

Date: 15 March 2019

RE: Memorandum For Record

## SUMMARY

In response to occupant concerns in Research Complex 2 (RC2; P15) over the construction activities related to the Anschutz Health Sciences Building (AHSB), the Department of Environmental Health and Safety (EHS) at the University of Colorado Denver | Anschutz Medical Campus measured the indoor air quality at 95 locations throughout the building. Long-term 24-hour samples and short-term spot check samples were taken throughout RC2 and all samples collected were well below regulatory limits and industry guidance standards for indoor environments. As such, the air sampling did not provide evidence of poor air quality or the presence of contaminants. While odors related to diesel exhaust and construction activities were noticeable during some sampling events, these odors did not correspond to increased concentrations of hazardous compounds found in diesel exhaust. The exposure data recorded during this survey were not intended to assess the suitability of the indoor air quality for all individuals, such as those who have chemical sensitivities; individuals with sensitivity to chemicals should seek advice from their medical provider.

## RESULTS

Long-term 24-hour sampling was performed at the air intake for the building, the vivarium (P15-0370), and 7<sup>th</sup> floor (P15-7400), and short-term spot checks (92 sampling locations checked) were performed on each floor in the building. In the vivarium, on the 7<sup>th</sup> floor, and for spot checks, measurements were collected for carbon monoxide (CO), oxygen, volatile organic compounds (VOCs), hydrogen sulfide (H<sub>2</sub>S), and the lower explosive limit (LEL) with the use of a RAE Systems MultiRAE gas monitor. The instrument placed at the air intake was a 3M Quest Environmental Monitor (EVM), which measured carbon monoxide (CO), particulates/dust, and VOCs.

Table 1 provides a representative overview of the sampling. Detailed field records are available from EHS.

There were no levels of H<sub>2</sub>S recorded indoors during the monitoring event. As such, the results for H<sub>2</sub>S were below the OSHA PEL, the National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit (REL), and the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit value (TLV) – see Table 2 for the regulatory and recommended exposure limit values. There were peak measurements of 1 ppm CO detected at the air intake, and an average concentration of 0.035 ppm CO on 92 measurements taken during spot checks. However, the overall average CO concentration for these locations as well as the vivarium and 7<sup>th</sup> floor were zero, meaning that again all results were below the recommended and permissible exposure limits.

The oxygen levels recorded in the vivarium, 7<sup>th</sup> floor, and spot checks were between 20.5 and 21.4%, which is within the acceptable range for human occupancy.

Both the MultiRAE and EVM for these assessments measured the total concentration of VOCs; however, the term VOCs includes a large class of carbon-based chemicals, such as acetone, benzene, and formaldehyde. As such, a specific PEL has not been established for “VOCs,” but air quality sampling typically includes VOCs measurements as the data can indicate whether there may be a potential source of a specific VOC to be further investigated. The maximum concentration of VOCs detected at the air intake was 1 ppm, 0.1 ppm in the vivarium, 0.1 ppm on the 7<sup>th</sup> floor, and 0.4 ppm on spot checks. These low levels of VOCs detected in this sampling event would be unlikely to produce adverse health effects for typical, healthy occupants. It is of note that the sensor which detects VOCs is a photoionization detector (PID) which in addition to detecting VOCs can also detect other chemicals with an ionization potential within the detector’s range of 10.6 eV, such as NO<sub>2</sub>.

The LEL is the minimum concentration of vapor in air below which generation of a flame does not occur in the presence of an ignition source. Typically, an atmosphere is considered safe if it is below 10 percent of the LEL. As you can see in Table 1 the LEL remained at zero for the 7<sup>th</sup> floor and during the spot checks, which indicates that no flammable vapors were present in the air at the time of sampling. The LEL was not measured at the air intake as the EVM device does not have this capacity. A maximum of 5% of the LEL was reached in the vivarium, with an average LEL of 3%; because the LEL represents the presence of all organic material present in air that contribute to the flammability, it is not surprising that there was a detectable LEL due to the large volume of organic matter present in this facility.

Particulate concentrations in air were monitored for the particulate matter (PM) 10 micron size range, which is a sub fraction of the inhalable range (and is generally considered the respirable particle size by most regulatory agencies for the purposes of basic environmental monitoring). Results of particulate sampling at the air intake did not yield spike levels of particle concentrations in the indoor air above those levels found in outside levels and/or regulated pollution levels for PM10, which would indicate a potential source for contamination of the workplace from an outdoor source. Additionally, the overall average particle concentration was below the levels found in outside levels and/or regulated pollution levels for PM10.

## CONCLUSIONS

Air sampling did not provide evidence of poor air quality or the presence of contaminants at the air intake, in the vivarium, on the 7<sup>th</sup> floor of RC2, or on any of the floors visited during EHS spot checks. Levels were within regulatory limits and industry guidance standards for indoor environments. Be advised that the exposure data recorded during this survey was not intended to assess the suitability of the indoor air quality for all individuals, such as those who have chemical sensitivities, immune system deficiencies, etc. Any individual experiencing health effects should seek medical care per the University Risk Management [incident procedure](#).

While construction equipment on site was required to have air pollution control devices from the onset, upon learning of indoor air quality concerns, several steps were taken by the contractor JE Dunn Construction, Facilities Management, and EHS, including:

- Installation of granular activated carbon filter media at the intake of the air handling units for R2.
- JE Dunn Construction has deployed hand held air monitoring devices to monitor air quality at the site.
- EHS has deployed hand held air monitoring devices to respond to areas of concern and perform the aforementioned spot check monitoring.
- Air monitoring devices have been installed at the R2 air intake that will measure CO and NO<sub>2</sub>; the same monitors have also been installed in RC1 North to serve as a comparison/background. These devices will be alarmed to the Building Automation System (BAS) and campus officials will be automatically notified when there is an instantaneous reading at the alarm limits of 12 ppm for CO and 3 ppm for NO<sub>2</sub>; these chemicals have an 8-hour time weighted average exposure limit of 50 ppm and a 5 ppm 15-minute ceiling exposure limit, respectively. When alarm limits are reached, EHS will respond to the building with hand held monitoring devices to determine if further actions are necessary.

To learn more about the status of the project, please visit the project [webpage](#); you will find monthly updates on the project status there, along with a comments box. If you have additional questions about the project you can contact Doug Wilson, the Project Manager with CAA ICON, at [doug.wilson@caaicon.com](mailto:doug.wilson@caaicon.com) or for immediate concerns about odors contact EHS at 303-724-0345.

Table 1 – Air Monitoring Results

Location	CO Range ppm (Avg)	VOC Range Ppm (Avg)	H <sub>2</sub> S Range ppm (Avg)	LEL Range % (Avg)	Oxygen Range % (Avg)	Dust Range mg/m <sup>3</sup> (Avg)
P15-7400	0-0 (0)	0-0.1 (0)	0-0 (0)	0-0 (0)	20.9-21.4 (21.3)	N/A
P15-0370	0-0 (0)	0-0.1 (0.1)	0-0 (0)	0-5 (3)	20.9-20.9 (20.9)	N/A
R2 Intake	0-1 (0)	0-1 (0.05)	N/A	N/A	N/A	0.01-0.82 (0.10)
Spot Checks	0-1 (0.035)	0-0.4 (0.012)	N/A	0-0.1 (0.003)	20.5-20.9 (20.89)	N/A

Table 2 – Exposure Limits

	CO (ppm)	LEL	Oxygen (%)	H <sub>2</sub> S (ppm)	Dust (mg/m <sup>3</sup> )
OSHA PEL	50	-	-	10	15
OSHA Range	-		19.5-22	-	
NIOSH REL	35	-	-	10 (ceiling)	
ACGIH TLV	25	-	-	1	10