No Further Action Decision Document
Oregon Air National Guard, Kingsley Field
Klamath County, Oregon
Project Manager: Cliff Walkey
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Responsible Party: Oregon Air National Guard

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Overview

Oregon Air National Guard (ANG) historically used Environmental Restoration Program Site 1 as Base Landfill Number 1 (Figure 1). Site 1 contains approximately 20 acres. This report recommends a No Further Action (NFA) finding for environmental conditions related to residual low level contamination in Site 1 soil and groundwater, which is considered protective based upon evaluation of all appropriate exposure scenarios. The recommended action was selected in accordance with Oregon Administrative Rules (OAR) Chapter 340, Division 122, and Sections 0070 to 0110 in accordance with Oregon Revised Statutes (ORS) 465.200 through 465.455.

The recommended action is based on information documented in the administrative record specific to Site 1. A Site 1-specific administrative record index is presented at the end of this report. This index lists principal documents that contain information specifically relevant to Site 1, although the cited documents may also contain information pursuant to other ANG site investigations located at Kingsley Field. This staff report specifically summarizes the more detailed information contained in the administrative file for Environmental Restoration Program (ERP) Site 1 (ECSI 4550). ANG and the Department of Environmental Quality (DEQ) completed a Defense-State Memorandum of Agreement (DSMOA) on June 30, 2004.

Site History

Site 1, known as Base Landfill Number 1, was a waste disposal area used by the United States Navy during World War II and by the United States Air Force between 1956 and 1957 (CH2M

Hill, 1982, p. 30). The area was reportedly used for the disposal of domestic refuse and equipment parts. This 20 acre area (Figure 2-2) is located on the eastern edge of Kingsley Field and is currently covered by grass. Subsequent investigations have since identified additional Contaminants-of-Interest (COIs) in the subsurface at Site 1. Environmental conditions at Site 1 were investigated comprehensively during 1991-1992; 2000-2003; and, 2006.

Environmental Site Investigation – 1991-1992

During the 1999-2001 Remedial Investigation and 8 quarters of subsequent groundwater monitoring (during 2002 and 2003), a total of 85 soil samples were collected and evaluated for metals, volatile organic hydrocarbons (VOCs), and pesticides. Soil samples were collected across Site 1 via test pit, direct-push probe, and monitoring well boreholes from intervals between 1 and 3 feet below ground surface (bgs).

The initial screening level investigation also consisted of an electromagnetic (EM) survey to delineate the extent of the former landfill, and installation of a single 1-inch-diameter peizometer (P01-03) to assess depth to groundwater at the site. Four areas with anomalous conductivity measurements were identified in the EM transects, which were further assessed in November 1992 by excavating a series of 6 test pits (Figure 3-1). In addition to excavation of a series of test pits, soil sampling, and installation and sampling from 3 groundwater monitoring wells (MW-1-01 through MW01-03) were completed.

Several constituents were observed in subsurface test pit samples. Polycyclic Aromatic Hydrocarbons (PAHs) were observed in two test pit samples at levels that exceeded screening standards for industrial direct contact exposure scenarios[1]. Specifically, concentrations of several metals were observed at approximately 10 times the values associated with a single background soil sample (from MW11-BG) collected at the time of the investigation. Arsenic was the only metal that exceeded an industrial screening standard. Low level VOCs, pesticides, and poly-chlorinated biphenols (PCBs) were observed in some test pits samples, but not at levels exceeding screening levels utilized[2] at the time.

Buried waste was observed in one test pit (TP-5), located south of a nearby drainage ditch. This waste was described as a mixture of "wood, charcoal, ash, and minor amounts of metal, clay pipe, glass, plastic, and brick" (HAZWRAP, 1994, p 5-19). The extent of this burial area was further delineated by excavating eleven additional test pits, and an area approximately 175 by 200 long and 25 by 35 feet wide containing similar material was described and interpreted to be associated with burn pit activities. The extent of this former burn pit is depicted on Figure 3-1.

Three groundwater monitoring wells (MW-1-01 through MW01-03) were installed during November 1992 (Figure 3-2). Two groundwater sampling events conducted during November 1992 and March 1993 evaluated for dissolved metals, cyanide, VOCs, and semi-volatile organic

[1] In 1994, Site Investigation soil results were screened against Oregon Industrial Maximum Allowable Soil Concentrations. These standards were eliminated by DEQ in 2006.
[2] Table 5-6 (ERM, July, 2001). These screening level values are not utilized in support of the present NFA recommendation. Appropriate exposure scenarios were identified in the Conceptual Site Model (CSM) and all site data are compared to screening level values (DEQ, 2003).

hydrocarbons (SVOCs), pesticides, and PCBs. Investigators noted elevated concentrations of arsenic and vanadium relative to the single background well (MW11-BG). Except for a single measurement of the common lab artifact bis(ethylhexyl)phthalate (at 14 ug/L), no other groundwater detection exceeded federal drinking water maximum contaminant levels.

Environmental Site Investigation – 2001-2003

This investigation's objective was to characterize the nature and extent of metals, PAHs, pesticides, and PCBs in soil; and, metals, SVOCs, PAHs, pesticides, and PCBs in groundwater.

Three additional monitoring wells (MW01-04 through MW01-06) were constructed to a depth of approximately 15 to 20 feet and screened beginning at approximately 5 feet bgs.

Specifically, the investigations conducted during this timeframe consisted of:

- Sampling 3 existing wells and 1 piezometer (July 1999);
- Excavating 21 test pits and collecting 12 soil samples (July 1999);
- Advancing soil probes at 60 locations; collecting 21 soil samples; and, 21 grab groundwater samples (September 1999);
- Installing 3 additional groundwater monitoring wells and collecting 3 soil samples from well boreholes (October 1999);
- Collecting 10 surface soil samples (May 2001);
- Collecting 14 background soil samples (May 2001); and,
- Collecting groundwater quality information during 8 quarters of monitoring between 1999 and 2000, and between 2002 and 2003.

Environmental Site Investigation - 2006

Three data gaps were identified in consultation with DEQ (Table 3-4). Information acquired during 2006 successfully addressed these data gaps and included:

- Inspection of the monitoring well network in preparation for resampling;
- Establishing a surface water gaging station;
- Measuring water elevations;
- Collecting groundwater quality samples for field and lab testing; and,
- Excavating test pits and conducting soil sampling.

The groundwater monitoring network was found to be in good condition and each of the 7 previously installed wells were determined to be undamaged. Piezometer P01-3 was also located and determined to be functional. One surface water gaging station (SW1-1) was established. Static water elevation measurements were obtained on May 1, 2006 from all groundwater monitoring wells and gaging station SW1-1.

Groundwater quality monitoring conducted during May 2006 was very similar to results observed during 2002-2003. Groundwater samples were collected from all 7 wells.

Conceptual Site Model

A Conceptual Site Model (CSM) identifies all of the suspected or potential sources of contamination at a specific site, and summarizes where it is located, how it is likely to move, and who is likely to be affected. At Site 1, the CSM identified the following applicable exposure scenarios (Figure 3):

Soil

- Soil Ingestion, Dermal Contact and Inhalation – Occupational, Construction Worker, Excavation Worker, Hypothetical Residential Receptor.

Groundwater

- Groundwater in Excavation – Construction & Excavation Worker.

Contaminants-of-Interest

Contaminants-of-Interest (COIs) were established by contaminant detections observed in Site 1 soil and groundwater over the course of all site investigations. Typically, COIs are retained as Contaminants-of-Potential-Concern (COPCs) based upon identification of specific screening level exceedances. Because various screening level standards were utilized for earlier site investigations, all Site 1 data is currently screened against criteria provided in DEQ, 2003. DEQ considers it important to reconcile previous screening level evaluation of earlier data by comparison of that data against updated screening level criteria. In addition, data acquired in 2006 is also evaluated against criteria provided in DEQ, 2003. In order to retain COIs as Contaminants-of-Potential-Concern (COPCs) across all data sets, and in order to ultimately retain COPCs as Contaminants-of-Concern (COCs)[3], DEQ required the evaluation of data usability to support risk evaluation.

Soils

Arsenic was the only metal to exceed a screening level in Site 1 soil (Table 3-1). Specifically, 7 of 65 detections exceeded the maximum arsenic background concentration (5.06 mg/kg), and 2 of the highest detections (T1-09 and T1-15) were associated with the former burn pit.

PAHs were detected in 12 of 81 Site 1 soil samples, although one specific sample (01-JJ2-S-3) considered so anomalously high that this location was resampled during 2006 for the purpose of verification of its magnitude. Specifically, the benzo(a)pyrene (BaP) value in this sample was about 3 orders of magnitude higher than the next highest value (01-II3-S3), which appeared inconsistent with adjacent sample values or in surface sample values at the same location. In addition, this value was suspected as spurious due to its association with a test pit (01-JJ2), which documented that soil between 1 and 4 feet bgs was comprised of 50 % concrete and asphalt rubble mixed with dark brown soil sand. With DEQ concurrence, the resample PAH data

[3] COCs are identified from COPCs if apparent statutory exceedances of screening level concentrations cannot be discounted in consideration of mitigating factors.

for sample location 01-JJ2 replaced the previous data for this location in the baseline risk assessment.

Five pesticide compounds were observed at Site 1 that included 4,4'-DDT; 4,4'-DDE; 4,4'-DDD, endosulfan sulfate; and, heptachlor-epoxide[4]. Ten of 79 samples were detected above reporting limits, but not at concentrations exceeding screening level standards.

Seventy-five soil samples were collected and evaluated for PCBs. None of these samples contained detectable PCB concentrations.

Groundwater

During preliminary site investigations 29 groundwater grab samples collected using direct-push were evaluated for PAHs, PCBs, pesticides, and total metals. PAHs were detected in 2 of 29 grab samples and several metals were detected above screening levels. No PCBs or pesticides were detected above reporting limits. These results are not considered representative because they were not field-filtered and because geoprobe grab sampling is commonly associated with turbidity-induced problems, especially given the lack of field filtration in sample collection methodology.

Groundwater samples collected from 6 monitoring wells and 1 piezometer (considered a background well) were tested for dissolved metals, SVOCs, PAHs, pesticides, and PCBs. Samples collected during 2002 and 2003 were evaluated for dissolved metals, VOCs, SVOCs, and pesticides. Low levels of tri-methyl benzene, xylenes, and acetone were infrequently detected at concentrations below levels of concern. SVOCs (including PAHs), pesticides, and PCBs were consistently non-detect in site groundwater.

Results for metals with screening level exceedances include arsenic, copper, molybdenum, selenium, and vanadium (Table 3-3). These screening levels include the use of United States Environmental Protection Agency (EPA) Region 9 Preliminary Remediation Goals (PRGs) (EPA, 2004a) and Ambient Water Quality Criteria (AWQC) (EPA, 2004b). These apparent exceedances of screening levels were further analyzed in the baseline risk assessment (CH2M Hill, May, 2007) by comparison to potentially completed exposure pathways values listed in DEQ, 2003.

Risk-Based Evaluation

Human Health

Concentrations of Contaminants-of-Interest (COIs) were compared to generic risk-based concentrations (RBCs) listed in DEQ's *Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites* (RBDM) guidance dated September 22, 2003 for the pathway and receptors listed above.

[4] DDT – 1,1,1-trichloro-2,2-bis(p-chlorophenyl) ethane; DDE – 1,1-dichloro-2,2-bis(p-chlorophenyl) ethylene; DDD – 1,1-dichloro-2,2-bis(p-chlorophenyl) ethane.

Fifty-six soil samples collected from 0-4 feet bgs were used for both surface and subsurface soil risk evaluation for construction worker, excavation worker scenarios, and hypothetical residential scenarios. Forty-nine groundwater samples collected during the time span from 1999 to 2006 were also utilized for risk estimation. Given the wide temporal span in site data, a data usability evaluation was performed, which resulted in the following conclusions:

- Soil and groundwater data from past investigations had adequate reporting limits to support risk assessment in most instances;
- Data for soils from past investigations are representative in all but two exceptions including one geoprobe sample from Site 1 associated with anomalously high PAH detections (01-JJ2-S-3); and,
- Groundwater data collected prior to 2002 are not temporarily representative, but are augmented by data collected during 2002, 2003, and 2006.

The noncancer and Excess Lifetime Cancer Rate (ELCR) estimates at Site 1 are summarized in Table 9. Table 10 provides the results of the Site 1 indoor air screening for soil and groundwater. Reasonable Maximum Exposure (RME) and Central Tendency Exposure (CTE) estimates for noncancer effects at Site 1 are below the regulatory threshold value of 1.0 for all exposure scenarios. The RME and CTE ELCR estimates from all carcinogenic COPCs at Site 1 are below the target of 1E-05 for cumulative risk for all exposure scenarios except the RME hypothetical residential scenario. The chemical-specific estimates for arsenic and BaP are above the target of 1E-06 under the occupational RME scenario and for the RME and CTE residential scenario. All maximum VOC detections in Site 1 soil and groundwater are below indoor screening levels, and the maximum lead concentration (196 mg/kg) is below the screening level (400 mg/kg).

The individual carcinogenic risk estimate predicted for BaP (2E-06) exceeds the screening level threshold of 1E-06 under the occupational exposure scenario. However, this specific data from Site 1 is based upon only 8 BaP detections among 81 samples evaluated, for a total frequency of 9.8%. While this exceeds the 5% frequency of detection that is often used as a cutoff for determining COIs that are unlikely to pose risks, it does also indicate that the occurrence of BaP is not widespread across Site 1.

In addition, the variability of this data set is high as indicated by a coefficient of variation (CV) of 7.6, which is elevated largely by the influence of a single sample (S1Soil01). As such, the sample appears to be a high outlier and not representative of Site 1 as an exposure unit. Specifically, increased variability correspondingly increases the estimates of Exposure Point Concentration (EPC)[5]. DEQ's analysis of the range of nonparametric Upper Confidence Limit (UCL) range from 0.35 to 0.57 mg/kg, which represents a risk estimate range of 1E-06 to 2E-06. If sample (S1Soil01) were eliminated based upon not being representative, the resulting UCL corresponds to a risk estimate of approximately 2E-07. In this case, even estimated residential risks would be within acceptable levels, corresponding to a risk estimate of 9E-07.

[5] EPC is defined in this memorandum as equivalent to 90% Upper Confidence Level (UCL) of data used to support risk computation. By policy, if a 90% UCL is not calculated, a maximum detection value is used as the EPC.

Based upon the DEQ's more refined analysis of the possible significance of the BaP screening level exceedances at Site 1, and in consideration of the specific nature of current and reasonably likely future occupational exposures, DEQ recommended a change of occupational exposure duration assumptions from default values. Specifically, there was recent precedent[6] that the current and future occupational worker at Kingsley Field is embodied in a maintenance worker who conducts mowing of grass for which DEQ recommended a modified 2 hour/7times per year exposure duration. Based upon this modification, the RME calculated risk estimate for the occupational maintenance worker is 5.9E-08, and BaP is not retained as a human health COC at Site 1.

The arsenic EPC was 3.6 mg/kg and the maximum background arsenic concentration is 5.1 mg/kg, which suggests that risk associated with this inorganic compound is associated with ambient levels at Site 1.

Ecological Risk

Level 1 Scoping Assessment identified potentially complete ecological exposure pathways prompting a Level 2 Screening Assessment to determine whether site-related constituents could pose unacceptable risks to ecologic receptors, especially wildlife. The candidate assessment endpoints and corresponding measures of exposure and effect for Site 1 is summarized in Table 17.

Site 1 downgradient perimeter wells MW01-01 and MW01-04 were evaluated against Level 2 Screening Level Values (SLVs) considered protective of aquatic organisms, birds, and mammals (Table 21). DEQ SLVs were exceeded in these well points consistently through the monitoring periods evaluated (1999-2006) for barium, bis(2-ethylhexyl)phthalate, copper, m,p-xylene, selenium, and vanadium. However, these apparent screening level exceedances are qualitatively discounted based upon consideration of the following:

- Barium was not detected at a value above background levels;
- Bis(2-ethylhexyl)phthalate concentrations previously reported (CH2M Hill, January 2007) should have been qualified because observed concentrations were less than observed in method blank;
- Copper exceedances occurred during 2003, but have not been observed above either SLV or background values during the last two sampling events;
- m,p-Xylene exceedances occurred in 2000, but have not been observed during the next 5 sampling events; and,
- Vanadium exceedances do not appear to be site related because they are consistent over time and space at concentrations near or below background established during the 2006 sampling event.

Land and Water Beneficial Use

[6] DEQ agreed that a modified exposure duration assumption for occupational workers was warranted at a similar site during 2005 at Kingsley Field.

Site 1 is currently on land leased from the City of Klamath Falls by ANG through 2045. Munitions are stored in bunkers in an area west of Site 1 and a buffer area with a 1,250-foot radius has been established around the bunkers that encompass Site 1 and adjacent offsite land. Land development within the buffer area is strictly limited. Land immediately east of Site 1 is privately owned and currently used for agricultural purposes. Due to the munitions storage area, ANG has an easement on this property that currently prohibits development. Klamath County has zoned the area for exclusive cropland farm uses (EFU-C).

Site 1 and the land surrounding it have the potential for industrial uses in the future. A 2005 planning document prepared for the municipal airport envisions a scenario where the munitions storage area is moved and the land at Site 1 is transferred back to the city and converted to commercial/light industrial uses. Although the private land adjacent to Site 1 is not presently included within Klamath Fall's Urban Growth Boundary (UGB) and is projected to remain agricultural, commercial development is planned for the other areas surrounding Kingsley Field. Neither Site 1 nor the private land adjacent to Site 1 lie within safety zones established around the runways for approaching and departing aircraft, so future commercial buildings are possible once the munitions storage area is relocated.

Water used at Kingsley Field is supplied by the City of Klamath Falls and is obtained from groundwater production wells (Conger well field). This network of water supply wells is located approximately 4 miles northwest and upgradient of Kingsley Field and produce from deep hydrostratigraphic intervals. A water well survey was completed for all known wells within a 0.5 mile radius of Kingsley Field by querying Oregon Water Resources Department (OWRD) databases identified a total of 43 wells, none of which are located within the Site 1 Locality-of-Facility (LOF)[7].

Conclusions

Site 1 screening risk evaluation demonstrates that there are no statutory exceedances of appropriate DEQ RBCs or SLV standards for environmental media of concern[8]. Site data are considered sufficient for supporting remedial action decisions for Site 1. For human health, the chemical specific risk estimate for arsenic was slightly above a regulatory target of 1E-06 under a hypothetical residential scenario. However, this apparent exceedance is not considered to be of concern because: 1] the (hypothetical) residential scenario is considered unlikely given current and reasonably likely future land use (zoned EFU, but under lease to ANG until 2045); and, 2] the arsenic EPC (3.6 mg/kg) is within the range of values considered ambient (up to 5.1 mg/kg). For ecological risk assessment, apparent exceedances of non-toxic SLV standards are qualitatively discounted based upon belief they are reasonably associated with high detection limits occurring in 2001, and that no detections were not reported in subsequent monitoring.

[7] LOF is defined in Oregon Administrative Rule (OAR) 340-122-115 as: "any point where a human or an ecological receptor contacts or is reasonably likely to come into contact with, facility-related hazardous substances...". The extent of residual contamination in groundwater at Site 1 is stable and/or diminishing both spatially and by magnitude of residual contaminant concentrations. Specifically, no COCs are identified in Site 1 groundwater because apparent screening level exceedances are qualitatively discounted based upon factors identified in this memorandum.

[8] There were some apparent screening levels exceedances – the significance of which is further evaluated and discussed under *Risk Based Evaluation* and *Conclusions* narratives in this memorandum.

No additional groundwater data acquisition is considered necessary because the similarity of 2006 to earlier site data for groundwater resolves the concern about temporal representativeness.

It is plausible that future use of Site 1 would be redeveloped into industrial aviation use pursuant to the City of Klamath Falls municipal airport master plan if the ANG munitions area were to be relocated and Site 1 ownership was rescinded to the City. This land use scenario is unlikely in the near term given that the City's lease with the ANG extends to 2045 and that there is no proposed relocation of the munitions area in the foreseeable future. Given that no COPCs were retained as COCs based upon a refined screening level risk evaluation, there is no identified unacceptable risk to either human or ecological receptors. Site 1 is therefore eligible to receive an unqualified No Further Action determination.

Recommendation

I recommend that DEQ proceed with a Public Opportunity to Comment during July 2007. Contingent upon any comments received during the formal comment period, I recommend that a No Further Action decision be issued for Site 1. The issuance of the NFA would be contingent upon ANG documentation to DEQ that all Site 1 monitoring wells have been permanently decommissioned in conformance with OWRD regulations.

Attachments [9]

Figure 2-2 – Facility Scale Site Location Map
Figure 3-1 – ERP Site 1 Electromagnetic Survey Grid and Test Pits
Figure 3-2 – Kingsley Field ERP Site 1
Table 3-4 – Kingsley Field Interim RA Operation Data Gaps for Site 1
Figure 3 – Conceptual Site Model for Human Health and Ecological Risk Assessment
Table 3-3 – 1999-2006 Dissolved Metals in Site 1 Groundwater Samples
Table 17 – Ecological Endpoints
Table 9 – Soil ERP Site 1
Table 10 – Comparison of Site 1 Maximum Groundwater and Surface Soil Concentrations with Vapor Intrusions RBCs
Table 21 – Screening for Groundwater Concentrations in Site 1 Perimeter Wells with Level 2 Screening Level Values for Surface Water

Administrative Record

1] Installation Restoration Program Records Search for Kingsley Field Oregon, CH2M Hill, February, 1982.

2] HAZWRAP (Hazardous Waste Remedial Actions Program) Final Kingsley Field Site Investigation Report, April, 1994.

[9] In order of citation in text.

3] Final Remedial Investigation Report for IRP Sites 1 and 5: 173rd Fighter Wing, Oregon Air National Guard, Kingsley Field, Klamath Falls, Oregon, ERM, July, 2001.

4] Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites, DEQ, September, 2003.

5] Final September 2003 Quarterly Monitoring Report for ERP Sites 1 and 5; 173rd Fighter Wing, Oregon Air National Guard, Kingsley Field, Klamath Falls, Oregon, ERM-West, Inc., March, 2004.

6] Final Remedial Process Optimization Site Visit Report: 173rd Fighter Wing, Oregon Air National Guard, Klamath Falls, Oregon, BB&E, July, 2005.

7] Environmental Restoration Program Final Interim Remedial Action Operation/Long-Term Monitoring Report, Volumes 1 & 2, CH2M Hill, Inc., January, 2007.

8] Environmental Restoration Program Final Interim Remedial Action Operation/Long-Term Monitoring Human Health and Ecological Risk Assessment, CH2M Hill, Inc., May, 2007.