Friends:

The DNR often collects responses from citizens and scientists regarding draft proposals they have created. Several weeks ago, I sent out a Frac Sand Sentinel (#46-8/13/2015) with the links to the DNR site and asked readers to comment on the guidelines for several listed issues.

Crispin Pierce submitted his comments on "Guidance for including PM2.5 in Air Pollution control Permit Applications" to Ms. Hart and Mr. Roth from the DNR. Dr. Pierce's comments are attached.

You can review the DNR draft document here. I am delighted to share Dr. Pierce's comments with you. It is very obvious that air quality permitting for frac sand issues is very complicated. More research and study is critical to the health and well being of many people living near or close to frac sand mines or any related facilities including the transportation of this material throughout the state and beyond.

Below are Dr. Pierce's comments to the DNR (also see attachment).

Dear Ms. Hart,

Please find attached my public comment concerns regarding the proposed "Guidance for Including PM2.5 in Air Pollution Control Permit Applications." I have copied Mr. John Roth of the DNR and Ms. Susan Kraj of the US EPA due to their interest in air quality permitting.

Sincerely,

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105 Garfield Avenue • P.O. Box 4004 • Eau Claire, WI 54702-4004

Ms. Kristin Hart
Wisconsin Department of Natural Resources

14 August 2015 Dear Ms. Hart:

With this letter, I would like to respond to the Wisconsin Department of Natural Resources request for public comments on the proposed elimination of "mechanical" sources of PM2.5 generation in the permitting of air emissions. While it is clear that combustion and secondary particle formation processes are the principal sources of PM2.5, mechanical processes can be important contributors and so must be considered in air permit calculations.

This response is organized in three areas: 1)Ambient particulate research; 2)Mining particulate research; and 3)Wisconsin frac sand mining and processing particulate research.

Ambient Particulate Research

Numerous studies and regulatory efforts document the generation of PM2.5 in urban particulate mixtures as a result of mechanical processes. The Chinese Academy of Science has identified soil dust as a major component of PM2.5 in evaluating sources of air pollution in Beijing (https://www.thechinastory.org/dossier/cas-identified-six-major-sources-for-pm2-5/). Dust has also been identified as a component of PM2.5 pollution in a Chinese nine-city analysis (http://www.globaltimes.cn/content/915067.shtml). Lee et al. have found that road salt contributes to PM2.5 in Toronto, Canada (http://www.ncbi.nlm.nih.gov/pubmed/14620807). Roadway dust is a component of Salt Lake Valley PM2.5 concerns (http://home.chpc.utah.edu/~whiteman/PM2.5/PM2.5.html#sources).

In the regulatory arena, a draft California Southern Coast Air Quality Management District guidance document states, "For mechanical dust generating sources, e.g., construction, the PM2.5 fraction of PM10 is 21 percent..."(http://www.aqmd.gov/docs/default- source/ceqa/handbook/localized-significance-thresholds/particulate-matter-(pm)-2.5- significance-thresholds-and-calculation-methodology/pm2-5-working-group-meeting-1-draft- methodology-to-calculate-pm2-5.doc?sfvrsn=2)

The US Environmental Protection Agency recognizes the following "top sources" of PM2.5 in their consideration of criteria and hazardous air pollutants (http://www.epa.gov/ttn/chief/net/2008neiv3/2008_neiv3_tsd_draft.pdf, table 4):

1. Agriculture - Crops & Livestock Dust 2. Agriculture - Livestock Waste
3. Dust - Construction Dust
4. Dust - Paved Road Dust

5. Dust - Unpaved Road Dust
6. Industrial Processes – Mining

They note that "[Year-to-year PM2.5] increases in the miscellaneous category are related to increases in dust from agricultural tilling and livestock ... and from paved roads."

The EPA has also listed emission factors for PM2.5 generation in the crushed stone industry for the following activities (http://www.epa.gov/ttn/chief/ap42/ch11/final/c11s1902.pdf Table11- 19-2.1):

1. Tertiary Crushing (controlled)
2. Fines Crushing (controlled)
3. Screening (controlled)
4. Conveyor Transfer Point (controlled)

An EPA workshop paper on reconciling PM differences between fugitive dust emissions inventory and ambient source contribution estimates found the following:

Source apportionment studies show that geological material contributes an average of ~5% to ~20% of PM2.5 in urban areas where National Ambient Air Quality Standards (NAAQS) have been or might be exceeded. Urban emissions inventories show dust emissions contributing ~50% to ~80% of PM2.5.

Measurement of atmospheric aerosols includes identification of crustal material dust:

These three models identified some common sources of PM2.5: marine aerosol, crustal material, traffic, secondary aerosols (secondary sulfate and secondary nitrate resolved by PMF), a mixed source of heavy fuels combustion and biomass burning, and industrial emissions. [1]

The PMF model identified six main sources: soil dust, coal combustion, biomass burning, traffic and waste incineration emission, industrial pollution, and secondary inorganic aerosol.[2]

A total of five source types were identified, including soil dust, vehicle emissions, sea salt, industrial emissions and secondary aerosols, and their contributions were estimated using PMF.[3]

Statistically significant contributions from natural gas combustion, paved road dust, and vegetative detritus.[4]

Dust: agricultural production, construction, paved road dust, unpaved road dust.[5]

Ho et al. have documented PM2.5 as 11–30% of PM10 in fugitive urban dirt and paved road dust.[6]

The Western Regional Air Particulates Fugitive Dust Handbook identifies the following sources of fugitive dust emissions, indicating a common AP-42 PM2.5 percentage of PM10 of 10-20%:

Agricultural Tilling
Construction and Demolition
Materials Handling
Paved Roads
Unpaved Roads
Agricultural Wind Erosion
Open Area Wind Erosion
Storage Pile Wind Erosion
Agricultural Harvesting
Mineral Products Industry
Abrasive Blasting
Livestock Husbandry
Miscellaneous Minor Fugitive Dust Sources (http://www.wrapair.org/forums/dejf/fdh/content/FDHandbook_Rev_06.pdf).

Given that PM2.5 is commonly measured in fugitive dust emissions and indeed is modeled through AP-42 emission factors from many mechanical sources of fugitive dust, the proposal to ignore mechanically-generated PM2.5 from permitted sources in Wisconsin is unsupported. Moreover, the proposal is inconsistent with the June 2015 DRAFT Wisconsin Air Dispersion Modeling Guidelines which state,

"Fugitive (non-point source) Emissions
Emissions created within a structure that are not vented to a stack but are considered in aggregate in the permit should be included in the dispersion modeling analysis."

And
"Fugitive Dust

When fugitive dust emissions on the facility property are affected by the permit, those emissions should be included in the dispersion modeling analysis."

PM2.5 Generation in Mining

Madungwe and Mukonzvi found levels of 14.23–69.01 mg/m3 PM2.5 around a stone quarry.[7] Zota et al, found that PM2.5 sources in mine waste included "mobile source combustion, secondary sulfates, mine waste, and crustal/soil."[8]

The US EPA has established PM2.5 emission factors for mechanical processes associated with coal mining (AP-42 section 11.9). Processes identified that generate PM2.5 include blasting, truck loading, bulldozing, dragline, vehicle traffic, grading, active storage pile (table 11.9-1) and drilling, topsoil removal by scraper, overburden replacement, truck loading by power shovel,

train loading, bottom dump truck unloading, end dump truck unloading, scraper unloading and wind erosion of exposed areas (table 11.9-4). Truck transport, conveyor belt transport, crushing and screening processes are not included. They further state "All operations that involve movement of soil or coal, or exposure of erodible surfaces, generate some amount of fugitive dust." (http://www.epa.gov/ttn/chief/ap42/ch11/final/c11s09.pdf). Given that these processes occur in non-metallic mining, particularly frac sand mining, these same conditions apply in Wisconsin.

PM2.5 Generation in Wisconsin Frac Sand Mining

Frequent measurement of PM2.5 and PM4 in Wisconsin sand mining and processing operations is further evidence of mechanical process-generation of fine particulates.

We examined 41 MSHA (Mine Safety and Health Administration) past tests for respirable (PM4) crystalline silica in Wisconsin sand operations using the MSHA mine report search tool (http://www.msha.gov/drs/drshome.htm) and found the following: 1) All samples contained silica, at concentrations ranging from 5.8–130 ug/m3 with an average of 41 ug/m3; and 2) There were three violations of the MSHA respirable crystalline silica standard (two at the EOG plant and one at the A F Gelhar Co Inc.). Values for the three violations are provided below:

..
Date

Location

.
Job

..
Contaminant

Concentration (mg/m3)

PEL (mg/m 3, varies by %SiO2)

..

%SiO2

SiO2 Concentration (mg/m3)

2/18/ 2009

M - Drying & Roasting

.
Kiln/ Dryer Operator

.
Quartz, respirable, >1% Qtz

0.34

.
0.28

.
.
34

.
0.11

3/27/ 2012

M- Washing & Screening

Washer Operator

Quartz, respirable, >1% Qtz

0.6

0.53

17

0.10

3/27/ 2012

S- General

Electricia n

Quartz, respirable, >1% Qtz

0.82

0.57

16

0.13

Respirable crystalline silica (quartz) is generated from mechanical processes including blasting, crushing and transporting of Wisconsin sandstone deposits (not formed from combustion nor secondary formation processes). Documentation of respirable quartz, sometimes at levels above the MSHA standard, is evidence of mechanical generation.

Esswein et al. found that PM4 quartz levels exceeded the OSHA occupational standard in 47% of samples at hydraulic fracturing sites.[9] These airborne particulate levels were generated either during the transport of larger-diameter frac sand from upper Midwest sources, and/or from mechanical processing during the hydraulic fracturing operations.

Our research has found levels of PM2.5 around frac sand operations higher than simultaneous measurements at regional WDNR and Minnesota Pollution Control Agency (MPCA) monitors.[10] A 24-hour filter sample in Winona, MN determined a level of 19.6 vs. 13.5 ug/m3 measured by the MPCA. This is of significance because Winona frac sand operations are principally engaged in sand transport (with few combustion or secondary particle sources of PM2.5), indicating mechanical generation of PM2.5.

We also routinely test our particulate monitors in a chemical fume hood where sandstone deposits from the Hoffman Hills area are stirred with a mechanical or magnetic stirrer bar, readily generating atmospheres with concentrations of 100-500 ug/ m3 PM2.5

PM2.5 generation is seen in mechanical dust generation in urban settings, mining, and specifically frac sand mining in Wisconsin. AP-42 emission factors for PM2.5 are widely used for mechanical processes. The inclusion of these emission estimates are essential for protection of human health in WDNR air permit processes.

Sincerely,

Crispin H. Pierce, Ph.D. Professor / Program Director

Excellence. Our measure, our motto, our goal.

Watershed Institute for Collaborative Environmental Studies
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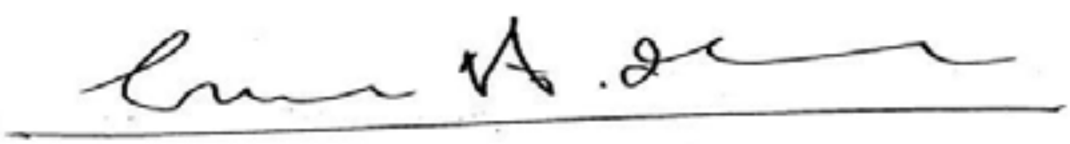

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