Cleaner Air Oregon—Risk Assessment Work Plan (Revision 3)

Hollingsworth & Vose Fiber Company

Prepared for:

Oregon Department of Environmental Quality

Cleaner Air Oregon Permitting Program

February 18, 2025

Project No. M1421.01.001

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Abbreviations

CAO	Cleaner Air Oregon
DEQ	Oregon Department of Environmental Quality
the facility	specialty glass fiber manufacturing facility located at 1115 SE Crystal Lake Drive in Corvallis, Oregon 97339
g/s	gram(s) per second
H&V	Hollingsworth & Vose Fiber Company
OAR	Oregon Administrative Rule
the Protocol	revised CAO modeling protocol dated March 14, 2024
RAL	risk action level
RAWP	Risk Assessment work plan
RBC	risk-based concentration
TAC	toxic air contaminant
TEU	toxic emissions unit
ug/m3	micrograms per cubic meter

1 Introduction

Hollingsworth & Vose Fiber Company (H&V) owns and operates a specialty glass fiber manufacturing facility located at 1115 SE Crystal Lake Drive in Corvallis, Oregon 97339 (the facility). The facility consists of two glass fiber manufacturing buildings: Glass Plant 1 and Glass Plant 2. Additional buildings at the facility are used for raw material and finished product storage, maintenance, and administration.

On January 10, 2022, the Oregon Department of Environmental Quality (DEQ) provided written notice to H&V that the facility was being officially called-in to the Cleaner Air Oregon (CAO) permitting program. H&V retained Maul Foster & Alongi, Inc.to assist the facility with each step of the CAO permitting process. H&V has completed the CAO permitting program requirements presented in Table 1-1.

Table 1-1. CAO Process Step Submittals and Approvals

CAO Requirement	Submittal Date	DEQ Approval Date
CAO Emissions Inventory	April 11, 2022 (Final Revision—March 14, 2024)	June 13, 2023 (Final Approval—June 20, 2024)
CAO Modeling Protocol	July 13, 2023 (Final Revision—February 18, 2025)	June 20, 2024
CAO Risk Assessment Work Plan	August 10, 2023 (Final Revision—February 18, 2025)	June 20, 2024
CAO Risk Assessment Report	October 15, 2024 February 18, 2025 (Revision 1)	--

The purpose of this revision to the CAO Risk Assessment Work Plan (RAWP) is to incorporate zoning changes identified by the DEQ in a letter dated January 17, 2025. A revised CAO modeling protocol (the Protocol) and revised CAO risk assessment report are being submitted to the DEQ concurrent with this revised RAWP.

H&V conducted a Level 3 Risk Assessment to estimate the potential excess cancer risk and chronic and acute noncancer risk (expressed numerically as the chronic and acute hazard index) from the facility using the approach provided in the CAO rules by applying the existing source risk action levels (RALs) shown in Oregon Administrative Rule (OAR) 340-245-8010 Table 1. The remainder of this RAWP outlines the methodology followed in completing the Level 3 Risk Assessment for the facility and presents specific information required by OAR-340-245-0210(2). To avoid duplicating efforts, sections of the Protocol that are relevant to the RAWP are directly referenced where applicable.

2 Conceptual Site Model

Sections 2 and 3 of the Protocol discuss the facility location, process description, toxic emission units (TEUs), and toxic air contaminant (TAC) emission estimates to satisfy the requirements of OAR 340-245-0210(2).

2.1 Significant TEUs

Daily and annual TAC emission estimates for the process equipment and emission control devices considered to be TEUs as defined in OAR 340-245-0020(59), are presented in the Protocol. Tables 3-1 and 3-3 show annual and daily TAC estimates for production Scenario 1 and Tables 3-2 and 3-4 for production Scenario 2. Dispersion model IDs and source parameters for significant TEUs are presented in Tables 3-7 and 3-8 of the Protocol.

2.2 Gas Combustion TEUs

The specific procedures for assessing the risk of each TEU depends on the TEU designation per OAR 340-245-0050(4). Per OAR 340-245-0050(5), the gas combustion "exemption applies to TEUs that solely combust natural gas, propane, [or] liquefied petroleum gas." H&V determined risk from gas combustion TEUs at each exposure location separately from the significant TEUs.

Daily and Annual TAC emission rates for the gas combustion TEUs are presented in Tables 3-5 and 3-6 of the Protocol, and dispersion model IDs and source parameters are presented in Table 3-7 of the Protocol.

2.3 Aggregated TEUs

A Level 3 Risk Assessment was conducted that included all facility TEUs other than those qualifying for the gas combustion TEU exemption. Cancer and noncancer risks are reported separately for gas combustion TEUs, aggregated TEUs (if any), and significant TEUs in the Risk Assessment Report dated February 18, 2025.

3 Exposure Assessment

3.1 Land-Use Zoning Classification—Exposure Types

Section 4 of the Protocol provides details relevant to the exposure assessment, including the dispersion modeling approach to estimate TAC concentrations at exposure locations and the corresponding exposure type classifications to satisfy the requirements under OAR 340-245-0210(2)(b).

3.2 Exposure Pathways

Cancer and noncancer risk resulting from facility TEUs are not expected to have additional exposure pathways (i.e., ingestion or injection) other than those already accounted for in each published risk-based concentration (RBC). Moreover, based on a review of land-use zoning classifications and aerial imagery, there are no known locations that might present additional exposure pathways. Since no additional exposure pathways have been observed, the Level 3 Risk Assessment was sufficient, and a Level 4 Risk Assessment was not warranted.

4 Risk Characterization

4.1 Risk-Based Concentrations

Excess cancer risk and chronic and acute noncancer risk were assessed using the most current RBCs available as shown in OAR 340-245-8010 Table 2. The TACs from the CAO emissions inventory and corresponding RBCs that were included in the Level 3 Risk Assessment are presented in Tables 4-1 and 4-2 for significant TEUs and gas combustion TEUs, respectively.

4.2 Risk Estimates

As described in Section 4.4 of the Protocol, a single dispersion model was executed using a unit emission rate of 1 gram per second (g/s) for each TEU for both the 24-hour and annual averaging periods. The maximum modeled unit concentration in micrograms per cubic meter (ug/m^3) for each averaging period was considered a modeled dispersion factor in units of ug/m^3 per g/s. When this dispersion factor is multiplied by the TAC emission rate for the modeled TEU, the result is the modeled concentration of the TAC.

The risk for a given TAC was calculated by dividing the maximum predicted model concentration of the TAC by the appropriate RBC. The resulting risk for all TACs was summed for each TEU at a given exposure location. This process was repeated for each TEU and the calculated risk for all TEUs will be summed to obtain the total excess cancer risk, the total chronic noncancer hazard index, and the total acute noncancer hazard index for a given exposure location.

4.2.1 Example Calculation—Level 3 Risk Assessment

Example calculations for estimating excess cancer risk and noncancer hazard index (representative of both chronic and acute assessments) for a single proposed exposure location are presented in Equations 1 through 3.

Equation 1.

$$\text{Excess cancer risk (chances-in-a-million)} = \Sigma \frac{(\text{TAC annual emission rate [g/s]}) \text{ x } (\text{proposed TEU dispersion factor } [\frac{\text{ug/m}^3}{\text{g/s}}])}{(\text{applicable RBC at exposure location [ug/m}^3])}$$

Equation 2.

$$\text{Chronic noncancer hazard index} = \Sigma \frac{(\text{TAC annual emission rate [g/s]}) \text{ x } (\text{proposed TEU dispersion factor } [\frac{\text{ug/m}^3}{\text{g/s}}])}{(\text{applicable RBC at exposure location [ug/m}^3])}$$

Equation 3.

$$\text{Acute noncancer hazard index} = \Sigma \frac{(\text{TAC daily emission rate [g/s]}) \text{ x } (\text{proposed TEU dispersion factor } [\frac{\text{ug/m}^3}{\text{g/s}}])}{(\text{applicable RBC at exposure location [ug/m}^3])}$$

The total facility excess cancer risk and chronic and acute noncancer hazard index were derived by summing each individual TAC risk contribution at each proposed exposure location.

4.3 Noncancer Risk Action Levels

The noncancer hazard index RALs for existing facilities are presented in Table 4-3.

Table 4-3. Noncancer Hazard Index RALs

RALs for Existing Sources	Noncancer Hazard Index [a]
Aggregate TEU Level	0.1
Source Permit Level	0.5
Community Engagement Level	1
TBACT Level	5[b] or 3[c] or Risk Determination Ratio of >1[d]
Risk Reduction Level	10[b] or 6[c] or Risk Determination Ratio of 2[d]
Immediate Curtailment Level	20[b] or 12[c] or Risk Determination Ratio of 4[d]

Notes:
OAR = Oregon Administrative Rule.
RAL = risk action level.
TAC = toxic air contaminants.
TBACT = toxics best available control technology.
OAR 340-245-8010, Table 1.
If all TACs emitted by the source are identified as hazard index of 5 in OAR 340-247-8010, Table 2, and OAR 340-245-8010, Table 2.

[a] If all TACs emitted by the source are identified as hazard index of 3 in OAR 340-247-8010, Table 2, and OAR 340-245-8010, Table 2.

[b] If TACs emitted by the source include contaminants listed as both hazard index of 3 and 5 in OAR 340-247-8010, Table 2, and OAR 340-245-8010, Table 2, and a Risk Determination Ratio is required to be calculated under OAR 340-245-0200.

The CAO rules identify certain TACs that may have developmental, reproductive, respiratory, or other noncancer severe health effects and set RALs for these TACs. The calculation of the risk determination ratio is required when facilities emit a mixture of TACs assigned noncancer toxics best available control technology (TBACT) RALs of both a hazard index of 3 and a hazard index of 5, as identified in OAR 340-245-8010, Table 2. The risk determination ratio formula under OAR 340-245-0200(5) is presented below in Equation 4.

Equation 4.

$$\text{Risk determination ratio} = \frac{\text{Risk}_{\text{HI3}}}{3} + \frac{\text{Risk}_{\text{HI5}}}{5}$$

As shown in the CAO emissions inventory, TAC emissions from the facility are comprised of a mixture of TACs with assigned hazard indices of 3 and 5 per OAR 340-245-8010 Table 2.

5 Uncertainty Analysis

Although the Level 3 Risk Assessment was conducted using the most accurate and readily available information, there are various levels of uncertainty associated with the risk assessment. Per OAR 340-245-0210(2)(d), known quantitative and qualitative uncertainties with the Level 3 Risk Assessment include, but may not be limited to, the following:

Acute Assessments:

- To assess acute noncancer risk, the full 24-hour exposure duration was assumed, though, by definition, the duration of acute exposure can be less than 24 hours. While this risk assessment assumed 24 hours of exposure, it is very unlikely that any individual would be exposed for a full 24 hours outside of a residential location. However, if the toxicity reference value is based on data collected for a lower exposure duration than the 24-hour exposure duration, the estimated risk may differ. Therefore, for TACs with RBCs that were developed using toxicity reference values based on longer exposure durations, the proposed Level 3 Risk Assessment may overestimate acute noncancer risk due to the 24-hour exposure duration assumption.
- The Level 3 Risk Assessment was conducted assuming each TEU at the facility is simultaneously operating at maximum design capacity for 24 hours. It is highly unlikely that all TEUs at the facility will simultaneously operate at their maximum capacity for a 24-hour period. Therefore, the proposed Level 3 Risk Assessment likely overestimates acute noncancer risk due to unrealistic operating conditions.
- The Level 3 Risk Assessment includes meteorological conditions which may only occur a few days or less in a one-year period that can result in worst-case dispersion characteristics. It is unlikely that these infrequent meteorological conditions would occur at the same time that the facility will be operating all TEUs at maximum capacity. Therefore, the Level 3 Risk Assessment likely overestimates acute noncancer risk because of the improbability of facility operations at maximum capacity aligning with worst-case meteorological conditions.
- Dispersion modeling was used to determine the daily dispersion factors per exposure location for use in risk estimate calculations. This method determines, for each TEU, a single day within the one-year period of hourly meteorological data, during which the highest predicted concentration occurs at each exposure location. It is highly unlikely that the maximum predicted concentration at a given exposure location occurs on the same day for all TEUs at the facility. For example, the highest predicted concentration for the Ceramic Filtration Unit 113 may occur at exposure location “X” on March 1 while, due to differences in location, release characteristics (i.e., stack height, velocity, etc.), and meteorological variation, the highest predicted concentration for the Emergency Generator 1 may occur at exposure location “X” on December 1. The maximum predicted concentrations were not paired-in-time such that maximum predicted concentrations per TEU may occur on different days within the meteorological dataset. Therefore, the Level 3 Risk Assessment likely overestimates acute noncancer risk because it is unlikely that that the highest predicted concentration from each TEU occurs at every exposure location on the same day.

Cancer and Chronic Noncancer Assessments:

- The RBCs developed by the DEQ for excess cancer risk and chronic noncancer risk assume a 70-year exposure duration for 24 hours per day. It is unlikely that a person would remain at the same residence or in areas potentially impacted by emissions covered by the CAO program for 70 consecutive years for 24 hours per day. The risk assessments also account for a person being exposed to the local facility emission rate for the entire exposure duration. Therefore, the Level 3 Risk Assessment overestimates cancer and chronic noncancer risk due to the unrealistic exposure duration assumption.
- The excess cancer and chronic noncancer risk assessments were performed assuming that all TEUs operate for the course of the calendar year at their maximum operational capacities. It is physically impossible that the facility could operate several of its TEUs at maximum capacity for an entire year without shutdown time for maintenance and cleaning of equipment. Therefore, the Level 3 Risk Assessment overestimates cancer and chronic noncancer risk due to the overestimation of emissions resulting from continuous maximum capacity facility operation.

All Assessments:

- Only excess cancer risk and chronic and acute noncancer hazard index from TACs that have RBCs published by the DEQ were assessed. Tables 5-1 and 5-2 present the TACs emitted from the significant TEUs and gas combustion TEUs, respectively, that do not have RBCs published by the DEQ. As a result, the proposed Level 3 Risk Assessment may not accurately assess cancer and/or noncancer risk associated with those TACs that do not yet have an associated RBC. However, the development of RBCs generally has a level of conservatism that will likely overestimate cancer and/or noncancer risk from TACs with known RBCs.

6 Closing

Maul Foster & Alongi, Inc. looks forward to working with the DEQ throughout the CAO permitting process. If there are any questions or comments regarding this RAWP, please contact Leslie Riley at lriley@maulfoster.com.

Limitations

The services undertaken in completing this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

Tables

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Table 4-1
Applicable RBCs - Significant TEUs
Hollingsworth & Vose Fiber Company—Corvallis, OR

TAC	CAS/DEQ ID	RBC? (Yes/No)	Noncancer TBACT RAL [1]	Risk-Based Concentration [1] (ug/m^3)						
				Residential Chronic		Nonresidential Chronic				Acute
				Cancer	Noncancer	Child Cancer	Child Noncancer	Worker Cancer	Worker Noncancer	Noncancer
METALS										
Aluminum	7429-90-5	Yes	HI5	--	5	--	22	--	22	--
Antimony	7440-36-0	Yes	HI3	--	0.3	--	1.3	--	1.3	1
Arsenic	7440-38-2	Yes	HI3	0.000024	0.00017	0.0013	0.0024	0.00062	0.0024	0.2
Cadmium	7440-43-9	Yes	HI3	0.00056	0.005	0.014	0.037	0.0067	0.037	0.03
Chromium VI	18540-29-9	Yes	HI3	0.000031	0.083	0.00052	0.88	0.001	0.88	0.3
Cobalt	7440-48-4	Yes	HI3	--	0.1	--	0.44	--	0.44	--
Copper	7440-50-8	Yes	HI3	--	--	--	--	--	--	100
Lead	7439-92-1	Yes	HI3	--	0.15	--	0.66	--	0.66	0.15
Manganese	7439-96-5	Yes	HI3	--	0.09	--	0.4	--	0.4	0.3
Mercury	7439-97-6	Yes	HI3	--	0.077	--	0.63	--	0.63	0.6
Nickel	7440-02-0	Yes	--	0.0038	0.014	0.1	0.062	0.046	0.062	0.2
Selenium	7782-49-2	Yes	HI3	--	--	--	--	--	--	2
Vanadium	7440-62-2	Yes	HI3	--	0.1	--	0.44	--	0.44	0.8
INORGANIC COMPOUNDS										
Ammonia	7664-41-7	Yes	HI3	--	500	--	2,200	--	2,200	1,200
Carbon disulfide	75-15-0	Yes	HI3	--	800	--	3,500	--	3,500	6,200
Fluorides	239	Yes	HI3	--	2.3	--	20	--	20	240
Hydrogen Fluoride	7664-39-3	Yes	HI3	--	2.1	--	19	--	19	16
Hydrochloric Acid	7647-01-0	Yes	HI3	--	20	--	88	--	88	2,100
Phosphoric Acid	7664-38-2	Yes	HI3	--	10	--	44	--	44	--
Silica, Crystalline	7631-86-9	Yes	HI5	--	3	--	13	--	13	--
Sulfuric Acid	7664-93-9	Yes	HI5	--	1	--	4.4	--	4.4	120
ORGANIC COMPOUNDS										
Acetaldehyde	75-07-0	Yes	HI3	0.45	140	12	620	5.5	620	470
Acetone	67-64-1	Yes	HI3	--	31,000	--	140,000	--	140,000	62,000
Acrolein	107-02-8	Yes	HI5	--	0.35	--	1.5	--	1.5	6.9
Benzene	71-43-2	Yes	HI3	0.13	3	3.3	13	1.5	13	29
1,3-Butadiene	106-99-0	Yes	HI3	0.033	2	0.86	8.8	0.4	8.8	660
Cyclohexane	110-82-7	Yes	HI3	--	6,000	--	26,000	--	26,000	--
Ethylbenzene	100-41-4	Yes	HI3	0.4	260	10	1,100	4.8	1,100	22,000
Chloroethane	75-00-3	Yes	HI3	--	30,000	--	130,000	--	130,000	40,000
Formaldehyde	50-00-0	Yes	HI3	0.17	9	4.3	40	2	40	49
Hexane	110-54-3	Yes	HI3	--	700	--	3,100	--	3,100	--
Chloromethane	74-87-3	Yes	HI3	--	90	--	400	--	400	1,000
2-Butanone	78-93-3	Yes	HI3	--	5,000	--	22,000	--	22,000	5,000
Methyl isobutyl ketone	108-10-1	Yes	HI3	--	3,000	--	13,000	--	13,000	--
1,2,4-Trimethylbenzene	95-63-6	Yes	HI3	--	60	--	260	--	260	--
Toluene	108-88-3	Yes	HI3	--	5,000	--	22,000	--	22,000	7,500
Xylenes (mixed isomers)	1330-20-7	Yes	HI3	--	220	--	970	--	970	8,700
o-Xylene	95-47-6	Yes	HI3	--	220	--	970	--	970	8,700
POLYCYCLIC AROMATIC HYDROCARBONS (PAH)										
PAHs	401	Yes	--	0.000043	--	0.0016	--	0.003	--	--
Benzo[a]pyrene	50-32-8	Yes	HI3	0.000043	0.002	0.0016	0.0088	0.003	0.0088	0.002
Naphthalene	91-20-3	Yes	HI3	0.029	3.7	0.76	16	0.35	16	200
DIESEL PARTICULATE MATTER (DPM)										
DPM	200	Yes	HI3	0.1	5	2.6	22	1.2	22	--

Notes

m^3 = cubic feet.

RAL = risk action level.

RBC = risk-based concentration.

TBACT = toxics best available control technology.

TAC = toxic air contaminant.

ug = micrograms.

References

[1] See Oregon Administrative Rule 340-245-8010 Table 2.

Table 4-2
Applicable RBCs - Gas Combustion TEU
Hollingsworth & Vose Fiber Company—Corvallis, OR

TAC	CAS/DEQ ID	RBC? (Yes/No)	Noncancer TBACT RAL [1]	Risk-Based Concentration [1] (ug/m^3)						
				Residential Chronic		Nonresidential Chronic				Acute
				Cancer	Noncancer	Child Cancer	Child Noncancer	Worker Cancer	Worker Noncancer	Noncancer
METALS										
Arsenic	7440-38-2	Yes	HI3	0.000024	0.00017	0.0013	0.0024	0.00062	0.0024	0.2
Beryllium	7440-41-7	Yes	HI3	0.00042	0.007	0.011	0.031	0.005	0.031	0.02
Cadmium	7440-43-9	Yes	HI3	0.00056	0.005	0.014	0.037	0.0067	0.037	0.03
Chromium VI	18540-29-9	Yes	HI3	0.000031	0.083	0.00052	0.88	0.001	0.88	0.3
Cobalt	7440-48-4	Yes	HI3	--	0.1	--	0.44	--	0.44	--
Copper	7440-50-8	Yes	HI3	--	--	--	--	--	--	100
Lead	7439-92-1	Yes	HI3	--	0.15	--	0.66	--	0.66	0.15
Manganese	7439-96-5	Yes	HI3	--	0.09	--	0.4	--	0.4	0.3
Mercury	7439-97-6	Yes	HI3	--	0.077	--	0.63	--	0.63	0.6
Nickel	7440-02-0	Yes	--	0.0038	0.014	0.1	0.062	0.046	0.062	0.2
Selenium	7782-49-2	Yes	HI3	--	--	--	--	--	--	2
Vanadium	7440-62-2	Yes	HI3	--	0.1	--	0.44	--	0.44	0.8
INORGANIC COMPOUNDS										
Ammonia	7664-41-7	Yes	HI3	--	500	--	2,200	--	2,200	1,200
ORGANIC COMPOUNDS										
Acetaldehyde	75-07-0	Yes	HI3	0.45	140	12	620	5.5	620	470
Acrolein	107-02-8	Yes	HI5	--	0.35	--	1.5	--	1.5	6.9
Benzene	71-43-2	Yes	HI3	0.13	3	3.3	13	1.5	13	29
Ethylbenzene	100-41-4	Yes	HI3	0.4	260	10	1,100	4.8	1,100	22,000
Formaldehyde	50-00-0	Yes	HI3	0.17	9	4.3	40	2	40	49
Hexane	110-54-3	Yes	HI3	--	700	--	3,100	--	3,100	--
Toluene	108-88-3	Yes	HI3	--	5,000	--	22,000	--	22,000	7,500
Xylenes (mixed isomers)	1330-20-7	Yes	HI3	--	220	--	970	--	970	8,700
POLYCYCLIC AROMATIC HYDROCARBONS (PAH)										
PAHs	401	Yes	--	0.000043	--	0.0016	--	0.003	--	--
Benzo[a]pyrene	50-32-8	Yes	HI3	0.000043	0.002	0.0016	0.0088	0.003	0.0088	0.002
Naphthalene	91-20-3	Yes	HI3	0.029	3.7	0.76	16	0.35	16	200

Notes

m^3 = cubic feet.

RAL = risk action level.

RBC = risk-based concentration.

TBACT = toxics best available control technology.

TAC = toxic air contaminant.

ug = micrograms.

References

[1] See Oregon Administrative Rule 340-245-8010 Table 2.

Table 5-1
List of TACs With No Published RBCs - Significant TEUs
Hollingsworth & Vose Fiber Company—Corvallis, OR

TAC	CAS/DEQ ID	RBC? [1] (Yes/No)
Barium	7440-39-3	No
Glasswool Fibers	352	No
Molybdenum trioxide	1313-27-5	No
Phosphorus	504	No
Zinc	7440-66-6	No
Zinc Oxide	1314-13-2	No

Notes

RBC = risk-based concentration.

TAC = toxic air contaminant.

References

[1] Oregon Administrative Rule 340-245-8010 Table 2.

Table 5-2
List of TACs With No Published RBCs - Gas Combustion TEU
Hollingsworth & Vose Fiber Company—Corvallis, OR

TAC	CAS/DEQ ID	RBC? [1] (Yes/No)
Barium	7440-39-3	No
Molybdenum trioxide	1313-27-5	No
Zinc	7440-66-6	No

Notes

RBC = risk-based concentration.

TAC = toxic air contaminant.

References

[1] Oregon Administrative Rule 340-245-8010 Table 2.