Dailey, Daniel (EGLE)

From: Burk, Ed <Ed.Burk@STERICYCLE.com>
Sent: Friday, August 23, 2019 9:06 AM
To: Dailey, Daniel (EGLE); Day, Jim (EGLE)
Cc: Frohriep, Melanie
Subject: Dispersion
Attachments: 201906_Deposition_Tech_Memo_20190821.pdf

Follow Up Flag: Follow up
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Categories: 2 - Commitments

Good morning,

Please see attached, the dispersion model requested to help evaluate the potential impact resulting from the roll-off box fire that occurred at the facility on June 10, 2019. As summarized on the last page of the memorandum and on Figure 2 the plume model does not show any off site impact. Depositional potential is/was very minimal. The Dispersion Model was completed by a third party consultant, Barr Engineering and Environmental Consultants, assisted/directed by MI EGLE personnel.

Please review and provide comment. Thank you. Ed

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Technical Memorandum

To: Edward Burk
From: Jeffry Bennett
Subject: Deposition Modeling Results – June 10, 2019 Fire Event
Date: August 21, 2019
Project: Stericycle Environmental Solutions, Inc – Detroit, MI (22821113.01)
c: Teresa Kinder – Barr

Deposition Modeling Results Summary

Barr performed a deposition modeling analysis to assess the most likely places that emissions from the June 10, 2019 fire may have deposited on nearby surface soil. The results of the modeling indicate that the maximum level of potential chromium deposition occurred onsite near the fire and the concentration in the soil is conservatively estimated at 0.015 – 0.016 ppm. There are multiple levels of conservatism contained in this analysis: assuming the maximum amount of emissions occurred during the event, using a simple volume source release maximizing nearby deposition, and assigning a concentration of 50 ppm chromium in the paint filters (where manifest indicates >5 ppm). Based on the results of this conservative analysis, Barr has determined that the potential maximum deposition impacts occur onsite and can be estimated at 0.0001% of the most probable species – Cr (III) US EPA Regional Screening Level (RSL) and 0.09% of the EGLE total chromium background.

Specific Modeling Methods and Assumptions

The modeling was performed using both the wet and dry deposition algorithms within US EPA's AERMOD software. Based on information provided, the fire occurred between 12:26 and 12:57 PM EDT on June 10, 2019. Surface deposition concentrations were assessed by characterizing the plume of emissions from the fire as a volume source using the hours of 12:00-13:00 and 13:00-14:00 DST on June 10, 2019. The volume source was characterized as a cube with side lengths of 3 meters (~10 feet).

The emission rate of chromium was estimated using the total mass of material contained in the roll-off container where the fire occurred. Based on the manifests provided, 400 lbs of chromium contaminated paint filters and wrapping was the material in the container that was potentially combusted during the fire. The chromium content in the paint filters is conservatively estimated at 50 ppm on a mass basis. The total chromium emissions from the fire for use in the modeling simulations was calculated as follows:

$$400\ lbs\ of\ material\ combusted\ x\ \frac{50\ parts\ Chromium}{1{,}000{,}000\ parts} = 0.02\ lbs\ Chromium$$

The deposition algorithm in AERMOD allows for the particle diameter, mass fraction, and particle density to be defined in the analysis. The particle diameter was defined as 10 µm based on the Toxicological

Profile for Chromium drafted by the U.S. Department of Health and Human Services[1]. The mass fraction of chromium was set to 100% because the estimated chromium emission rate was used in the model. The particle density was defined as 7.2 g/cm^3 based on the density of chromium. Also, the modeling included both dry and wet deposition algorithms in AERMOD.

The Department of Environment, Great Lakes and Energy (EGLE), Air Quality Division (AQD) provided surface meteorological data from the Coleman A. Young International Airport (KDET) and upper air data from Detroit/White Lake, MI, preprocessed for use in AERMOD, to perform the analysis. During the hours assessed in the modeling, the winds were out of the west-north-west and averaged 11-13 mph with a light rain. The hours assessed were chosen because the fire occurred in the middle/end of hour 12 (12:26 – 12:57) to ensure that both potential meteorological conditions were included in the analyses.

The specific results of the modeling simulations are presented in Table 1. The maximum modeled deposition concentration is located along the facility property boundary to the east of buildings 23/24/25.

Table 1. Deposition Modeling Results - June 10, 2019 Fire Event

Source Type Modeled	Hour of Met Data, DST	Maximum Modeled Deposition, g/m^2	Maximum Soil Concentration, ppm	Cr (III) USEPA RSL, ppm	Total Chromium Background, ppm
Volume	12:00-13:00	1.01E-03	0.015	11,500	18
Volume	13:00-14:00	1.07E-03	0.016	11,500	18

The maximum model-predicted deposition from the simulations was determined at each receptor (turquoise crosses in attached Figures 1 and 2). Based on that deposition, the soil concentration is calculated using a soil depth of 1" and soil density of 2,650 kg/m^3 as shown below:

$$\frac{\left(1.07E-03\,\frac{g}{m2}\right)\left(1{,}000\,\frac{mg}{g}\right)}{\left[(1\ in)\left(\frac{0.0254m}{in}\right)\right]\left(\frac{2{,}650\ kg}{m3}\right)} = 0.016\,\frac{mg\ Cr}{kg\ soil} = 0.016\ ppm$$

According to agency guidance (MDEQ, 2002)[2], "if contamination is predominantly located at the immediate surface (such as through air deposition of hazardous substances), surface soil samples should represent the immediate surface (e.g., top one inch)." The maximum calculated soil concentrations are 0.0001% of the most probable species Cr (III) US EPA RSL, and 0.09% of the EGLE total chromium background.

[1] "*Toxicological Profile for Chromium*", U.S. Department of Health and Human Services Public Health Service Agency for Toxic Substances and Disease Registry, September 2012

[2] MDEQ, 2002. Sampling Strategies and Statistics Training Materials for Part 201 Cleanup Criteria, Statistical Evaluation Guidesheet for Soil Data (Statistical Guidesheet 19): Generic Residential and Commercial I Direct Contact Criteria (DCC). Environmental Response Division, Michigan Department of Environmental Quality, 2002.

In order to provide a response to the EGLE request for "most likely places of potential deposition to surface soils", the fire plume would have traveled to the east-south east of the roll-off box. However, the results indicate that the deposition levels are only a fraction of all the screening and background levels.

The contours in the figures illustrate the concentrations at each receptor as a percentage of the 11,500 ppm Cr(III) RSL[3]. The US EPA RSL for Cr (III) was used because it provided a conservative threshold for comparison to the soil concentrations. A literature search for chromium speciation in combustion revealed that the range of chromium (III) concentrations was 98-100%, with the remainder being chromium (VI). Also, based on US EPA speciation for chromium used in the wood coating industry that would likely be found in the paint filters, there is no chromium (VI), only chromium (III) – i.e., 100% Cr (III).

Overall, based on the information provided by Stericycle Environmental Solutions, Inc and the assumptions described above, the AERMOD analyses results indicate that the deposition from the June 10, 2019 fire might have resulted in soil concentrations that are a very small fraction of chromium soil concentration thresholds, 0.0001% of the most probable species Cr (III) US EPA RSL, and 0.09% of the EGLE total chromium background.

[3] US EPA Regional Screening Level Website: https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search

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Deposition Model Result, % of Benchmark

- 1.0E-05% - 5.0E-05%
- 5.0E-05% - 1.3E-04%
- Location of Fire
- Receptors
- Maximum, 0.015 ppm

The chromium benchmark of 11,500 ppm is based on EPA's Regional Screening Level in soil for chromium (III).

Meteorological Surface data from Coleman A. Young Internation Airport (KDET) and upper air data from Detroit/White Lake, MI

N

80 0 80

Meters

DEPOSITION MODELING ANALYSIS RESULTS-12:00 PM
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FIGURE 1

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Deposition Model Result, % of Benchmark

- 1.0E-05% - 5.0E-05%
- 5.0E-05% - 1.4E-04%
- Location of Fire
- Receptors
- Maximum, 0.016 ppm

The chromium benchmark of 11,500 ppm is based on EPA's Regional Screening Level in soil for chromium (III).

Meteorological Surface data from Coleman A. Young Internation Airport (KDET) and upper air data from Detroit/White Lake, MI

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FIGURE 2

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