

**Subject: Request for Maximum Allowable Chromium Usage Rate
Bullseye Glass Company**

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On behalf of Bullseye Glass Company (“Bullseye”) this memorandum is being submitted to the Oregon Department of Environmental Quality (“the Department”) to request an annual and daily maximum allowable chromium usage rate for Bullseye’s facility located at 3722 SE 21st Avenue in Portland, Oregon pursuant to OAR 340-244-9040. The memorandum includes the methodology and calculations used to establish a maximum chromium usage rate so that the source impact levels provided in OAR 340-244-9040 (3)(b)(C) are not exceeded.

Introduction

Rules adopted by ODEQ in November of 2016 placed operating restrictions on Colored Art Glass Manufactures (CAGMs). One such restriction is that CAGMs may not use raw materials containing chromium in a glass-making furnaces until ODEQ establishes an annual and daily maximum allowable chromium usage rate for CAGMs that prevents the source impact from exceeding an annual acceptable source impact level of 0.08 nanograms per cubic meter (ng/m^3) at the nearest sensitive receptor and a daily acceptable source impact level of $5 \text{ ng}/\text{m}^3$ at any off-site receptor. In general, the CAGM rules also require that to establish the maximum allowable chromium usage rates the following must be performed:

- Conduct source tests for total chromium or total chromium and chromium VI. If source testing is done for total chromium only, the CAGM must assume all chromium emitted is in the form of chromium VI.
- Conduct the source tests while making glass that ODEQ agrees is made under the most oxidizing combustion conditions and that contains a high percentage of the type of chromium for which the usage rate is being established.
- Perform air dispersion modeling to determine the annual average and daily maximum ambient concentrations of chromium VI that result from the CAGMs air emissions associated with using raw materials containing chromium.

Bullseye submitted a source test plan to the Department on January 25, 2017 and received approval of the test plan on February 17, 2017. The testing protocols included testing for total chromium. Testing was conducted on March 26-27, 2017 and a source test report was submitted to the Department on May 12, 2017. Bullseye submitted an air dispersion modeling protocol to the Department on May 17, 2017 and received conditional approval of the protocol on May 26, 2017. The final air dispersion modeling report is provided with this submission.

Both the source test and the air dispersion modeling analysis are discussed below followed by calculations supporting a chromium usage request.

Source Testing

Total chromium source testing at Bullseye was conducted over the course of two days from March 26-27, 2017 and results were provided to the Department in a report issued May 12, 2017. Pertinent data from the testing is summarized below.

Source tested:	Outlet of baghouse BHW connected to eighteen colored art glass manufacturing furnaces. 16 hour glass production cycle.
Tests performed and test methods:	Three test runs of approximately 4 hours each. Total chromium by EPA method 29.
Total chromium emission rate:	0.00000382 lb/hr (average of three runs)
Amount of chromium used:	8.05 lbs

Air Dispersion Modeling

Using the U.S. Environmental Protection Agency's AERMOD air quality dispersion model and the protocols approved by the Department, air dispersion modeling of baghouse BHW was conducted to evaluate ambient air quality impacts. For the modeling analysis, a unit emission rate of 1.0 gram/second was used to model BHW emissions and determine the unit X/Q value (also referred to as a unit concentration or dispersion factor) around the facility. X/Q values were determined for each receptor and meteorological data set, from which the maximum values are found.

The maximum 24-hour and annual X/Q values determined from the air dispersion modeling are as follows:

TABLE 1
X/Q Values ((ug/m³)/(g/sec.))

Source	24-hr (any off-site receptor)	Annual (nearest sensitive receptor)
BHW	215.60	31.9

Chromium Usage Request

Establishing a chromium usage rate that does not result in an impact exceeding an annual acceptable source impact level of 0.08 nanograms per cubic meter (ng/m³) at the nearest sensitive receptor and a daily acceptable source impact level of 5 ng/m³ at any off-site receptor involves the following three steps:

1. From the source test data determine a chromium VI emission factor. Because testing was conducted for total chromium it is conservatively assumed that all measured chromium is in the form of chromium VI.

2. From the modeling analysis determine the daily maximum and average annual chromium emission rate that will not cause an exceedance of the acceptable daily maximum and annual impact levels.
3. Combined the results of 1 & 2 to determine chromium usage rates.

Chromium VI Emission Factor Derivation

$$\frac{\text{lb Cr VI emitted}}{\text{lb Cr Use}} = \left(0.00000382 \frac{\text{lb Cr VI}}{\text{hr}}\right) \left(16 \frac{\text{hr}}{\text{batch}}\right) \left(\frac{1 \text{ batch}}{8.05 \text{ lb Cr}}\right) = 7.59 \times 10^{-6} \text{ lb/lb}$$

Maximum Chromium VI Emission Rates not to Exceed Acceptable Source Impact Levels

$$\text{Cr VI Daily Max} \left(\frac{\text{g}}{\text{s}}\right) = \left(\frac{1 \frac{\text{gm}}{\text{s}}}{215.60 \frac{\text{ug}}{\text{m}^3}}\right) \left(5 \frac{\text{ng}}{\text{m}^3}\right) \left(\frac{1 \text{ ug}}{1000 \text{ ng}}\right) = 2.32 \times 10^{-5} \text{ g/s}$$

$$\text{Cr VI Annual} \left(\frac{\text{g}}{\text{s}}\right) = \left(\frac{1 \frac{\text{gm}}{\text{s}}}{31.9 \frac{\text{ug}}{\text{m}^3}}\right) \left(0.08 \frac{\text{ng}}{\text{m}^3}\right) \left(\frac{1 \text{ ug}}{1000 \text{ ng}}\right) = 2.51 \times 10^{-6} \text{ g/s}$$

Combine Results to Determine Chromium Usage Rate

$$\text{Cr Daily Max} = \left(2.32 \times 10^{-5} \frac{\text{gm Cr VI}}{\text{s}}\right) \left(86,400 \frac{\text{s}}{\text{day}}\right) \left(\frac{1 \text{ lb}}{453.59 \text{ gm}}\right) \left(\frac{\text{lb Cr}}{7.59 \times 10^{-6} \text{ lb Cr VI}}\right) = 582.2 \text{ lb/day}$$

$$\text{Cr Annual Max} = \left(2.51 \times 10^{-6} \frac{\text{gm Cr VI}}{\text{s}}\right) \left(31.536 \times 10^6 \frac{\text{s}}{\text{yr}}\right) \left(\frac{1 \text{ lb}}{453.59 \text{ gm}}\right) \left(\frac{\text{lb Cr}}{7.59 \times 10^{-6} \text{ lb Cr VI}}\right) = 22,991.9 \text{ lb/yr}$$

Discussion

This analysis describes the calculations and methodology used to determine a maximum allowable daily and annual chromium usage rate in Bullseye's glass making furnaces controlled by baghouse BHW pursuant to OAR 340-244-9040. The analysis determined chromium usage rates based on Department approved source testing and air dispersion modeling. Bullseye is requesting maximum daily and annual chromium usage allowances as shown in the following table.

TABLE 2
Chromium Usage Rate Request

	Daily Maximum (lb/day)	Annual Maximum (lb/yr)
Chromium Usage Rate	582	22,992