes	0	0	0
WI	2461021000	Cutback Asphalt	4,295	0	4,295
WI	2461022000	Emulsified Asphalt	<u>1,336</u>	<u>534</u>	802
		Subtotal for Wisconsin	5,631	534	5,097
		<b>LADCO 5-State Total</b>	<b>48,348</b>	<b>16,106</b>	<b>32,242</b>

Notes: Emissions for Ohio were missing from the LADCO 2002 inventory; the emissions presented in this table are from the 2002 Preliminary NEI; the emissions for 2009 are not growth-adjusted.

Note that these estimated emission reductions are very uncertain for two reasons. First, we do not have information on the VOC contents for emulsified asphalt that were used by the States in calculating emissions. The range of VOC content for emulsified asphalt is 0 to 12 percent. We applied a 50 percent reduction to the VOC content limit based on the assumption that the average VOC content is 6 percent and will be reduced to 3 percent. Second, Illinois did not differentiate between cutback and emulsified asphalt. Third, there were no asphalt paving emissions for Ohio in the LADCO inventory. We used the older data from the Preliminary 2002 NEI for Ohio, which included emission estimates only for cutback asphalt. A comparison of methods/emission estimates for the LADCO states should be done so that the potential emission reductions can be better quantified.

## **TIMING OF IMPLEMENTATION**

States generally provided a 2-year period for compliance with RACT rules. For the purposes of this White Paper, we have assumed that SIP rules would be adopted in early 2007. Since the lower-VOC content limits for emulsified asphalt are already in place in Ohio and California, it seems reasonable to assume that a 2-year period after SIP submittal is adequate for the requirement to be implemented. Thus, emission reductions would occur in 2009 for Measure SOLV8A.

## **COST EFFECTIVENESS AND BASIS**

We could not locate any references describing the cost-effectiveness of the SCAQMD or Ohio EPA asphalt paving regulations.

## **CONTROL FACTORS**

For purposes of modeling, we have assumed that rules will be adopted in 2007 and that compliance will occur by the end of 2008. The control efficiency (CE) is the weighted average emission reduction efficiency for the entire category, which we are assuming will be a 50 percent reduction in VOC content for emulsified asphalt. The rule effectiveness is an adjustment to the CE to account for failures and uncertainties that affect the actual performance of the control measure. Because emissions will be controlled via reformulations, the EIIP guidance recommends that the rule effectiveness (RE) can be assumed to be 100 percent. The rule penetration (RP) is the percentage of the area source category that is expected to be complying with the regulation. Since it is likely that smaller entities may not be aware of the rules and not all will likely by 2009, the RP is set to 80 percent default value recommended by the U.S. EPA. In developing the control factor files for this category, we will use a base year a forecast year 50 percent incremental VOC emission reduction value in 2009 for all counties (except those in Ohio) with emulsified asphalt SCCs.

## **RULE DEVELOPMENT ISSUES**

EPA has not yet issued final rules for implementing the RACT/RACM provisions associated with the 8-hour ozone SIPs. The proposed implementation rule contained different options for residual 1-hour areas and 8-hour basic, marginal, and moderate areas. For ozone nonattainment areas, States can work from existing authority under state and federal law. States may need additional authority to impose VOC RACT/RACM requirements outside of nonattainment areas.

## **GEOGRAPHIC APPLICABILITY**

This candidate control measure is intended to apply to all counties in the 5-state MRPO region, except those in Ohio where the existing state rule is as stringent as the candidate control measure.

## **TEMPORAL APPLICABILITY**

Emission reductions would be realized throughout the year.

## **AFFECTED SCCs**

Area source SCCs affected by this control measure include:

2461020000 Asphalt Application All Processes  
2461022000 Emulsified Asphalt

## **REFERENCES**

1. Eastern Research Group. *Emission Inventory Improvement Program, Asphalt Paving, Volume III, Chapter 17*. January 2001.

**Attachment 1 - Comparison of RACT Regulations**

<b>CTG Category: Cutback Asphalt</b>	
<p><b>CTG RACT Recommendation:</b> December 1977 CTG recommended substituting emulsified asphalt for cutback asphalt with exemptions for outside the ozone season. 1979 EPA added specification for maximum oil distillate in emulsified asphalt:</p> <p>7% all grades , or                      Combination of:                      3% for seal coats in early spring or late fall                      3% for chip seals when aggregate is dusty or dirty                      8% when mixing with open grade aggregate that is not well washed                      12% when mixing with dense graded aggregate</p>	
<b>LADCO States</b>	
<p>Illinois – Subpart X Construction                      215.563, 218.563, and 219.563</p>	<p>Prohibits the use of cutback asphalt from May 1 to September 30 except for prime coating and from stockpile storage. Cutback asphalt defined as blended with other than residual oil and not emulsified with water.</p>
<p>Indiana – 326 IAC 8-5-2 Asphalt Paving Rules</p>	<p>Prohibits the use of cutback asphalt or asphalt emulsion containing more than 7% oil distillate by volume from April 1 to October 30 except for prime coating and from stockpile storage</p>
<p>Michigan – 336.1618 Use of Cutback Paving Asphalt</p>	<p>Prohibits the use of cutback asphalt from May 1 to September 30 except for prime coating and from stockpile storage</p>
<p>Ohio – 3745-21-09 (N) Use of Cutback Asphalts and Emulsified Asphalts</p>	<p>Prohibits the use of cutback asphalt, or asphalt emulsion containing oil distillate greater than 8% for open-graded mix, 12% for dense-graded mix, or 3% for any other application from April 15 to October 15 except for prime coating, from stockpile storage, or for dust control</p>
<p>Wisconsin – 422.16 Use of Asphalt Surfacing Materials</p>	<p>Prohibits use of rapid curing cutback asphalts containing gasoline or naphtha as diluent                      Prohibits use of cutback asphalts from May 1 to September 30 except for dust control and prime coat during May and September. Cutback asphalt includes blending with petroleum solvents other than residual oils at levels of 5% by weight or more.</p>

<b>CTG Category: Cutback Asphalt</b>	
<b>Other States</b>	
California – Bay Area – Rule 8-15 Emulsified and liquid Asphalts	Prohibits rapid-cure liquid asphalt Prohibits medium-cure asphalt except when temperature 50 °F or less Prohibits emulsified asphalt containing more than 3% petroleum solvent Prohibits slow-cure asphalt with more than 0.5% petroleum solvent boiling at less than 500 °F
California – South Coast 1108 Cutback Asphalts, 1108-1 Emulsified Asphalts	Prohibits slow-cutback asphalt with more than 0.5% petroleum solvent boiling at less than 500 °F Prohibits emulsified asphalt with more 3% petroleum solvent boiling at less than 500 °F
Maryland – 26.11.11.02 Asphalt Paving	Prohibits the use of cutback asphalt from April 15 to October 15 except for prime coating and from stockpile storage
Massachusetts – 310 CMR 7.18 (9) Cutback Asphalt	Prohibits the use of cutback asphalt with more than 5% petroleum solvent boiling at less than 500 °F from May 1 to September 30 except for prime coating and from stockpile storage
New Jersey – 7.27-16.19 Application of Cutback and Emulsified Asphalts	Prohibits the use of cutback asphalt or asphalt emulsion containing any VOC from April 15 to October 15 except for prime coating and from stockpile storage, or the emulsified asphalt is mix in place containing no more than 8% VOC