



## North Carolina Department of Environment and Natural Resources

Division of Air Quality

Michael F. Easley, Governor

William G. Ross, Jr., Secretary  
B. Keith Overcash, P.E., Director

### **MEMORANDUM**

**TO:** Section Chiefs, Regional Supervisors

**FROM:** Keith Overcash

**DATE:** June 8, 2005

**SUBJECT:** Emission Factors for Ready-Mixed Concrete Facilities

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The Carolina Ready-Mixed Concrete Association requested that the Division of Air Quality (DAQ) re-evaluate the toxic emissions from ready-mixed concrete facilities to gain a better understanding of emission rates for use in setting permit limitations with respect to North Carolina's air toxic program. Based on stack test data supplied by the Ready-Mixed Concrete Research Foundation (RMC Research Foundation), the DAQ developed updated emission factors of particulate matter (PM), particulate matter with an aerodynamic diameter less than 10 microns (PM<sub>10</sub>), and arsenic (As) for ready-mixed concrete facilities. The DAQ is proposing that these factors, as provided in the attached table, should be used by DAQ permit engineers in lieu of the emission factors provided in the most current version of the U.S. EPA AP-42. These emission factors will tentatively be approved and will be reevaluated when the U.S. EPA completes its review of this data on an industry-wide basis.

RMC Research Foundation contracted Air Control Techniques, P.C. (ATC) to conduct stack testing at ready-mixed concrete facilities in North Carolina, South Carolina, and Virginia. ATC conducted stack tests at the loading operations of three (3) truck mix-type facilities and three (3) central mix-type facilities between December 2003 and May 2004. All tested facilities were equipped with "central control", or a fabric filter used to control emissions from loading operations. Stack tests sampled PM and PM<sub>10</sub> from the fabric filter inlet stream, the fabric filter outlet stream, and fugitive, or uncaptured, emissions from the back of the concrete truck.<sup>1</sup> The particulate matter captured at the inlet of the fabric filter was analyzed to determine the arsenic concentrations (in micrograms per milligram, µg/mg).<sup>2</sup>

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<sup>1</sup> ATC Tests also include analyses of PM<sub>10-2.5</sub> and PM<sub>2.5</sub> concentrations. DAQ did not include this data in the emission factors summarized in this memorandum.

<sup>2</sup> ATC Tests also include analyses of arsenic (As) concentrations of cement and flyash in the concrete mix. DAQ did not estimate cement and flyash contributions to the overall arsenic emission factors summarized in this memorandum.

The ATC stack tests utilized a sampling array design (using R&P TEOM instruments) to quantitatively measure fugitive emissions from the back of the loading truck. This is an important difference from the tests used to develop the emission factors for the most current version of the U.S. EPA AP-42, which utilized qualitative visible emission evaluations to estimate (1) the capture efficiency of the central control and (2) uncaptured, fugitive emissions.

The Technical Services Section has reviewed the final test report provided by RMC Research Foundation and has found that the test methods met the requirements of the test protocol. In addition, it has found that the analysis and calculations were conducted according to test method requirements. The Technical Services Section makes no assertion that the test results are representative of all conditions or operating scenarios; however, similar emission rates would be expected when similar operating conditions occur. In this determination, the DAQ concluded that to properly evaluate the arsenic emissions, it must also tentatively approve the particulate emission rates. The attached PM, PM<sub>10</sub>, and as emission factors should be used for permitting and compliance determinations of ready-mixed concrete plants pending any further evaluation.

Any questions regarding the technical aspects of the testing procedure or the emission factor development should be directed to Mr. Gary Saunders at (919) 733-1497 or Ms. Fern Paterson at (919) 715-6242 respectively.

Attachment

Cc: Brock Nicholson  
Gary Saunders  
Fern Paterson

## ATTACHMENT

### Summary of PM/PM<sub>10</sub>/As Emission Factors for Loading Operations at Ready-Mixed Concrete Facilities

	PM Emission Factors <sup>+</sup>		PM <sub>10</sub> Emission Factors <sup>+</sup>		Arsenic (As) Emission Factors <sup>+</sup>	
	AP-42 <sup>†</sup>	ATC Test <sup>%</sup>	AP-42 <sup>†</sup>	ATC Test <sup>%</sup>	AP-42 <sup>†</sup>	ATC Test <sup>%</sup>
<b>Truck Mix Facilities</b>						
<i>With central control</i> <sup>*</sup>	2.10e-01 lb/ton C+S	2.80e-02 lb/ton C+S (7.81e-03 lb/yd)	5.10e-02 lb/ton C+S	1.05e-02 lb/ton C+S (2.88e-03 lb/yd)	1.16e-06 lb/ton C+S	1.59e-06 lb/ton C+S (4.38e-07 lb/yd)
<i>Without central control</i> <sup>#</sup>	6.10e-01 lb/ton C+S	1.46e-00 lb/ton C+S (4.13e-01 lb/yd)	1.50e-01 lb/ton C+S	4.17e-01 lb/ton C+S (1.15e-01 lb/yd)	3.04e-06 lb/ton C+S	6.80e-05 lb/ton C+S (1.88e-05 lb/yd)
<b>Central Mix Facilities</b>						
<i>With central control</i> <sup>*</sup>	1.10e-02 lb/ton C+S	2.12e-02 lb/ton C+S (5.72e-03 lb/yd)	3.80e-03 lb/ton C+S	5.77e-03 lb/ton C+S (1.56e-03 lb/yd)	1.87e-08 lb/ton C+S	8.85e-07 lb/ton C+S (2.38e-07 lb/yd)
<i>Without central control</i> <sup>#</sup>	2.20e-01 lb/ton C+S	6.83e-01 lb/ton C+S (1.87e-01 lb/yd)	7.80e-02 lb/ton C+S	1.81e-01 lb/ton C+S (4.95e-02 lb/yd)	2.32e-07 lb/ton C+S	2.80e-05 lb/ton C+S (7.61e-06 lb/yd)

<sup>+</sup> Emission factors are given on the basis of pounds per ton of cement plus supplement (e.g., flyash) loaded (lb/ton C+S) and, for the updated factors, are also given on a basis of pounds per yard of concrete loaded (lb/yd).

<sup>†</sup> U.S. EPA, Office of Air Quality Planning and Standards, AP-42, Fifth Edition. *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources*. Chapter 11.12, October 2001.

<sup>%</sup> Final Stack Test Report. Prepared for RMC Research Foundation by Air Control Techniques, P.C. ATC, P.C. File 877. August 2004.

<sup>\*</sup> "Central control" constitutes a fabric filter used to control emissions from loading operations. Emission factors include the sum of emissions detected from the outlet stream of the fabric filter and fugitive, or uncaptured, emissions detected at the back of the loading truck.

<sup>#</sup> The ATC tests did not include any ready-mixed concrete facilities without central control. Emissions factors include the sum of emissions detected at the inlet stream of the fabric filter and the fugitive, or uncaptured, emissions detected at the back of the loading truck.

Memorandum from Mr. Keith Overcash to Regional Supervisors and Section Chiefs  
 Date: June 8, 2005  
 Subject: PM/PM<sub>10</sub>/As Emission Factors for Ready-Mixed Concrete Facilities

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