

# Technical Memorandum

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**TO:** Julia Schwarz, Washington State Department of Ecology  
**FROM:** Colette Gaona  
**DATE:** January 20, 2023  
**RE:** **Soil and Groundwater Screening Process  
North Boeing Field/Georgetown Steam Plant Remedial Investigation  
Seattle, Washington  
Project No. 0025082.922.123**

## Introduction

This memorandum has been prepared by Landau Associates, Inc. (Landau) to outline the process used in developing screening levels and identifying contaminants of concern (COCs) for the North Boeing Field/Georgetown Steam Plant (NBF/GTSP) Remedial Investigation (RI). The Boeing Company (Boeing), King County, and the City of Seattle (City) are the potentially liable parties (PLPs) conducting an RI under an Agreed Order (AO No. DE 5685; Ecology 2008) with the Washington State Department of Ecology (Ecology) for the NBF/GTSP site (site).

Boeing and the City submitted a Preliminary Draft RI Report to Ecology on June 6, 2016 (Landau 2016). Significant milestones related to the RI are listed below:

Date	Milestone
June 2016	Preliminary Draft RI Report submitted to Ecology.
August 2016	Ecology provided preliminary comments on the Preliminary Draft RI Report.
November 2016	Ecology provided final comments on the Preliminary Draft RI Report.
2017-2018	Boeing and the City conducted Phase 3 soil and groundwater investigations and the Offsite Investigation and made significant revisions to the RI Areas of Concern (AOCs) to respond to Ecology comments.
June 2018	Ecology provided a document to Boeing and the City titled “Developing Revised Screening Levels and Chemicals of Concern” (Ecology 2018) to outline Ecology’s requirements for NBF/GTSP RI data screening.  Boeing and the City began revisions to the RI database to address the revised AOCs and revised RI data set in response to Ecology comments. This included coordination with Ecology’s consultant, Leidos, to prepare the revised RI database.  The PLPs also began revisions to the soil and groundwater screening tables included in the Draft RI report.
January 2019	Boeing and the City submitted revised soil and groundwater screening tables in accordance with Ecology’s June 2018 document and the December 2018 Ecology Lower Duwamish Waterway (LDW) Preliminary Cleanup Level (PCUL) Workbook.

Date	Milestone
May 2019	Ecology provided preliminary comments on the January 2019 soil and groundwater screening tables. These preliminary comments required significant revisions to the AOCs and subsequently the RI database. <sup>1</sup>
September 2019	Boeing and the City responded to Ecology's comments on the January 2019 screening tables and provided Ecology with updated figures to confirm revisions to the AOCs.
September 2019– November 2020	All progress on the RI stopped while Ecology worked to get its consultant back under contract.
November–December 2020	Ecology re-engaged with Boeing and the City to discuss the outstanding RI comments and the soil and groundwater screening tables submitted in September 2019.  In September 2020, Ecology also released another update to the LDW PCUL workbook and required the PLPs to revise the September 2019 screening tables to incorporate the September 2020 updates to the LDW PCUL workbook.  Boeing and the City also worked with Leidos, Ecology's consultant, again on database coordination.
April 2021	Boeing and the City provided updated screening tables to Ecology.
June 2021	Ecology provided comments on the April 2021 soil and groundwater screening tables, which included a request to update the screening levels again, using the May 2021 version of the LDW PCUL Workbook. Ecology also requested that the PLPs draft a technical memorandum summarizing the RI soil and groundwater screening process.  Additional coordination with Leidos to address Ecology and Leidos questions related to the RI database was also requested by Ecology.
December 2021	Boeing and the City provided updated screening tables and the technical memorandum describing the soil and groundwater screening process to Ecology.
March 2022	Ecology provided comments on the December 2021 soil and groundwater screening tables and technical memorandum.
May 2022	Ecology and the PLPs met to review Ecology's comments on the screening tables and technical memorandum and to discuss steps required to complete the RI.
October 2022	Boeing and the City provided updated screening tables and technical memorandum to Ecology responding to Ecology's March 2022 comments.
November 2022	Ecology provided comments on the screening tables and technical memorandum submitted in October. This technical memorandum has been revised to address Ecology comments; minor revisions to the screening tables to address comments will be incorporated into the Draft RI Report.

<sup>1</sup> Significant revisions included revising AOC06 to be a contaminant- and medium-specific AOC as opposed to an area-specific AOC, resulting in AOC and database revisions. Other AOC boundaries were also revised based on Ecology comments, resulting in further database revisions.

## Background

AOCs for the NBF/GTSP RI were initially developed by Ecology in the 2007 and 2009 Data Gaps reports (SAIC 2007, 2009). Following the Data Gaps evaluations, Ecology prepared the NBF/GTSP RI Work Plan (Leidos 2013). As part of the RI Work Plan development, Ecology completed a thorough evaluation of the identified data gaps in each area of the RI site, which informed the subsequent RI investigation between 2013 and 2018. The data gaps evaluations completed by Ecology provided a robust review of historical operations and potential COCs in each area of the RI site and informed RI sampling to address any identified deficiencies in data. Additional data gaps were identified by Ecology in its review of the Preliminary Draft RI Report (Landau 2016). These data gaps were addressed in the Phase 3 investigation. The RI data set that was compiled during the screening process described in this technical memorandum has been thoroughly vetted by both Ecology and the PLPs for potential COCs in each AOC and identifies COCs for each AOC to be presented in the RI.

AOCs as defined in the data gaps evaluations, RI/FS Work Plan, and Preliminary Draft RI were described by area name within the site boundary (i.e., Building 3-323 Area). Following submittal of the Preliminary Draft RI, and prior to the Phase 3 RI investigation, Ecology and the PLPs revised the AOC designations and boundaries to group areas of site operation and COCs more effectively. The AOC boundaries used in this screening will be included in the Draft RI and are shown on Figure 1. A summary of the current AOC descriptor (e.g., AOC01) is provided below with a comparison to the AOC descriptor as defined in the RI/FS Work Plan:

Current Area of Concern	AOC Description (from RI/FS Work Plan and Preliminary Draft RI)
AOC01	GTSP Property – North Yard, Fuel Tank, East Yard, South Yard, and Low-Lying Areas
AOC02	North PEL Area – Building 3-323, 3-302, 3-322, and NBF Fenceline Areas
AOC03	Green Hornet Area including Wind Tunnel Area
AOC04	South PEL Area – Building 3-329, 3-333, 3-335, 3-626, 3-324, and Former Building 3-304 Areas
AOC05	Willow St Substation
AOC06	Chlorinated VOC Plume(s)
AOC07	3-800 Building Area
AOC08	3-801 Building Area
AOC09	Main Fuel Farm
AOC10	Site Wide AOC; Low-Density Sampling Area

Detailed information regarding historical operations and potential COCs for each of the AOCs (Figure 1), as well as an evaluation of the data gaps investigation that informed the RI sampling, is provided in the RI/FS Work Plan (Leidos 2013).

## Identification of Screening Levels

Per Ecology,<sup>2</sup> the RI screening levels will be the screening levels listed in the May 2021 LDW PCUL Workbook and Ecology will not require additional updates to the screening levels regardless of any future revisions to the LDW PCUL Workbook. As part of the final step in the RI, Ecology will determine if any significant changes have been made to the PCUL screening levels that require notation or consideration in the RI and selection of COCs.

The most-stringent screening levels in the May 2021 LDW PCUL Workbook for soil and groundwater were used for preliminary identification of COCs in each AOC. Pathways and exposure routes will be evaluated and identified in the RI and used in the feasibility study (FS) to determine appropriate cleanup levels (CULs). It is possible that final CULs may not be based on the most-stringent screening levels used in the RI.<sup>3</sup>

## Soil Screening Levels

The soil screening level for each analyte was set to the minimum (most restrictive concentration) of the following pathways:<sup>4</sup>

- Direct contact under unrestricted land use (SL-1)
- Saturated zone protection of drinking water (SL-5)
- Saturated zone protection of surface water via groundwater (SL-6)
- Saturated zone protection of sediment via groundwater (SL-7)
- Protection of sediment via soil transport through the storm drain system (SL-8)
- Site-specific terrestrial ecological evaluation for unrestricted land use (SL-9).

If the minimum soil screening level was below the natural background concentration (e.g., SL-10, metals and dioxins/furans), the screening level was adjusted up to the natural background concentration.

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<sup>2</sup> As discussed with Ecology and the PLPs during the May 12, 2022 NBF/GTSP RI meeting.

<sup>3</sup> Screening levels based on industrial land use were not used to identify soil and groundwater COCs; however, the site qualifies for industrial land use inside the NBF/GTSP secured fence line and industrial land use will be considered during the FS.

<sup>4</sup> Soil pathways for the vadose zone were not included in the selection of the most-stringent criteria; saturated zone screening levels are more stringent than vadose zone.

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## Groundwater Screening Levels

The groundwater screening level for each analyte was set to the most stringent (minimum) value of the following pathways:

- Drinking water (GW-1)
- Protection of surface water (GW-2)
- Protection of sediment (GW-3)
- Protection of air under unrestricted land use (GW-4).

If the minimum groundwater screening level was below the natural background concentration (e.g., GW-5, arsenic only), the screening level was adjusted up to the natural background concentration.

## Preparation of the RI Database

Landau developed the RI database to identify soil and groundwater data to be evaluated in the RI based on Ecology's June 13, 2018 letter (Ecology 2018) and subsequent communications with Ecology during review of the various iterations of draft screening tables. The RI database contains soil and groundwater results for analytes with PCULs in the LDW PCUL Workbook. For both soil and groundwater samples, in the event a sample was analyzed by more than one method for the same analyte (thus generating multiple results), the "best" result was selected by the following criteria:

- If all results were non-detect, then the minimum non-detect result was selected for inclusion.
- If all results were detections, then the maximum of the detections was selected for inclusion.
- If results were a mix of detections and non-detects, then the maximum detection was selected for inclusion.

Only the parent samples were included in the soil and groundwater data sets described below; field duplicate samples were omitted from the screening. For soil and groundwater carcinogenic polycyclic aromatic hydrocarbons (cPAH), toxicity equivalency concentrations (TEQs) were added to the RI database based on the TEQ calculation defined in the sampling and analysis plan/quality assurance project plan (Leidos 2014).

## Soil

The RI soil data set consists of results for analytes in soil that remains on site (i.e., soil that has not been excavated). The RI soil data set encompasses a time frame of August 1984 to November 2015.

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## Groundwater

The RI groundwater data set consists of the most recent consecutive 2 years of data (up through 2018) for each analyte at each existing/active monitoring well, including two offsite locations.<sup>5</sup> The groundwater data set also includes groundwater grab samples collected during the Phase 3 RI investigation and groundwater grab samples collected during the Offsite Investigation (Landau 2018).

Both total and dissolved metals results are included in the RI groundwater data set. For cases where groundwater samples were filtered for analysis of polychlorinated biphenyls (PCBs), only the unfiltered results were included in the RI groundwater data set.

The RI groundwater data set includes groundwater data through August 2018. Groundwater data generated through the ongoing semi-annual sampling in the 3-360 and 3-800 building areas (AOC06 and AOC07, respectively) will not affect the determination of COCs in these AOCs.

## Selection of Contaminants of Concern

COCs were identified in each AOC separately. An analyte was selected as a COC if the detected concentrations exceeded the screening level at a frequency of 10 percent or greater in the AOC, or if the maximum detected concentration of the analyte was greater than two times the screening level (i.e., exceedance factor greater than 2) in the AOC. If an analyte did not meet these criteria, it was not selected as a COC in the AOC. COC selection criteria were consistent for both soil and groundwater.

## Evaluation of Non-Detect Statistics

At the request of Ecology, summary tables of non-detect statistics (Tables S10 and G10) have been prepared for Ecology's review. These tables present the frequency at which historical detection limits for analytes in the RI data set exceed the screening levels. The frequency of non-detect exceedances in these tables are based on the data and the historical method detection limits (MDLs)/reporting limits (RLs) of the data set (which can vary based on the data package and media); it is not based on comparing the non-detect result to the current MDL.

Current laboratory MDLs and RLs are included in the soil and groundwater screening tables (Tables S1 through S9 and Tables G1 through G9) and in the non-detect summary tables (Tables S10 and G10). The MDLs presented in these tables are the current, best possible MDLs based on current laboratory methods from Analytical Resources, Inc. Although laboratory methods have improved over time, some MDLs and RLs still exceed screening levels. The current MDLs and RLs are presented throughout the screening tables in comparison to the screening levels to show where current laboratory MDLs are

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<sup>5</sup> There are two existing/active offsite monitoring wells located outside of the RI boundary: NGW208 and FS-27A.

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greater than the screening levels, for future evaluation of adjusting the screening levels up to the MDLs during development of CULs in the FS.

The comparison of current MDLs to the screening levels also allows evaluation of which analytes have screening levels that could not currently be achieved by the analytical laboratory. The non-detect summary tables (Tables S10 and G10) have been prepared with this evaluation in mind. The non-detect screening tables for soil and groundwater present analytes for each AOC that meet three criteria:

- 1) The analyte is not already identified as a COC based on detected results.
- 2) The screening level for the analyte is greater than the current MDL.
- 3) The non-detect exceedances are greater than 50 percent.

Therefore, the analytes presented on the non-detect summary tables represent analytes that could theoretically be sampled to achieve non-detect results (at the current MDL) that would not exceed the screening level. This evaluation has been prepared at Ecology's request for review of non-detect exceedances of screening levels and does not represent significant data gaps in the RI data set; Boeing and the City do not plan to complete any additional sampling for the RI/FS as part of the non-detect evaluation presented herein.

## **Summary of Soil and Groundwater Screening Tables**

A Site-Wide Soil and Groundwater COC Summary Table and soil and groundwater screening tables for each AOC have been developed using the screening process summarized in this memorandum. COCs identified in soil and groundwater for each AOC are summarized on the Site-Wide Soil and Groundwater COC Summary Table. The most-stringent pathway for each screening level is also identified on the summary table. The COC summary table also presents analytes that were (or were not) evaluated in each AOC. For AOCs where a soil COC has been identified and groundwater data are also available for that analyte, an empirical demonstration will be used in the FS as part of the development of AOC-specific cleanup levels; however, an evaluation of potential leaching from soil to groundwater will be discussed in the RI as part of the nature and extent, and fate and transport evaluation. Where no groundwater data are available in that AOC, groundwater may be evaluated in nearby AOCs or in the site-wide AOC (AOC10) to make a similar demonstration if appropriate for the AOC and analyte. The RI will present a geographic evaluation of COCs in each AOC, through graphics and figures, to evaluate the geographic relationship of soil and groundwater exceedances.

Boeing and the City do not plan to conduct any additional data gaps investigations related to the COCs listed in Table 1 (Site-Wide Soil and COC Summary Table). The analytes selected for inclusion in the RI were selected as the result of a robust data gaps screening completed by Ecology and Ecology's subsequent development of the RI/FS Work Plan as described above.

The screening tables and COCs presented in this technical memorandum, and the text of this technical memorandum, will be incorporated into the Draft RI Report.

LANDAU ASSOCIATES, INC.



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## Attachments

Figure 1: Areas of Concern

Table 1. NBF/GTSP RI Site-Wide Soil and Groundwater Chemicals of Concern

### Soil Screening Tables

Abbreviations, Acronyms and Notes—Soil Screening Statistics

Table S1. AOC01 Soil Screening Statistics

Table S2. AOC02 Soil Screening Statistics

Table S3. AOC03 Soil Screening Statistics

Table S4. AOC04 Soil Screening Statistics

Table S5. AOC05 Soil Screening Statistics

Table S6. AOC07 Soil Screening Statistics

Table S7. AOC08 Soil Screening Statistics

Table S8. AOC09 Soil Screening Statistics

Table S9. AOC10 Soil Screening Statistics

Table S10. Summary of Non-Detect Results—Soil

### Groundwater Screening Tables

Abbreviations, Acronyms and Notes—Groundwater Screening Statistics

Table G1. AOC01 Groundwater Screening Statistics

Table G2. AOC02 Groundwater Screening Statistics

Table G3. AOC03 Groundwater Screening Statistics

Table G4. AOC04 Groundwater Screening Statistics

Table G5. AOC06 Groundwater Screening Statistics

Table G6. AOC07 Groundwater Screening Statistics

Table G7. AOC08 Groundwater Screening Statistics

Table G8. AOC09 Groundwater Screening Statistics



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Table G9. AOC10 Groundwater Screening Statistics

Table G10. Summary of Non-Detect Results—Groundwater

## References

- Ecology. 2008. Agreed Order No. DE5688; In the Matter of Remedial Action by The Boeing Company, King County, and the City of Seattle; North Boeing Field/Georgetown Steam Plant. Washington State Department of Ecology. August 14.
- Ecology. 2018. Developing Revised Screening Levels and Chemicals of Concern, North Boeing Field/Georgetown Steam Plant Remedial Investigation. Mark Adams and Priscilla Tomlinson, Washington State Department of Ecology. June 13.
- Landau. 2018. Offsite Soil Vapor and Groundwater Investigation Data Report, NBF/GTSP Remedial Investigation, Seattle, Washington. June 11.
- Landau. 2016. Preliminary Draft, Remedial Investigation Report, North Boeing Field/Georgetown Steam Plant, Tukwila, Washington. Landau Associates, Inc. June 6.
- Leidos. 2013. Final: North Boeing Field/Georgetown Steam Plant Site, Remedial Investigation/Feasibility Study Work Plan. November 11.
- Leidos. 2014. North Boeing Field/Georgetown Steam Plant Site Remedial Investigation/Feasibility Study Final Sampling and Analysis Plan and Quality Assurance Project Plan. April.
- SAIC. 2007. North Boeing Field and Georgetown Steam Plant, Summary of Existing Information and Identification of Data Gaps. Science Applications International Corporation. February.
- SAIC. 2009. North Boeing Field and Georgetown Steam Plant, Supplemental Report: Summary of Existing Information and Identification of Data Gaps. Science Applications International Corporation. August.