



STATE OF WASHINGTON  
DEPARTMENT OF ECOLOGY

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January 22, 2015

Ms. Karen Wood  
Department of Ecology  
Eastern Regional Office  
Air Quality Program  
4601 N. Monroe Street  
Spokane, WA 99205-1295

**Re: Second Tier Petition by Terex Company**

Dear Ms. Wood:

In reference to my May 13, 2014, letter to you regarding the "Second Tier Petition by Terex Company," I have now received Robert Koster's Preliminary Determination for the project. Therefore, all parties to this petition have now satisfied the five requirements under Chapter 173-460-090 as necessary for Ecology to review the petition. Based on the fulfillment of the requirements and on our review, Ecology recommends approval of the proposed project. As stated in my prior letter, the project's health risks are permissible under WAC 173-460-090.

If you would like to discuss this project further, please contact Matt Kadlec at (360) 407-6817 or [matt.kadlec@ecy.wa.gov](mailto:matt.kadlec@ecy.wa.gov).

Sincerely,

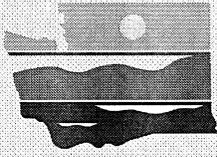
Jeff Johnston, Ph.D.  
Science and Engineering Section Manager  
Air Quality Program

jj/te

Enclosures

cc: Gregory Flibbert, Ecology  
Kathryn Hall, Genie Industries  
Robert Koster, Ecology  
Dean Wisler, Terex





DEPARTMENT OF  
**ECOLOGY**  
State of Washington

## **Second Tier Review Recommendation Document for**

**TEREX Aerial Works Platforms Facility  
Moses Lake, Washington**

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**May 13, 2014**

## **1. Summary and Purpose**

Terex Aerial Works Platforms Facility (Terex) Terex proposes to install two new powder coating operations and a burn-off oven at its Moses Lake facility (the Project). The proposed new equipment will be installed in High Bay 3 (HB3) and High Bay 4 (HB4) and will enable an increase in the production of work platforms at the facility. Increased production will result in increased welding activity.

Manganese emissions from this project – mainly from increased welding – are estimated to occur at a rate that could cause the ambient air concentration to exceed a regulatory trigger level called an acceptable source impact level (ASIL). Terex was therefore required to submit a Second Tier petition under WAC 173-460-090. A Second Tier petition requires a health impact assessment (HIA) quantifying the health hazards.

Terex hired ENVIRON International Corp. (ENVIRON) to prepare a HIA. In this assessment, ENVIRON estimated manganese neurotoxicity hazard to people simultaneously exposed to Terex project-related manganese emissions and to manganese from other sources. The highest likely offsite hazard quotient, approximately 0.5, may occur at existing commercial property and on commercial-zone property in the vicinity of the boundary between Terex and the PSE facility located immediately north of and adjacent to Terex. The highest likely hazard quotient at existing residential property and residential-zone property, approximately 0.1, may occur at property about 1800 meters SSE of Terex. Chronic noncancer hazards attributable to Terex's manganese emissions are lower than one. This indicates that increased emissions from the proposed project, together with existing emissions and emissions from other sources, are unlikely to result in adverse noncancer health effects.

Because the increase in neurotoxicity hazard attributable to the Terex alone does not exceed an acceptable level of noncancer hazard allowed by a Second Tier review, and because there are no appreciable cancer hazards likely to result from the project, the project can be approved under WAC 173-460-090.

This document presents Ecology's review of the proposed Terex Aerial Works Platforms Facility HIA and other requirements under WAC 173-460.

## **2. Second Tier Review Processing and Approval Criteria**

### **2.1. Second Tier Review Processing Requirements**

In order for Ecology to review the Second Tier petition, each of the following regulatory requirements under Chapter 173-460-090 must be satisfied:

- (a) The permitting authority has determined that other conditions for processing the Notice of Construction Order of Approval (NOC) have been met, and has issued a preliminary approval order.

- (b) Emission controls contained in the preliminary NOC approval order represent at least “toxics Best Available Control Technology (t-BACT).
- (c) The applicant has developed a HIA protocol that has been approved by Ecology.
- (d) The ambient impact of the emissions increase of each toxic air pollutant (TAP) that exceed ASILs has been quantified using refined air dispersion modeling techniques as approved in the HIA protocol.
- (e) The Second Tier review petition contains a HIA conducted in accordance with the approved HIA protocol.

Acting as the “permitting authority” for this project, Ecology’s Air Quality Program Eastern Regional Office will satisfy item (a) above once they confirm that Terex will align the emission rates given in the preliminary approval order with those ENVIRON used in the modeling. At that time, ERO will also place a compliance demonstration plan requirement into the Preliminary Determination.<sup>[1]</sup> Ecology’s Second Tier Review Engineer verified item (b).<sup>[2]</sup> Ecology found that the HIA protocol demonstrated an appropriate method for estimating potential health impacts from Terex’s proposed project, and approved the Protocol (item (c)) on April 22, 2014. Ecology’s air dispersion modeler found the refined modeling conducted by ENVIRON to be acceptable (item (d)).<sup>[3]</sup> The HIA (item (e)) was received by Ecology on May 2, 2014.<sup>[4]</sup> The parties have satisfied four of the five requirements above. The recommendation to approve the project is contingent on the ultimate Permit requirement that manganese emissions be limited to rates no greater than what ENVIRON used in the impacts modeling.

## **2.2. Second Tier Review Approval Criteria**

As specified in WAC 173-460-090(7), Ecology may recommend approval of a project that is likely to cause an exceedance of ASILs for one or more toxic air pollutants (TAPs) only if it:

- (a) Determines that the emission controls for the new and modified emission units represent tBACT.
- (b) The applicant demonstrates that the increase in emissions of TAPs is not likely to result in an increased cancer risk of more than one in one hundred thousand.
- (c) Ecology determines that the noncancer hazard is acceptable.

### **2.2.1. tBACT Determination**

Ecology’s Second Tier review engineer reviewed the Terex NOC submittal (received March 3, 2014) and found that the controls proposed satisfy t-BACT for the types of activities at the Moses Lake facility.

### 3. Health Impact Assessment Review

As described above, the applicant is responsible for preparing the HIA under WAC 173-460-090. Ecology's project review team - consisting of an engineer, a toxicologist, and a modeler - review the HIA to determine if the methods and assumptions are appropriate for assessing and quantifying the surrounding community's health risks from the applicant's project.

The Terex HIA focused mainly on health hazards attributable to manganese exposure as this was the only TAP with a modeled ambient air concentration that exceeded its ASIL.

#### 3.1. Manganese Health Effects Summary

Manganese is an essential nutrient for the human body, serving in nervous system function and in the formation of bones.<sup>[5]</sup>

Following exposure to high concentrations in air, manganese is a neurotoxicant, producing Parkinson's disease-like symptoms. Early onset symptoms include weakness, lethargy, and behavioral changes. Long-term exposure to lower concentrations is associated with subclinical effects such as reduced hand-eye coordination and reaction time. Exposure to manganese dusts may also irritate the lungs and initiate an inflammatory response that can contribute to development of pneumonia. The most common health problems in people exposed to high levels of manganese, typically in occupational settings, involve the nervous system, although decreased lung function and pneumonia have also been documented, and neurological effects can range from weakness, ataxia, pain, and tremor to bradykinesia.<sup>[6]</sup> This combination of symptoms, when sufficiently severe, is referred to as "manganism." Typically, prolonged exposure to concentrations from 2- to 22-mg Mn/m<sup>3</sup> has been linked to occupational manganism. There are no data linking manganism to acute exposures. The lowest exposure level known to cause a harmful effect is one that produces neurotoxicity. Thus, the manganese critical effect risk-based concentrations (RBCs) are derived to prevent is a testable stimulus-response reaction time.

##### 3.1.1. manganese Toxicological Reference Values

The ATSDR<sup>[7]</sup>, the USEPA<sup>[8]</sup>, and the California Office of Environmental Health Hazard Assessment (OEHHA)<sup>[9]</sup> developed RBCs for manganese based on data from a study of occupationally exposed humans by Roels *et al.* (1992).<sup>[10]</sup> Table 9-1: *Toxicological Values Derived for Noncancer Inhalation Effects* of the Terex HIA shows these RBCs. They are intended to indicate the level of manganese concentrations below which adverse noncancer health effects would be unlikely.

Because each of these organizations derived a RBC that was non-equal to the RBCs derived by the other organizations, ENVIRON requested Ecology to recommend one of the RBCs for use in the Terex HIA. Ecology reviewed the procedures each organization followed, and found the most defensible procedures were used by OEHHA, therefore Ecology recommend ENVIRON

use the resulting Reference Exposure Levels (RELs) as the RBCs for the HIA. Both RELs are intended to assess chronic repeated manganese exposures. The Chronic REL ( $0.09\text{-}\mu\text{g}/\text{m}^3$ ) for continuous exposure and the 8-hr REL ( $0.17\text{-}\mu\text{g}/\text{m}^3$ ) for repeated daily exposures lasting eight hours.

There is no evidence manganese is carcinogenic. Consequently, none of these three authorities (or others) have published a cancer unit risk factor for manganese exposure.

### **3.2. Ambient Air Quality Analysis**

ENVIRON modeled existing and proposed emissions of manganese and other TAPs from the Terex Aerial Works Platforms Facility. Ecology reviewed the AERMOD modeling input and output files and found them to represent an adequate ambient air quality analysis. Figure C-3: *Scenario 1 Maximum Annual Manganese Concentrations* and Figure C-4: *Scenario 2 Maximum Annual Manganese Concentrations* of the HIA show the estimated project-related annual average concentration contours near the Terex facility. Scenario 1 represents the standard operations where the general exhaust exits through the vent fans on each High Bay. Scenario 2 represents the periods of time (typically warmer days) when the large upper doors of the High Bays are opened. In the latter case, manganese emissions are likely to exit through the upper doors rather than the exhaust fans. The two scenarios have the same quantity of emissions but different emission points.

### **3.3. Land Use – Exposed Receptors**

The Terex Aerial Works Platforms Facility is located approximately in Grant County four miles north of Moses Lake, Washington. The facility is adjacent to the Grant County International Airport. Figure 2-1: *Facility Location* of the HIA shows the facility in relation to the surrounding area. Figure 2-2: *Facility Layout* provides an aerial photo depicting buildings, stack locations, and the facility property boundary. Figure 2-3: *Land Use and Zoning of the Areas Around the Terex Facility* shows the current land use of the areas around the Terex facility.

The Terex facility is located on land owned by the Grant County International Airport. The majority of the facility boundary is restricted by fences. The parking area to the east of the building is controlled by the facility and is routinely patrolled by security personnel. No unauthorized people or vehicles are allowed to remain in the parking area.

Figure 2-4: *Future Land Use and Zoning of the Areas around the Terex Facility* presents the future land use and zoning of the areas around the Terex facility. Beyond the airport property boundary, to the east of the facility, is an area that is most undeveloped industrial-zone land. The land-uses southeast, south, and southwest of the facility property boundary are zoned for rural general commercial or public open space. The nearest residential area is located approximately

900 meters southeast of the Terex site. The next closest residential-zone area is approximately 2200 meters southwest of the Terex facility.

Ecology's review of the HIA found that ENVIRON identified appropriate receptors to capture the highest exposures for residential, commercial, and fence line receptors. ENVIRON also identified other potential sensitive receptor areas, but these areas were outside the area impacted by manganese concentrations greater than the ASIL, so Ecology did not require hazards at these locations to be quantified.

### **3.4. Noncancer Hazard**

In order to evaluate the potential for noncancer adverse health effects that may result from exposure to air pollutants, exposure concentrations at each receptor location are compared to relevant noncancer RBCs such as RELs. If a concentration exceeds the toxicological value, this indicates adverse health effects may be possible. The magnitude of this potential can be inferred from the degree to which this value is exceeded. This comparison is known as a hazard quotient (HQ) and is given by the equation below:

$$HQ = \frac{\text{time weighted average concentration of toxicant in air } (\mu\text{g}/\text{m}^3)}{\text{time interval specific toxicant RBC } (\mu\text{g}/\text{m}^3)}$$

A HQ of less than one indicates that the exposure to a toxicant is not likely to result in adverse noncancer health effects. As the HQ increases above one, the probability of adverse health effects increases by an undefined amount. However, it should be noted that due to uncertainty in deriving RBCs, a HQ above one does not necessarily mean health impacts will occur.

#### **3.4.1. Chronic Hazard Quotients**

ENVIRON evaluated chronic hazards associated with exposure to manganese emitted from the Terex facility.

Chronic continuous long-term exposure HQs were calculated for each receptor's average concentration as attributed to project-related manganese emissions as well as to manganese concentrations attributable to other regional sources.

Under either emissions scenario, the highest HQ at the maximally impacted residential receptor (MIRR) was 0.07, and the highest HQ at any MIRR in a currently un-built residential zone was 0.09.

The HIA submitted by ENVIRON did not list the average of 8-hour time-weighted average manganese concentration at any offsite commercial location (and these data were not located on the data disk provided with the HIA; however, Ecology was able to evaluate commercial location hazards using available data. Rather than deriving 8-hour chronic HQs using averages of 14,600 sequential eight-hour time-weighted average concentrations<sup>[11]</sup> for the 2007–2011 model period

at different locations, Ecology used the average of the highest 25 manganese concentrations (the highest 5 in each of the 5-years) at each existing and undeveloped commercial-zone maximally impacted commercial receptor (MICR) under each of the two emissions scenarios. To calculate these quasi-HQs, we divided these high concentration averages by the 8-hour chronic REL (0.17- $\mu\text{g}/\text{m}^3$ ). The highest resulting HQ was 1.27, located at an un-built point on commercial-zone land with emissions scenario 1. In addition, with emissions scenario 2, a quasi-HQ of 1.17 was evident at different location in an un-built commercial zone. These quasi-HQs do not indicate there are potential health hazards because neither emissions scenario will be sustained long enough to achieve a chronic long-term exposure, and because the quasi-HQs were derived from the mean of the top 25 eight-hour time weighted average concentrations, not from averages of all 14,600 eight-hour time-weighted average concentrations. If the averages of the full model output dataset were evaluated, they would likely be much lower than the average of the highest 25 days. Therefore the true HQs are likely to be less than one.

The chronic 8-hour quasi-HQs at currently occupied MICRs were  $\leq 0.87$  under both emission scenarios.

All known and reasonably anticipated manganese HQs were lower than one. This indicates that receptors near Terex are not likely to experience adverse noncancer effects from chronic exposure to manganese emitted from Terex alone or in combination with other local and regional manganese sources.

### **3.5. Increased Cancer Risk**

Increased cancer risks were not estimated for the project because emissions rates of potentially carcinogenic TAPs by Terex were less than their ASILs and SQERs. And as noted, there is no published evidence indicating manganese may be carcinogenic.

## **4. Conclusions and Recommendation**

The project review team has reviewed the HIA and determined that:

- a) The TAP emissions estimates presented in the HIA represent a reasonable estimate of the project's future emissions.
- b) Emission controls for the new and modified emission units will meet the tBACT emission requirements.
- c) The ambient impact of the emissions increase of the TAP that exceeds its ASIL has been quantified using refined air dispersion modeling techniques as approved in the HIA protocol.
- d) The HIA submitted by ENVIRON on behalf of Terex adequately assesses project-related increased health hazards attributable to TAP emissions.

The project review team concludes that the HIA presents an appropriate estimate of potential increased health hazards posed by Terex's TAP emissions. There is no evidence Terex's manganese emissions – alone or in combination with other manganese sources - could pose chronic noncancer hazards. Furthermore, cancer risk among people exposed to Terex's emissions is unlikely to increase as a result. Exposure to manganese within the 16-km x 16-km area centered on the Terex facility is not expected to result in adverse health effects.

Based on the project team's review of the HIA, and with awareness that this project review is based manganese emissions rates that will be limited to rates no greater than what ENVIRON used in modeling the impacts, the risk manager may recommend approval of the proposed project because project-related health hazards are permissible under WAC 173-460-090.

## 5. References

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- <sup>1</sup> Robert Koster, "Subject: RE:Terex t-BACT" e-mail message, addressed to Matthew Kadlec, May 13, 2014.
- <sup>2</sup> Robert Koster, "Subject: Terex t-BACT" e-mail message, addressed to Matthew Kadlec, April 14, 2014.
- <sup>3</sup> Ranil Dhammapala, "RE: Terex Health Risk Analysis" addressed to Matthew Kadlec, May 6, 2014.
- <sup>4</sup> The HIA (item (e)) titled "Second Tier Health Impacts Analysis Associated with the Powder Coating Project, Terex Aerial Works Platforms Moses Lake Facility. Prepared for: Terex Aerial Works Platforms, 8987 Graham Road NE, Building 5820, Moses Lake, Washington, by: ENVIRON International Corporation, Lynnwood, Washington, Date: May 2014, Project Number: 29-31906A" was received by Ecology on May 2, 2014
- <sup>5</sup> National Research Council. 2001. *Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc*. Washington, DC: The National Academies Press.
- <sup>6</sup> Agency for Toxic Substances and Disease Registry. *Toxicological Profile for Manganese*. U.S. Department of Health and Human Services, Public Health Service. September 2012
- <sup>7</sup> Agency for Toxic Substances and Disease Registry. *Toxicological Profile for Manganese*. U.S. Department of Health and Human Services, Public Health Service. September 2012
- <sup>8</sup> USEPA Integrated Risk Information System. *Manganese CASRN — 7439-96-5, I.B. Reference Concentration for Chronic Inhalation Exposure (RfC)* — Last Revised 12/01/1993
- <sup>9</sup> OEHHA. *TSD for Noncancer RELs. Appendix D. Individual Acute, 8-Hour, and Chronic Reference Exposure Level Summaries*. December 2008, Revised August 2013
- <sup>10</sup> Roels HA, Ghyselen P, Buchet JP, Ceulemans E and Lauwerys RR (1992). Assessment of the permissible exposure level to manganese in workers exposed to manganese dioxide dust. *Br J Ind Med* 49(1): 25-34
- <sup>11</sup> 14,600 eight-hr intervals = 8/24-hr x 8760-hr/yr x 5-yr



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May 13, 2014

Ms. Karen Wood  
Department of Ecology  
Air Quality Program  
Eastern Regional Office  
4601 N. Monroe Street  
Spokane, WA 99205-1295

**Re: Second Tier Petition by Terex Company**

Dear Ms. Wood:

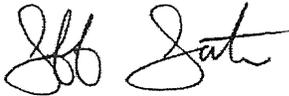
The Washington State Department of Ecology's Air Quality Program (Ecology) has completed its review of health risks from manganese emissions from a proposed project by the Terex Company in Moses Lake, Washington. The proposed project consists of adding two new powder coating operations and a burn-off oven at the Moses Lake facility. The new equipment will enable an increase in production of work platforms, which will result in increased welding activity at the facility.

Ecology's review of the different manganese health risk-based reference concentrations published by USEPA, ATSDR and the California OEHHA revealed the most technically defensible ones are those from OEHHA. Terex's consultant, ENVIRON, used OEHHA's reference concentrations to estimate noncancer hazards of Terex's manganese emissions. The resulting hazard quotients for residential areas near Terex were less than one, meaning adverse health effects attributable to Terex emissions are unlikely among people living nearby. Ecology estimate hazard quotients for commercial receptors near Terex. The results indicate adverse health effects attributable to Terex emissions are unlikely among people working nearby. Ecology's review also indicates that Toxic Air Pollutant emissions from the proposed project will not increase risk of cancer among people at residential or commercial properties neighboring Terex.

Parties to this project have satisfied four of the five requirements under Chapter 173-460-090 necessary for Ecology to review the Second Tier petition. Based on the review of Terex's second tier petition, Ecology recommends approval of the proposed project because its health risks are permissible under WAC 173-460-090. The recommendation to approve the project is contingent on an ultimate Permit condition that manganese emissions be limited to rates no greater than those ENVIRON applied when they modeled concentration impacts.

If you would like to discuss this project further, please contact Matt Kadlec at 360-407-6817 or matt.kadlec@ecy.wa.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "Jeff Johnston". The signature is fluid and cursive, with the first name "Jeff" and last name "Johnston" clearly distinguishable.

Jeff Johnston, Ph.D.  
Science and Engineering Section Manager  
Air Quality Program

jj/te

Enclosure

cc: Ranil Dhammapala, Ecology  
Beth Davis, Thompson Hine  
Alma Feldpausch, Environ  
Gregory Flibbert, Ecology  
Kathryn Hall, Genie Industries  
Eric Hansen, Environ  
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Matt Kadlec, Ecology  
Robert Koster, Ecology  
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Dean Wisler, Terex