Colored Art Glass Manufacturer Air Emissions Agreement
Questions & Answers

April 5, 2016

On March 14, 2016, DEQ signed an agreement with the art glass company Uroboros that reduces metals emissions. Small colored art glass manufacturing facilities in Portland use metals such as cadmium and chromium in production. Currently there are no state or federal rules that limit levels of metal emissions from small colored art glass facilities, and the agreement addresses that regulatory gap.

The agreement is effective immediately and fills the regulatory gap by setting operational limits for Uroboros that are meant to prevent the emission of metals at levels that could expose the public to unsafe levels of air contaminants. The agreement prohibits the use of chromium VI and cadmium without the installation of approved emission control devices to reduce the risk from airborne metal exposure to those in the surrounding community.

The agreement also prohibits the use of chromium III until DEQ establishes a maximum allowable usage rate. This prohibition is in place under certain conditions, an unknown percentage of chromium III may convert to chromium VI, and more certainty is needed to determine the appropriate levels that will be protective of public health. Failure to comply with the agreement will result in penalties.

DEQ is partnering with the Oregon Health Authority on a permanent rule proposal to address emissions from all types of industry across the state using a new approach based on risks to human health. DEQ and OHA will engage the public to assist in developing the rule.

GENERAL

Question: What does the agreement do?

Answer: DEQ and Uroboros agreed to the following:

- By Sept. 1, 2016 the facility must install emission control devices on any glass-making furnaces that use cadmium, chromium or nickel;
- The facility may not use cadmium or chromium VI in uncontrolled glass-making furnaces (Uroboros does not currently and has not used arsenic for at least 20 years);
- The facility must limit the use of nickel, and must reduce the use of nickel if required to by DEQ, based on monitoring data;
- The facility must not use chromium III until emission testing has been done and DEQ has established usage limits that are protective of ambient concentrations of chromium VI;
- The facility must not use chromium VI in controlled furnaces until DEQ has established usage limits that are protective of ambient concentrations of chromium VI.

Question: Why do the agreements distinguish between raw materials and cullet?

Answer: Cullet is recycled glass that is mixed with raw materials and put into a glass-melting furnace to produce glass. Cullet is not considered to be a raw material for the purpose of the agreement. In the preamble to 40 CFR Part 63, Subpart SSSSSS, EPA states that remelting of

glass, such as cullet, does not re-emit the metal hazardous air pollutants once the glass has been formed. For that reason, EPA places no restriction on the use of cullet in Subpart SSSSSS and similarly, in the agreement, there is no restriction on the use of cullet.

METALS

Question: Why are you letting Uroboros use metals in their colored art glass furnaces when you know the ambient levels were too high?

Answer: The agreement does not allow the use of cadmium or chromium VI in uncontrolled glass-making furnaces, and it limits the use of nickel. The agreement also requires establishing maximum usage rates for chromium III and chromium VI. Operating within these restrictions will be protective.

Question: The agreement appears to treat each metal differently; why is that?

Answer: The agreement does treat different metals differently. The reasons for this different treatment are given below:

CADMIUM
The agreement states that cadmium may not be used in uncontrolled furnaces. This is because the furnaces at Uroboros (as at Bullseye) are uncontrolled at this time, meaning they are not equipped with emission control devices; and because the average ambient concentration of cadmium monitored near Bullseye was well above the Ambient Benchmark Concentration for this metal. DEQ believes that immediate action was needed to reduce the ambient concentration of cadmium, so the agreement doesn't allow the use of cadmium in uncontrolled furnaces.

DEQ is confident that the required emission control devices will significantly reduce the ambient concentration of cadmium to levels that are considered protective of human health. For this reason, once emission control devices are installed, there will be no restrictions on the use of cadmium.

CHROMIUM, CHROMIUM III and CHROMIUM VI
The October ambient monitoring near Bullseye did not include monitoring for chromium VI; monitoring for chromium VI did not begin until after Bullseye stopped using chromium compounds. In addition, DEQ has no information on how much chromium VI might be emitted by Uroboros. In effect, DEQ has no information that might be used to make an informed decision regarding chromium VI, so DEQ has taken a very cautious and protective approach to chromium.

Two forms of chromium are used by Uroboros: chromium III and chromium VI. These are discussed below:

Chromium may be emitted as either chromium III or chromium VI, but sampling for chromium VI is more difficult and expensive than sampling for "total chromium". Sampling for total chromium tells how much chromium is present, but it doesn't tell whether it is all chromium III, all chromium VI, or a mix of both chromium III and VI. The ambient monitoring in October, 2015, was only for total chromium.

Chromium III is of much less concern than chromium VI because it is not a known carcinogen. However, DEQ and EPA believe it is possible that some chromium III gets converted to chromium VI in the glass-making furnaces. While DEQ expects that little, if any, chromium III will be converted to chromium VI, DEQ can find no directly applicable information that can be used to determine the possible amount of chromium III that may be converted to chromium VI. Therefore DEQ cannot rule out the possibility that such conversion occurs. For this reason, the

agreement does not allow the use of chromium III in uncontrolled furnaces until the facility provides information that can be used to:

- Determine, by emission testing, how much chromium VI is emitted; and
- Determine, by dispersion modeling, what the ambient concentrations of chromium VI would be.

Using the information above, DEQ will establish usage limits for chromium III that would ensure that ambient concentrations of chromium VI would not exceed acceptable levels.

Usage of chromium VI is of greater concern than usage of chromium III. As with chromium III, DEQ has found no information that indicates how much chromium VI would be emitted if chromium VI is used. Without this information, DEQ assumes that all chromium emitted from the use of chromium VI would be emitted as chromium VI. However, even with this assumption, there is still no information on how much chromium would be emitted so there is no way to determine how much chromium VI may be emitted.

DEQ expects that the same total amount of chromium will be emitted whether the chromium used is III or VI. The testing discussed above for chromium III usage can provide information about how much chromium is emitted. As mentioned above, DEQ would use the very protective assumption that if chromium VI is used, all chromium emitted will be emitted as chromium VI. This would allow DEQ to calculate the emissions of chromium VI from the use of chromium VI, and to then use dispersion modeling to determine a limit on the amount of chromium VI that may be used. The agreement also would allow emission testing to determine how much chromium VI is emitted, but such testing would only be allowed after DEQ has determined the limit on the amount of chromium VI that may be used; the limit would apply during the testing.

NICKEL

The October 2015 ambient monitoring shows an average concentration of nickel that is only a little over the Ambient Benchmark Concentration, and is well below the short-term level that DEQ and OHA have determined to be protective. DEQ believes there is little risk of nickel exceeding a level that is protective of human health, but also feels that some precautions should be taken to be sure that nickel levels do not rise to levels of concern. For that reason, the agreement requires that nickel be used only in amounts allowed by the agreement.

Question: Does chromium III turn into chromium VI under any circumstance? What science is available on this matter?

Answer: There is inconclusive information at this point about the conversion of chromium III to chromium VI. The EPA is also interested in understanding the conversion factors and it remains a focus of federal and state regulators to get more certainty on. For this reason, DEQ has assumed that some chromium III may turn into chromium VI in glass-making furnaces and is requiring that testing be done to determine how much, if any, chromium VI is emitted when chromium III is used.

Question: Why doesn't the agreement include beryllium, cobalt, manganese and selenium?

Answer: DEQ's ambient monitoring includes the following other metals: beryllium, cobalt, lead, manganese, nickel and selenium. The average ambient concentrations of these metals were either well below or only slightly above the Ambient Benchmark Concentrations (which are highly protective because they are conservatively based on the assumption that a person is continually exposed to the metal for an entire lifetime) in DEQ's October sampling, and DEQ

believes that these metals present little need for concern, so they are not addressed in the agreement. Also, Uroboros does not use beryllium.

Question: How do we know if levels of chromium VI in the air are safe after they start using chromium again?

Answer: DEQ has a high level of confidence that emission control devices will reduce the emissions so they will not result in ambient concentrations that are above safe levels. In addition, the agreement requires modeling to show that ambient concentrations will not exceed safe levels. If monitoring shows ambient concentrations exceed safe levels, DEQ will take enforcement actions as described in the agreement to reduce or terminate usage of these metals.

Question: Where did 1.6 ng/m^3 come from as an ambient concentration of chromium VI that is used to set a safe level of usage for chromium III?

Answer: The Ambient Benchmark Concentration for chromium VI is 0.08 ng/m^3 on an average annual basis, meaning the average monitored concentration over a whole year should be used for comparison. When data is averaged over a whole year, very high and very low values are smoothed out. The ambient concentrations monitored near Bullseye are daily concentrations, not average annual concentrations. Therefore, comparing the daily ambient concentration to an average annual concentration is like comparing apples to oranges. To establish a basis for a more accurate comparison, DEQ chose 1.6 ng/m^3 for chromium VI on a rolling two-week average. This value is 20 times the ABC for chromium VI.

Question: How can 20 times the benchmark be safe? Is this a safe level for children?

Answer: Twenty times the benchmark is used only for carcinogenic compounds. All of our Ambient Benchmark Concentrations have layers of protection built into them. For example, the benchmarks are based on an assumption that a person will be exposed to a particular concentration for an entire lifetime, which doesn't usually occur. The benchmarks are also protective of sensitive groups such as children and the elderly, which provides an additional level of conservativeness. Since the benchmark is related to a risk of one additional case of cancer in a population of one million people (1×10^{-6}), then 20 times the benchmark would be related to a risk of 20 additional cases of cancer in a population of one million people (i.e. 2×10^{-5}). As a comparison, EPA uses an acceptable risk of up to 100 in a million in regulatory determinations, and 20 in a million is well below that level, and more protective of human health..

Question: Why is DEQ using a rolling two-calendar week average for ambient concentrations?

Answer: The reduce usage and stop usage action levels are based on exposure levels applicable to two-week periods which the Agency for Toxic Substances and Disease Registry considers acute.

EMISSION CONTROL DEVICES

Question: What kind of emission control devices can be used on colored art glass furnaces?

Answer: Baghouses, electrostatic precipitators and certain types of wet scrubbers are emission control devices that could be effective at controlling these emissions. They are all designed to

remove particulate matter (dust) from exhaust gases, which can contain metals. Spectrum Glass in Woodinville, Washington uses a baghouse on its colored art glass furnace.

Question: What is a baghouse?

Answer: A baghouse or fabric filter is an emission control device that removes particulate matter (dust) from exhaust gases. A baghouse can be described as a giant vacuum-cleaner. Most baghouses use long, cylindrical bags made of woven or felted fabric as the filter. Dust-laden gas enters the baghouse, is drawn through the bags and a layer of dust accumulates on the bag surface until air can no longer move through it. At that point the automatic cleaning process begins. Baghouses are very efficient particle collectors because the dust cake formed on the surface of the bags also acts as a filter.

Question: How do you know a baghouse will make the air safe?

Answer: Baghouses typically have a particulate matter (dust) removal efficiency of 99 percent or better, even when the particle size is very small. The following table shows the average of the monitored data near Bullseye from 10/06/15 through 11/02/15 followed by an estimate of the effect of an emission control device that provides 98 percent and 99 percent removal efficiency. This is based on the assumption that the entire ambient concentration is related to the emission source; in reality there are background levels of metals from other sources.

Question: What will source testing of the emission control devices show?

Answer: Source testing, also known as stack testing, will provide information on chromium VI emissions, on the removal efficiency of the emission control devices (that is, how well they work), and may provide information on whether any chromium III converts to chromium VI in the glass-making furnaces.

REDUCED NICKEL USAGE

Question: How did DEQ establish the ambient concentration Reduce Use and Stop Use Action Levels for nickel?

Answer: DEQ used the 2015 weekly average usage levels of nickel by Uroboros to set the maximum usage level. The agreement includes a mechanism to reduce or stop usage of nickel if ambient concentrations reach the specified Reduce Use Level or Stop Use Level. Based on those ambient Reduce Use and Stop Use levels, DEQ estimated the nickel usage levels that would result in ambient air impacts that would be less than the Reduce Use and Stop Use Action Levels specified in the agreement.

In consultation with Oregon Health Authority, DEQ has chosen to use an interim acceptable risk level of two additional cancer cases in a population of 100,000 (i.e., 2×10^{-5}). This level is protective of both acute or short-term (up to 2 weeks or more) and long-term or chronic (lifetime) exposures. Also, the risk level is meant to be applicable to ambient concentrations monitored and modeled very close to these facilities where it is highly unlikely people spend 100% of their time. Since nickel has carcinogenic effects, the Stop Use Level is set at a concentration that is 20 times the Ambient Benchmark Concentration (ABC). The Stop Use Level is then divided by 2 to obtain the lower Reduce Use Level.

Question: How will Uroboros know when to reduce or stop usage?

Answer: DEQ will notify Uroboros immediately upon receipt of ambient air quality data that shows nickel above the Reduce Usage Level or Stop Usage Levels in the Air Emissions Agreement.

Question: And how long will it take for Uroboros to reduce or stop usage?

Answer: The requirement to reduce or stop usage applies to the calendar week following the week in which notification was given to Uroboros and all following calendar weeks until DEQ provides further notification.

Question: Why do you have so many steps to reduce usage?

Answer: DEQ's goal is to protect public health while allowing Uroboros to operate at a limited level until the emission control systems are installed. DEQ assumes that there is a relationship between the amounts of metals the facilities use and the monitored ambient concentrations, and that a reduction in usage will result in a reduction in the ambient monitored concentrations. This assumes that the ambient monitored concentrations are affected largely by Uroboros' emissions. However, there are other sources of metals that may affect ambient concentrations to an unknown degree.

Assuming that the ambient monitored concentrations are affected largely by Uroboros' emissions, the usage reductions required by the agreement are intended to prevent ambient monitored concentrations from reaching the Stop Usage Level. The Stop Usage Level is considered to be protective of human health, but DEQ believes action should be taken before the Stop Usage Level is reached. For this reason, the Reduce Usage Level has also been included in the agreements, with the intent of requiring reductions to minimize the possibility of reaching the Stop Usage Level.

Question: Why is Uroboros allowed to resume usage after being required to stop usage?

Answer: Uroboros will be required to stop usage if the two-week average ambient concentration reaches or exceed the Stop Usage Level. Uroboros is allowed to resume usage only after the ambient concentrations return to below the Reduce Usage Level. The Stop Usage Level is protective of human health and the Reduce Usage Level is lower to provide an additional safety factor.

Question: Why is Uroboros allowed to stop usage and then resume usage three times before you make them stop usage completely until the emission control system is installed?

Answer: There are other possible sources of metals that could cause ambient concentrations to go above the Stop Usage Level in the agreements, and DEQ cannot be confident that Uroboros is the only reason for ambient concentrations that exceed the Stop Usage Level. However, the more often the Stop Usage Level ambient concentration is exceeded, the more likely it is that Uroboros is causing the exceedance. Therefore, if the Stop Usage Level ambient concentration is exceeded three times, they must stop usage completely until the emission control system is installed.

AMBIENT MONITORING

Question: Why does it take so long to get results from the ambient monitors?

Answer: The ambient monitors take samples each day. A week's worth of samples are gathered each Wednesday. A lot of specialized equipment and set-up time is needed to analyze a sample so it is inefficient to run a single sample each day. Therefore, samples are gathered for one week and are all analyzed at the same time.

Following the actual analysis, there are other quality assurance steps that need to be taken to ensure that the samples have been analyzed correctly and that there are no errors in the calculations. This entire process of analysis until the quality assurance is done takes between a week to two weeks. Any available results will be released Thursdays of each week.

Question: How long will DEQ monitor air quality near these Uroboros?

Answer: DEQ expects to monitor near Uroboros at least for at a minimum until 30 days of 24-hour samples are collected. Monitoring will continue depending on the results and actions taken under the agreement.

LEGAL

Question: What if Uroboros breaks the agreement?

Answer: The Air Emissions Agreement contains penalties (referred to as stipulated damages) of $1,600 for each day that Uroboros violates any compliance requirements and $800 for each violation of any of the usage requirements. Even with the Air Emissions Agreement signed by Uroboros, DEQ still has the right to take enforcement action against Uroboros for any past or future violations not addressed in the agreements.

Question: How did DEQ determine the amount of the stipulated damages?

Answer: DEQ calculated the penalties based on DEQ's enforcement and penalty policies. The penalties may be assessed for every day of every violation.

Question: What happens if they don't install the emission control devices required by the agreements?

Answer: If Uroboros does not install the required emission control devices, they would not be allowed to use cadmium or chromium VI. If they used these metals, they would be in violation of the agreement and DEQ would impose the penalties specified in the agreement. If necessary, DEQ would consider other enforcement actions as well. However, DEQ does not expect Uroboros to violate the agreements. DEQ and Uroboros believe that the terms of the agreements are achievable.