Oregon
Tina Kotek, Governor

**Department of Environmental Quality**
**Agency Headquarters**
700 NE Multnomah Street, Suite 600
Portland, OR 97232
(503) 229-5696
FAX (503) 229-6124
TTY 711

March 18, 2025

Orchid Orthopedic Solutions Oregon, Inc.
13963 S Fir St.
Oregon City, OR 97045
*Sent via email only*

Nathan Holwege,

DEQ received the submittal of the Cleaner Air Oregon (CAO) Emissions Inventory (Inventory) for the Orthopedic Solutions Oregon, Inc. (Orchid Orthopedics) in Oregon City, OR on November 22, 2024, and has completed an initial review.

In accordance with Oregon Administrative Rule (OAR) 340-245-0030(2), DEQ has determined that the following additional information, corrections, and updates are required by **May 19, 2025** to approve the Inventory:

**General Comments**

1. Baghouse Control Efficiencies: DEQ will not accept 99.9 percent control efficiency of particulate matter (PM) for activities controlled by a baghouse. Vendor specifications for the filters used at Orchid Orthopedics' baghouses state a 99.9 percent control of PM sized between 2.5 and 10 microns. Fabric filters typically have a lower control efficiency for PM less than 2.5 microns. The activities controlled by the baghouses at Orchid Orthopedics are understood to produce PM sized less than 2.5 microns ($PM_{2.5}$) therefore a control efficiency of 99.9 percent overestimates the removal efficiency of the baghouses for smaller particulates. DEQ has addressed specific instances and required updates to the Inventory or supporting calculations in the proceeding section.
2. Crystalline Silica: The CAS registry number (CASRN) of 7631-86-9 is for silica of both amorphous and crystalline form. However, at this time only crystalline silica (of respirable size) is a listed toxic air contaminant (TAC). The following silica materials are of the crystalline form: quartz (CASRN 14808-60-7), cristobalite (CASRN 14464-46-1), and tridymite (CASRN 15468-32-3). Materials under these CASRNs should be evaluated as crystalline silica and are potentially reportable as "silica, crystalline (respirable)" (CASRN 7631-86-9) for CAO. DEQ has reviewed Safety Data Sheets (SDSs) for materials used at Orchid Orthopedics and found that in multiple instances amorphous silica compounds have been reported as crystalline silica. DEQ has addressed these specific instances and required updates to the Inventory or supporting calculations in the proceeding "Specific Comments" section.
3. Hexavalent Chromium: DEQ has reviewed Orchid Orthopedics' industrial hygiene report on hexavalent chromium exposure conducted for employees performing welding, casting, cutoff, and barrel change activities. DEQ has determined that the analysis presented is inadequate to support the assumption of zero hexavalent chromium emissions from foundry activities. DEQ has provided acceptable values to use in estimating hexavalent chromium as percentage of total chromium in the proceeding section.

4. Short-term variability: DEQ recommends accounting for some safety factor in estimating short-term (maximum daily) throughputs and usage rates. This safety factor will help account for short-term variability in production and add conservatism to the acute risk assessment.

**Specific Comments**

1. **Process Flow Diagram**: Provide a copy of the facility's process flow diagram which meets the requirements of OAR 340-245-0040(4)(b)(C)(i). The process flow submitted with the Inventory is a text-based flow document which, while useful, does not fulfill the requirements.

2. **Alloy Composition Data**: DEQ requests that more refined alloy compositional information be provided for the purposes of developing the Inventory. Batch sheets or alloy specification sheets provided by the supplier should be used over SDS sheets for the alloys.
    a. Provide DEQ copies of this compositional information for review. If this information is considered Confidential Business Information (CBI), follow appropriate CBI protocols when submitting these documents.
    b. Update TAC emission estimates for all TEUs which use alloy compositional data. Specific instances are identified below in Specific Comment 3.

3. **Revised Inventory**: Submit to DEQ a revised Inventory (AQ520), along with all supporting calculations in Excel format, as well as all information required under OAR 340-245-0040(4). Include the following updates to the AQ520:
    a. NATURAL GAS TEU:
        i. Review of previous year's annual reports show that the annual Requested PTE from the Inventory has been exceeded in recent years (see 2017 and 2018). Review and revise the Requested PTE as needed to ensure it is reflective of the facility's future operations.
        ii. Incorporate the following updates to the emission factors in Worksheet 3:
            1. Use the emission factor of 3.2 lb/MMscf for ammonia (CASRN 7664-41-7). The emission factor used is for units equipped with an SCR.[1]
            2. Include emissions estimates for benzo[a]pyrene (CASRN 50-32-8) using an emission factor of 0.0000012 lb/MMscf.[2]
    b. 17-4 Alloy TEUs:
        i. For the 17-4 alloy, confirm the estimate of maximum daily production/processing throughputs are reflective of worst-case daily activities at the facility. The Inventory calculates maximum daily production and metal processing throughputs as a split of annual usage across 250 days. However, supplemental information provided with the Inventory notes that "work with the 17-4 alloy comes in batches. … Some months may have a couple small batches; most months there will be zero use." This comment is included with supplemental information pertaining specifically to TIG production welding, but DEQ assumes it applies more generally to production using the 17-4 alloy.

[1] DEQ. March 1, 2024. "AQ104B Toxics Reporting and Air Toxics Emissions Inventory: Combustion Emission Factor Search Tool." https://www.oregon.gov/deq/aq/air-toxics/Pages/Air-Toxics-Emissions-Inventory.aspx

[2] EPA. September 1998. AP-42 Chapter 1, Table 1.4-3 "Emission Factors for Speciated Organic Compounds from Natural Gas Combustion." https://www.epa.gov/sites/production/files/2020-09/documents/1.4_natural_gas_combustion.pdf

ii. Refine the maximum daily assumptions across all 17-4 alloy specific TEUs as appropriate.

c. WELD (F-75) TEU:
   i. Update alloy content based on refined compositional information for the F-75 alloy (see Specific Comment 2.b).
   ii. Per General Comment 1, DEQ will not accept a PM control efficiency of 99.9 percent for processes captured by a baghouse. DEQ will accept the following control efficiencies:[3]
      1. 100 percent control of PM that is greater than 10 microns; and
      2. 99 percent control of PM less than 10 microns ($PM_{10}$).
   iii. Include emission estimates for hexavalent chromium (CASRN 18540-29-9) as 5 percent of total chromium emissions based on guidance from San Diego County Air Pollution Control District.[4]
   iv. Include emissions estimates for molybdenum trioxide (CASRN 1313-27-5). In the absence of data specific to molybdenum trioxide, account for 100 percent conversion to molybdenum trioxide by multiplying molybdenum emissions by 1.5 (the ratio of the molecular weight of molybdenum trioxide and the atomic weight of molybdenum).
   v. Unless more refined alloy specifications are available (see Specific Comment 2.b), include emission estimates for compounds listed under the SARA Title III subsection of the Regulatory Information section of the SDS.
      1. Nickel (CASRN 7440-02-0): Assume the de minimis concentration of 0.1 percent. [5]
      2. Beryllium (CASRN 7440-41-7): Assume the de minimis concentration of 0.1 percent.[5]

d. WELD (17-4) TEU:
   i. Update the maximum daily (actual and Requested PTE) usage rates per response to Specific Comment 3.b.
   ii. Per General Comment 1, DEQ will not accept a PM control efficiency of 99.9 percent for processes captured by a baghouse. DEQ will accept the following control efficiencies:[3]
      1. 100 percent control of PM that is greater than 10 microns; and
      2. 99 percent control of $PM_{10}$.
   iii. Update alloy content based on refined compositional information for the 17-4 alloy (see Specific Comment 2.b).
   iv. Include emission estimates for hexavalent chromium (CASRN 18540-29-9) as 5 percent of total chromium emissions based on guidance from San Diego County Air Pollution Control District.[4]
   v. Include emissions estimates for molybdenum trioxide (CASRN 1313-27-5). In the absence of data specific to molybdenum trioxide, account for 100 percent conversion to molybdenum trioxide by multiplying molybdenum emissions by

[3] DEQ will consider other more refined emission estimate approaches for PM emissions with supporting representative information.

[4] San Diego County Air Pollution Control District. October 16, 1998 (revised July 11, 2022). "Welding Operations." (https://www.sdapcd.org/content/dam/sdapcd/documents/permits/emissions-calculation/welding/APCD-Welding-Operations.pdf).

[5] EPA. "EPCRA Section 313 Chemical List for Reporting Year 2010." (https://www.epa.gov/sites/default/files/documents/RY2010ChemicalList.pdf)

1.5 (the ratio of the molecular weight of molybdenum trioxide and the atomic weight of molybdenum).

e. WELD (MIG) TEU: The maximum daily usage rate for the MIG welding rod presented in Worksheet 2 differs from information presented in supporting workbook "2024.11.21 Orchid Ortho CAO - Supporting Calcs for Emissions.xlsx." Review and revise throughputs as appropriate to resolve the discrepancy.

f. F-75 CAST TEU:
   i. Review of 2023 actual annual metal poured against information submitted in both the 2023 Annual Report and the Air Toxics Emissions Inventory (ATEI) show discrepancies. Review and revise throughputs as appropriate to resolve the discrepancy.
   ii. The Inventory uses both AP-42 and RTI International (RTI) emission factors for casting operations. RTI's "Emission Estimation Protocol for Iron and Steel Foundries" document (RTI document) is DEQ's preferred source for emission factors for foundry sources.[6] Update emission factors to reference only the RTI document. Use the following particulate matter (PM) emission factors from RTI, which represent the sum of both filterable PM (PM-FIL) and condensable PM (PM-CON), for casting operations at Orchid Orthopedics:
      1. Induction melting uncontrolled (RTI, Table 3-3): 1.55 lb/ton metal poured;
      2. Induction charging & tapping uncontrolled (RTI, Table 3-3): 0.51 lb/ton metal poured;
      3. Pouring, captured, uncontrolled (RTI, Table 5-4): 0.317 lb/ton metal poured; and
      4. Cooling, captured, uncontrolled (RTI, Table 5-4): 1.06 lb/ton metal poured.
   iii. DEQ will not accept a building control efficiency of 99 percent for casting activities as set forth in the Inventory. The justification provided is inadequate to support such a high degree of control for PM generated from casting activities. Either substantiate the requested control efficiency or remove entirely.
   iv. Update alloy content based on refined compositional information for the F-75 alloy (see Specific Comment 2.b).
   v. Include emission estimates for hexavalent chromium (CASRN 18540-29-9). The percent of total chromium as hexavalent chromium varies across casting activities. Use the following defaults from Table B-9 in Appendix B of the RTI document:[6]
      1. Induction melting (steel foundry, electric induction furnace [EIF]): 12 percent;
      2. Charging & tapping (steel foundry, charge handling): 3 percent;
      3. Pouring (steel foundry, pouring and casting): 3 percent; and
      4. Cooling (steel foundry, casting cooling): 3 percent.
   vi. Include emissions estimates for molybdenum trioxide (CASRN 1313-27-5). In the absence of data specific to molybdenum trioxide, account for 100 percent conversion to molybdenum trioxide by multiplying molybdenum emissions by 1.5 (the ratio of the molecular weight of molybdenum trioxide and the atomic weight of molybdenum).

[6] RTI International. 2012. "Emission Estimation Protocol for Iron and Steel Foundries."

vii. Unless more refined alloy specifications are available (see Specific Comment 2.b), include emission estimates for compounds listed under the SARA Title III subsection of the Regulatory Information section of the SDS.
    1. Nickel (CASRN 7440-02-0): Assume the de minimis concentration of 0.1 percent.[5]
    2. Beryllium (CASRN 7440-41-7): Assume the de minimis concentration of 0.1 percent.[5]

g. 17-4 CAST TEU:
    i. Review of 2023 actual annual metal poured against information submitted in both the 2023 Annual Report and the ATEI show discrepancies. Review and revise throughputs as appropriate to resolve the discrepancy.
    ii. Update the maximum daily (actual and Requested PTE) metal poured per response to Specific Comment 3.b.
    iii. The Inventory uses both AP-42 and RTI emission factors for casting operations. The RTI document is DEQ's preferred source for emission factors for foundry sources.[6] Update emission factors to reference only the RTI document. Use the following PM emission factors from RTI, which represent the sum of both filterable PM (PM-FIL) and condensable PM (PM-CON), for casting operations at Orchid Orthopedics:
        1. Induction melting uncontrolled (RTI, Table 3-3): 1.55 lb/ton metal poured;
        2. Induction charging & tapping uncontrolled (RTI, Table 3-3): 0.51 lb/ton metal poured;
        3. Pouring, captured, uncontrolled (RTI, Table 5-4): 0.317 lb/ton metal poured; and
        4. Cooling, captured, uncontrolled (RTI, Table 5-4): 1.06 lb/ton metal poured.
    iv. DEQ will not accept a building control efficiency of 99 percent for casting activities as set forth in the Inventory. The justification provided is inadequate to support such a high degree of control for PM generated from casting activities. Either substantiate the requested control efficiency or remove entirely.
    v. Update alloy content based on refined compositional information for the 17-4 alloy (see Specific Comment 2.b).
    vi. Include emission estimates for hexavalent chromium (CASRN 18540-29-9). The percent of total chromium as hexavalent chromium varies across casting activities. Use the following defaults from Table B-9 in Appendix B of the RTI document:[6]
        1. Induction melting (steel foundry, electric induction furnace [EIF]): 12 percent;
        2. Charging & tapping (steel foundry, charge handling): 3 percent;
        3. Pouring (steel foundry, pouring and casting): 3 percent; and
        4. Cooling (steel foundry, casting cooling): 3 percent.
    vii. Include emissions estimates for molybdenum trioxide (CASRN 1313-27-5). In the absence of data specific to molybdenum trioxide, account for 100 percent conversion to molybdenum trioxide by multiplying molybdenum emissions by 1.5 (the ratio of the molecular weight of molybdenum trioxide and the atomic weight of molybdenum).

h. F-75 CUT TEU:
   i. Review of 2023 actual annual metal poured against information submitted in both the 2023 Annual Report and the ATEI show discrepancies. Review and revise throughputs as appropriate to resolve the discrepancy.
   ii. Update alloy content based on refined compositional information for the F-75 alloy (see Specific Comment 2.b).
   iii. Per General Comment 1, DEQ will not accept a PM control efficiency of 99.9 percent for processes captured by a baghouse. DEQ will accept the use of the $PM_{10}$ emission factor of 3.0 lb/ton metal poured for "cutting, captured and uncontrolled" (RTI, Table 6-2)[6] as representing PM emissions and the following control efficiencies for activities controlled by baghouses:[3]
      1. 100 percent control of PM that is greater than 10 microns; and
      2. 99 percent control of $PM_{10}$ (PM less than 10 microns).
   iv. Include emission estimates for hexavalent chromium (CASRN 18540-29-9) as 3 percent of total chromium emissions.[7]
   v. Include emissions estimates for molybdenum trioxide (CASRN 1313-27-5). In the absence of data specific to molybdenum trioxide, account for 100 percent conversion to molybdenum trioxide by multiplying molybdenum emissions by 1.5 (the ratio of the molecular weight of molybdenum trioxide and the atomic weight of molybdenum).
   vi. Unless more refined alloy specifications are available (see Specific Comment 2.b), include emission estimates for compounds listed under the SARA Title III subsection of the Regulatory Information section of the SDS.
      1. Nickel (CASRN 7440-02-0): Assume the de minimis concentration of 0.1 percent.[5]
      2. Beryllium (CASRN 7440-41-7): Assume the de minimis concentration of 0.1 percent.[5]

i. 17-4 CUT TEU:
   i. Review of 2023 actual annual metal poured against information submitted in both the 2023 Annual Report and the ATEI show discrepancies. Review and revise throughputs as appropriate to resolve the discrepancy.
   ii. Update the maximum daily (actual and Requested PTE) metal poured per response to Specific Comment 3.b.
   iii. Per General Comment 1, DEQ will not accept a PM control efficiency of 99.9 percent for processes captured by a baghouse. DEQ will accept the use of the $PM_{10}$ emission factor of 3.0 lb/ton metal poured for "cutting, captured and uncontrolled" (RTI, Table 6-2)[6] as representing PM emissions and the following control efficiencies for activities controlled by baghouses:[3]
      1. 100 percent control of PM that is greater than 10 microns; and
      2. 99 percent control of $PM_{10}$ (PM less than 10 microns).
   iv. Update alloy content based on refined compositional information for the 17-4 alloy (see Specific Comment 2.b).
   v. Include emission estimates for hexavalent chromium (CASRN 18540-29-9) as 3 percent of total chromium emissions.[7]

[7] RTI International. 2012. Appendix B, "Development of Chromium Hexavalent Distribution of Total Chromium." Assume hexavalent chromium is 3 percent of total chromium for finishing activities.

vi. Include emissions estimates for molybdenum trioxide (CASRN 1313-27-5). In the absence of data specific to molybdenum trioxide, account for 100 percent conversion to molybdenum trioxide by multiplying molybdenum emissions by 1.5 (the ratio of the molecular weight of molybdenum trioxide and the atomic weight of molybdenum).

j. KNOCK OUT TEU:
   i. DEQ will also approve use of the PM emission factor or Shakeout at Gray Iron Foundries of 3.2 lb/ton metal poured.[8] Orchid Orthopedics has used the emission factor from the RTI document, which, while conservative, likely presents an overestimate of PM emissions from the knockout activities at an investment foundry.
   ii. Ceramic Mold Composition Development:
      1. Provide additional details on the ceramic mold weight analysis conducted by Orchid Orthopedics. Describe when molds were weighed (such as before or after curing) and provide justification for the representativeness of the mold used in the evaluation.
      2. Provide justification for the assumption that the relative weight of the slurry layer and the sand layer is consistent across all dips. The information collected for the first slurry dip and first sand application show that for Dip #1 the slurry layer and sand layer are of equal weights. Based on this, the same weight ratio was applied across all slurry dips and sand applications despite different compositions of both the slurries and sands.
      3. Dow Corning Antifoam Y-30 Emulsion (M-1971): Review content of this material in the recipe for Dips 3 through 8. The recipe description says the content is 62 millimeters per batch, but the calculation uses 120 millimeters.
      4. Account for emissions of the volatile components of the ceramic mold in a separate TEU as these would likely be emitted during the mold curing process. See Specific Comment 4.b for additional guidance. Also note that fabric filters provide negligible removal of gaseous compounds such as 1,3-butadiene (CASRN 106-99-0).
      5. Nalco Esp-Prime (M-385): Update silica content of the ceramic molds to include only crystalline silica. This material contains only amorphous silica. No crystalline silica is listed in SDS.
      6. Mulgrain 47/Remasil 48/Ez-Cast, all grades (M-396):
         a. Update calculations to reference content of Cristobalite (CASRN 14464-46-1) which is the crystalline form of silica in the material. Current calculations reference the amorphous silica content.
         b. Account for the aluminum (CASRN 7429-90-5) content of kaolin ($Al_2Si_2O_5(OH)_4$) by multiplying the weight percentage of kaolin by 0.209 (the ratio of the atomic weight of two aluminum atoms and the molecular weight of kaolin).

[8] EPA. January 1995. AP-42 Chapter 12, Table 12.10-7 "Particulate Emission Factors for Ancillary Operations and Fugitive Sources at Gray Iron Foundries." https://www3.epa.gov/ttnchie1/ap42/ch12/final/c12s10.pdf

7. Biocide MC 68 MW, bleach (M-406): This material contains a copper salt (cupric nitrate, CASRN 3251-23-8). Account for the copper (CASRN 7440-50-8) content of cupric nitrate ($Cu(NO_3)_2$) by multiplying the weight percentage of cupric nitrate by 0.339 (the ratio of the atomic weight of the copper atom and the molecular weight of cupric nitrate).
8. Remasil 48 RG20, RG23, RG25, RG30, RG40, RG50, RG70 (M-415):
    a. Update calculations to reference content of Cristobalite (CASRN 14464-46-1) which is the crystalline form of silica in the material. Current calculations reference the amorphous silica content.
    b. Account for the aluminum (CASRN 7429-90-5) content of kaolin ($Al_2Si_2O_5(OH)_4$) by multiplying the weight percentage of kaolin by 0.209 (the ratio of the atomic weight of two aluminum atoms and the molecular weight of kaolin).
9. Zircon – all grades (M-425): Account for the aluminum (CASRN 7429-90-5) content of aluminum silicate (CASRN 1302-76-7, $Al_2H_6O_5Si$) by multiplying the weight percentage of aluminum silicate by 0.321 (the ratio of the atomic weight of two aluminum atoms and the molecular weight of aluminum silicate).
10. NALCO 1130 (M-429): Update silica content of the ceramic molds to include only crystalline silica. Colloidal silica is amorphous. No crystalline silica listed in SDS.
11. GZM TZM EZM Zircon flour Sand A (M-1837): Account for the aluminum (CASRN 7429-90-5) content of kyanite (CASRN 1302-76-7, $Al_2H_6O_5Si$) by multiplying the weight percentage of kyanite by 0.321 (the ratio of the atomic weight of two aluminum atoms and the molecular weight of kyanite).
12. Cobalt aluminate blue spinel (M-2045): Current calculations assume 100 percent of material as cobalt. Update emission calculations to account for both the cobalt (CASRN 7440-48-4) and aluminum (CASRN 7429-90-5) content of the cobalt aluminate blue spinel ($CoAl_2O_4$).
    a. Calculate the cobalt content of by multiplying the weight percentage of cobalt aluminate blue spinel by 0.333 (the ratio of the atomic weight of the cobalt atom and the molecular weight of cobalt aluminate blue spinel).
    b. Calculate the aluminum content of by multiplying the weight percentage of cobalt aluminate blue spinel by 0.305 (the ratio of the atomic weight of two aluminum atoms and the molecular weight of cobalt aluminate blue spinel).

iii. Update calculations in Worksheet 3 of the AQ520 form (Column J) to reference the correct throughput from Worksheet 2 for annual emission calculations.

k. Grinding TEUs (CELL 1 GATE GRIND, CELL 2 HAND GRIND, REWORK GRIND):
    i. Split each of the grinding TEUs into two TEUs, one for each alloy type, consistent with other TEUs which use alloy composition as the emissions basis for metal TACs (such as the Weld, Cast, and Cut TEUs).
    ii. Comments in the AQ520 workbook suggest that the current grinding throughput basis is total mass of metal shipped. The basis for finishing operations emission factors presented in Table 6-2 of the RTI document is the total mass of metal

cast, not the mass of the final metal product (see Example 6-1).[6] Grinding throughputs can account for portion of metal gating removed at the cut-off stage. Update grinding throughputs in Worksheet 2 to reflect total metal poured for parts.

iii. Per General Comment 1, DEQ will not accept a PM control efficiency of 99.9 percent for processes captured by a baghouse. DEQ will accept the use of the $PM_{10}$ emission factor of 8.0 lb/ton metal produced for "grinding, captured and uncontrolled" (RTI, Table 6-2)[6] as representing PM emissions and the following control efficiencies for activities controlled by baghouses:[3]
    1. 100 percent control of PM that is greater than 10 microns; and
    2. 99 percent control of $PM_{10}$ (PM less than 10 microns).

iv. Currently both the grinding throughputs in Worksheet 2 and emission factors in Worksheet 3 are apportioned to account for a split of emissions across the three grinding TEUs. Based on information provided, this split (95/2.5/2.5 percent) should not be incorporated into *both* throughputs and emission factors. Therefore, update the Inventory in one of the following ways. If none of the below is appropriate, provide justification for an alternate approach.
    1. If not all parts are processed through each grinding TEU, update throughputs for individual grinding TEUs to reflect appropriate estimates of parts and alloys through each process. Use the full grinding emission factor (8 lb/ton metal produced) without accounting for any additional reduction.
    2. If all parts are processed through each grinding TEU, present as a single TEU for each alloy (such as "F-25 GRIND" and "17-4 GRIND") and account for total throughput of parts for each alloy through their respective grinding TEU. Use the full grinding emission factor (8 lb/ton metal produced) for each TEU. The distribution of emissions from the different grinding stations and/or control devices can be accounted for in the Modeling Protocol. Update Worksheet 2 to reflect all appropriate control devices (Column C) and stack IDs (Column E).
    3. If all parts are processed through each Grinding TEU, update throughputs for Grinding TEUs to estimate of total throughput of parts and alloys through grinding. Account for split of emissions by apportioning the grinding emission factor (8 lb/ton metal produced).

v. Include emission estimates for hexavalent chromium (CASRN 18540-29-9) as 3 percent of total chromium emissions.[7]

vi. Include emissions estimates for molybdenum trioxide (CASRN 1313-27-5). In the absence of data specific to molybdenum trioxide, account for 100 percent conversion to molybdenum trioxide by multiplying molybdenum emissions by 1.5 (the ratio of the molecular weight of molybdenum trioxide and the atomic weight of molybdenum).

vii. 17-4 Alloy TEUs: Develop the maximum daily (actual and Requested PTE) metal produced per response to Specific Comment 3.b.

viii. F-75 Alloy TEUs: Unless more refined alloy specifications are available (see Specific Comment 2.b), include emission estimates for compounds listed under the SARA Title III subsection of the Regulatory Information section of the SDS.
    1. Nickel (CASRN 7440-02-0): Assume the de minimis concentration of 0.1 percent.[5]

2. Beryllium (CASRN 7440-41-7): Assume the de minimis concentration of 0.1 percent.[5]

l. PARTS CLEANING TEU: Include a reference for the source of compositional information for the "Isopropyl Alcohol" material in Column H of Worksheet 5.

m. FLASHFIRE DEWAX TEU:
   i. 2023 actual maximum daily material usage for both wax materials presented in Worksheet 4 differs from information presented in the supporting workbook "2024.11.21 Orchid Ortho CAO - Supporting Calcs for Emissions.xlsx." This workbook states usage of 994-1-1002 Green Cerita Casting Wax (M-711) as 38.9 lb/yr and usage of 2-R736 Mod-A Reclaim Wax (M-476) as 73.4 lb/yr. Review and revise throughputs as appropriate to resolve the discrepancy.
   ii. Provide manufacturer documentation to support assumption that 10 to 20 percent of wax is lost as smoke.
   iii. DEQ requires that Orchid Orthopedics reach out to the wax manufacturer (Paramelt) for information on products of combustion for their materials. Of particular interest is any data available on the combustion products of paraffin wax (CASRN 8002-74-2).
   iv. 2-W07F-3 Pink Water Soluble Wax (M-524): This material contains multiple TACs. If this material is melted at the dewax furnace, include emission estimates for the below TACs. If otherwise, provide an explanation of how this wax is used.
      1. Potassium aluminum silicate, mica (12001-26-2): Account for the aluminum (CASRN 7429-90-5) content of mica ($Al_2K_2O_6Si$) by multiplying the weight percentage of mica by 0.211 (the ratio of the atomic weight of two aluminum atoms and the molecular weight of mica).
      2. Aluminum silicate, kaolin (CASRN 1332-58-7): Account for aluminum (CASRN 7429-90-5) content of kaolin ($Al_2Si_2O_5(OH)_4$) by multiplying the weight percentage of kaolin by 0.209 (the ratio of the atomic weight of two aluminum atoms and the molecular weight of kaolin).
      3. Sodium aluminum silicate, feldspar (CASRN 68476-25-5): Account for aluminum (CASRN 7429-90-5) content of feldspar ($AlO_8Si_3Na$) by multiplying the weight percentage of feldspar by 0.103 (the ratio of the atomic weight of aluminum and the molecular weight of feldspar).
      4. Quartz (CASRN 14808-60-7): Quartz is a form of crystalline silica (CASRN 7631-86-9).

n. Sandblast TEUs (CELL 1 SANDBLAST, CELL 2 SANDBLAST, FINISH SANDBLAST):
   i. Include emission estimates for metal TACs from sandblasting activities.
   ii. Split each of the sandblast TEUs into two TEUs, one for each alloy type, consistent with other TEUs which use alloy composition as the emissions basis for metal TACs (such as the Weld, Cast, and Cut TEUs).
   iii. Per General Comment 1, DEQ will not accept a PM control efficiency of 99.9 percent for processes captured by a baghouse. DEQ will accept the use of the $PM_{10}$ emission factor of 8.0 lb/ton metal produced for "shot blasting or sand blasting, captured and uncontrolled" (RTI, Table 6-2)[6] as representing PM emissions and the following control efficiencies for activities controlled by baghouses:[3]

1. 100 percent control of PM that is greater than 10 microns; and
2. 99 percent control of $PM_{10}$ (PM less than 10 microns).

iv. Speciate PM emissions using alloy composition consistent with the method used for the other alloy-specific TEUs.
1. Include emission estimates for hexavalent chromium (CASRN 18540-29-9) as 3 percent of total chromium emissions.[7]
2. Include emissions estimates for molybdenum trioxide (CASRN 1313-27-5). In the absence of data specific to molybdenum trioxide, account for 100 percent conversion to molybdenum trioxide by multiplying molybdenum emissions by 1.5 (the ratio of the molecular weight of molybdenum trioxide and the atomic weight of molybdenum).

v. 17-4 Alloy TEUs: Develop the maximum daily (actual and Requested PTE) metal produced per response to Specific Comment 3.b.

vi. F-75 Alloy TEUs: Unless more refined alloy specifications are available (see Specific Comment 2.b), include emission estimates for compounds listed under the SARA Title III subsection of the Regulatory Information section of the SDS.
1. Nickel (CASRN 7440-02-0): Assume the de minimis concentration of 0.1 percent.[5]
2. Beryllium (CASRN 7440-41-7): Assume the de minimis concentration of 0.1 percent.[5]

vii. Washington mills Duralum 60 Grit, aka Brown Aluminum oxide 60 grit (M-2012): Confirm this material contains aluminum oxide of fibrous forms. Currently the DEQ pollutant list only has aluminum oxide of fibrous forms listed as a TAC, though all forms of aluminum oxide share the CASRN of 1344-28-1. Non-fibrous forms of aluminum oxide should be reported as aluminum (CASRN 7429-90-5). Account for aluminum content of aluminum oxide ($Al_2O_3$) by multiplying the weight percentage of aluminum oxide by 0.529 (the ratio of the atomic weight of two aluminum atoms and the molecular weight of aluminum oxide).

viii. Duralum Special White 24 Grit (U-013): Confirm this material contains aluminum oxide of fibrous forms. Currently the DEQ pollutant list only has aluminum oxide of fibrous forms listed as a TAC, though all forms of aluminum oxide share the CASRN of 1344-28-1. Non-fibrous forms of aluminum oxide should be reported as aluminum (CASRN 7429-90-5). Account for aluminum content of aluminum oxide ($Al_2O_3$) by multiplying the weight percentage of aluminum oxide by 0.529 (the ratio of the atomic weight of two aluminum atoms and the molecular weight of aluminum oxide).

o. ROBOT POLISH TEU:

i. P-255 Liquid Compound (U-014): Confirm this material contains aluminum oxide of fibrous forms. Currently the DEQ pollutant list only has aluminum oxide of fibrous forms listed as a TAC, though all forms of aluminum oxide share the CASRN of 1344-28-1. Non-fibrous forms of aluminum oxide should be reported as aluminum (CASRN 7429-90-5). Account for aluminum content of aluminum oxide ($Al_2O_3$) by multiplying the weight percentage of aluminum oxide by 0.529 (the ratio of the atomic weight of two aluminum atoms and the molecular weight of aluminum oxide).

ii. Update removal efficiency of the BH9 filters to reflect the MERV 10 equivalency rating stated by the manufacturer. The Inventory uses the manufacturer's stated removal efficiency for PM of size 20 microns or greater. However, in the absence

of size distribution data, DEQ will accept a removal efficiency of 50 percent based on the EPA's minimum stated control efficiency for MERV 10 filters.[9]

p. KOLENE TEU:
   i. Review of 2023 actual annual usage of the Caustic Soda Beads material against information submitted in the ATEI show discrepancies. Review and revise throughputs as appropriate to resolve the discrepancy.
   ii. Provide additional information on the hydrochloric acid (CASRN 7647-01-0) bath at the Kolene system. Including whether emissions from this tank are captured and controlled by the Viron Scrubber.
   iii. Provide additional information on the nitric acid (CASRN 7697-37-2) used for passivation in the Kolene process. Emissions estimates for nitric acid from the Kolene TEU were included in both the 2020 and 2023 ATEI. In the 2023 ATEI it was noted that use of this material was discontinued during 2023. If this material was used in 2023 and the Kolene process resulted in emissions of nitric acid (CASRN 7697-37-2), include 2023 actual annual and maximum daily throughput or usages for this material in the Inventory. Emissions do not need to be estimated if this material will not be included in Orchid Orthopedics' Requested PTE.

4. **Investing**: DEQ has identified two materials containing potentially volatile TACs from review of SDS for materials used in the Investing Department. Include emission estimates for these TACs or provide justification for excluding.
   a. REMET Citriwash (M-384): SDS shows 2-Butoxyethanol (CASRN 111-76-2) content of 15 percent.
   b. Latrix 6300 (M-421): Orchid Orthopedics included emissions of 1,3-butadiene (CASRN 106-99-0) from this material at the KNOCK OUT TEU (see Specific Comment 3.j.i.4). The SDS lists 1,3-butadiene in the Regulatory Information section under CERCLA Reportable Quantity. Based on information in this section Orchid Orthopedics should use a minimum concentration of 0.01 percent.

5. **Casting**: Provide additional information on the use of hexamethylenetetramine powder during casting of the 17-4 alloy. Supplemental material provided with the Inventory indicates that the hexamethylenetetramine undergoes a reaction with the molten metal.
   a. Review the reaction mechanics to identify if this is a source of TAC emissions. Revise the Inventory as needed to include TAC emission estimates from this activity.
   b. Provide DEQ additional information on this reaction and the hexamethylenetetramine SDS.

6. **Machining**: Review of SDSs identified a number of materials used at the facility contain TACs but were not included in the Inventory. Information included in supporting documents note that these materials are used for equipment maintenance and that total use is minimal (less than 2 ounces per year). DEQ conducted an Exempt TEU analysis following guidance presented in the "Cleaner Air Oregon Exempt TEU Reporting" document and has approved use of these materials as an Exempt TEU for the purposes of CAO.[10] DEQ conducted the analysis assuming conservative usage rates of 12 ounces per year and 100 percent volatilization of the TACs.

[9] EPA. Indoor Air Quality. Updated March 5, 2024. "What is a MERV rating?" (https://www.epa.gov/indoor-air-quality-iaq/what-merv-rating)

[10] Oregon DEQ. March 21, 2022. "Cleaner Air Oregon Exempt TEU Reporting." (https://www.oregon.gov/deq/aq/cao/Documents/ExemptTEUReporting-Appendices.pdf)

Emission rates for TACs were below thresholds presented in Appendix A-1 of the guidance.[10] Exempt TEUs must be listed in Worksheet 4, but there is no requirement to include usage and/or waste rates for the materials and they can be excluded from Worksheet 5 as you do not need to estimate emissions for Exempt TEUs. Include the following materials under the MACHINING TEU on Worksheet 4 but note as exempt:

a. Granite Surface Plate Cleaner (U-010);
b. LPS Force 842 (U-011);
c. Quicker Clean (U-012); and
d. Gel Lube (U-023).

7. **Compound ZF 113-1 (M-2261)**: This material, which is used in both the Finishing-Polishing and Polishing Water Pre-Treatment processes, contains two potentially volatile TACs. Include emission estimates for the following TACs or provide justification for excluding:
    a. 2,2'-iminodiethanol (diethanolamine, CASRN 111-42-2). Weight percentage of 1-10 (average 5.5 percent); and
    b. Propan-2-ol (isopropyl alcohol, CASRN 67-63-0). Isopropyl alcohol is listed in the Regulatory Information section under SARA Section 313. Unless more refined compositional information is available, assume a content of 1 percent for this TAC. This is the de minimis concentration in the EPCRA Section 313 Chemical List For Reporting Year 2005 (the calendar year of the provided SDS).[11]
8. **Cooling Tower**: Confirm if Orchid Orthopedics operates a cooling tower. If so, provide copies SDSs for all cooling tower chemicals. If these chemicals contain TACs, include emission estimates for the cooling tower TEU in the revised Inventory. Alternatively, provide DEQ with an Exempt TEU analysis. [OAR 340-245-0060(3)(a)]
9. **Safety Data Sheets**: The SDSs for some materials were either missing or the copies provided were incomplete in the initial submittal. Provide SDSs for the following materials:
    a. P-255 Liquid Compound (U-014) – incomplete in initial submittal;
    b. Caustic Potash (M-1136) – missing in initial submittal; and
    c. ER70S-6 MIG Welding rod – missing in initial submittal.

DEQ requests that you submit additional information to complete your Inventory. If you think that any of that information is confidential, trade secret or otherwise exempt from disclosure, in whole or in part, you must comply with the requirements in OAR 340-214-0130 to identify this information. This includes clearly marking each page of the writing with a request for exemption from disclosure and stating the specific statutory provision under which you claim exemption. Emissions data is not exempt from disclosure.

DEQ remains available to discuss this information request and answer any questions you may have. Failure to provide additional information, corrections, or updates to DEQ by the deadlines in this letter may result in a violation of OAR 340-245-0030(1).

[11] EPA, EPCRA Section 313 Chemical List for Reporting Year 2005. Reporting Year 2005 referenced as SDS was for product was published in 2005. (https://www.epa.gov/sites/default/files/documents/RY2005ChemicalList.pdf)

If you have any questions regarding this letter, please contact me directly at (971) 300-3653 or amy.devita-mcbride@deq.oregon.gov. I look forward to your continued assistance with this process.

Sincerely,

Amy DeVita-McBride

Amy DeVita-McBride
Cleaner Air Oregon Project Engineer

Cc: Lynn Green, EVREN Northwest Inc.
Lisa Simmons, EVREN Northwest, Inc.
Boris Barrera, DEQ
Joshua Alexander, DEQ
Heather Kuoppamaki, DEQ
J.R. Giska, DEQ
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