4.0 CONTAMINANT CONCENTRATIONS AND POTENTIAL EXTENT OF CONTAMINATION

Decisions documented in this DD are based upon information gathered from various environmental field investigations performed at the 10 petroleum-contaminated sites between 1990 and 2002. A summary of free-product monitoring during this time period is provided in Table 4-1 for all of the sites. In addition, a summary of the analytical results from these field investigations for all contaminants of potential concern identified in Section 3 is provided for each site in Tables 4-2 through 4-10. It should be noted that the concentrations of contaminants at each site were compared to Alaska DEC cleanup criteria and/or human health and ecological risk-based screening criteria to identify the contaminants of potential concern in soil, groundwater, surface water, and sediment. Therefore, some chemicals listed in Table 4-2 through 4-10 may only have been detected at concentrations which exceed the human health and/or ecological risk-based screening criteria and not the Alaska DEC cleanup levels.

Based upon the results of these field investigations, the potential extent of contamination at these 10 sites was estimated for free product, soil, and groundwater. The extent of contamination is shown graphically in figures included at the end of this section. The potential extent of free product was determined based on the monitoring information available for the site through 2002. Potential extent of contamination for soil and groundwater was estimated by comparing site concentrations to the Alaska DEC cleanup levels. Locations where the concentrations exceeded the Alaska DEC cleanup levels were identified and then used to delineate the area of potential contamination. The Alaska DEC Method Two cleanup levels established to prevent migration of contaminants from soil to groundwater in the over 40 inches of rainfall zone (18 AAC 75.341, Tables B1 and B2) were used to estimate the potential extent of soil impacted by petroleum contamination at each site. The tabulated groundwater cleanup levels [18 AAC 75.345(b)(1), Table C] or 10 times these values were used to estimate the potential extent of groundwater impacted by petroleum contamination at each site. It should be noted that the potential extents of contamination shown in these figures are based solely on exceedances of the Alaska DEC cleanup levels. The potential extents of contamination shown on these figures do not necessarily represent areas where risks are unacceptable or where cleanup actions will be required. However, these areas may be a potential concern and therefore require further evaluation in a risk assessment. The site data used to estimate the potential extents of contamination was used in the risk assessment to determine if contaminant concentrations at the sites pose an unacceptable risk to humans and ecological receptors.

Detailed site characterization information for each of the 10 petroleum-contaminated sites is provided in part 2 of the site characterization report (URS 2004a) and is summarized below.

4.1 GCI COMPOUND, UST GCI-1

From 1992 through 2002, several environmental field investigations have been performed at or in the vicinity of the GCI Compound:

- A 1992 investigation to evaluate possible petroleum releases associated with the Main Road pipeline (URS 1994)
- A 1995 site assessment to evaluate site conditions during the removal of UST GCI-1, the associated piping, and the dispenser island from the site (URS 1995b)
- A 1996 summary of site conditions (EMCON 1996a)
- A 1999 site summary report to present all site data collected to that point (URSG 1999a)
- A 2000 free-product recovery closure report to demonstrate that free-product recovery at the site is no longer practicable (URSG 2000a)
- A 2002 groundwater sampling and analyses investigation to evaluate concentrations of petroleum related chemicals and natural attenuation parameters in groundwater at the site (Foster Wheeler 2002)

Results of these investigations indicated that petroleum-related chemicals were confirmed in samples of soil and groundwater collected from several locations at the GCI Compound site. Free product, although detected historically at the site, has not been detected at the GCI Compound since 1997.

Between September 1996 and August 2002, monitoring wells within the GCI Compound have been gauged periodically for the presence of free product. During this time period, free product has been detected in 2 of 11 wells. The maximum measured thickness of free product at the GCI Compound was 1.93 feet in well 04-201 on November 14, 1996. Information on free product monitoring is summarized in Table 4-1 for all sites discussed in this DD including the GCI Compound.

Passive-style product skimmers were used at this site to recover product when detected in measurable quantities. Skimmers were checked twice monthly, or quarterly depending on the product recovery rate in the particular well. Less than 5.0 gallons of free product were recovered at the GCI Compound area during the first 2 months of 1997. The quantity of recovered product decreased to less than 0.1 gallon during the last 10 months of 1997. No product has been recovered at this site since November 1997, and free product has not been observed in any monitoring well in the vicinity of the GCI Compound since November 12, 1997. Because free product has not been found in any monitoring well since November 1997, free product has been recovered to the maximum extent practicable following the requirements of the OU A ROD and 18 AAC 75.325(f)(1)(B) (URSG 2000a).

The potential extent of soil and groundwater contamination at the GCI Compound was estimated in part 2 of the site characterization report (URS 2004a) and is summarized in this DD. This potential extent of contamination is based on a review of analytical results for petroleum-related chemicals in soil samples collected at the site between 1992 and 1998 and in groundwater samples collected at the site between 1992 and 2002. Figures showing these results for GRO, DRO, and BTEX compounds are provided in Appendix B. The total number of samples collected at GCI Compound including field duplicates, the number of samples used in the risk assessment, the minimum concentration used in the risk assessment, the maximum concentration used in the risk assessment, the location of the maximum concentration used in the risk assessment, the detection frequency, and the range of detection limits is provided in Table 4-2 for all contaminants of potential concern in soil, surface soil, and groundwater. (The contaminants of potential concern were previously identified in Section 3 for the GCI Compound.) The estimated potential extent of soil and groundwater contamination at GCI Compound is shown on Figure 4-1.

Petroleum-related chemicals were reported in 10 soil samples collected from nine locations at detected concentrations greater than their respective Alaska DEC soil criteria. The petroleum compounds that exceed criteria at these locations are DRO, GRO, benzene, ethylbenzene, and total arsenic. The single reported arsenic concentration that exceeds its screening criteria (1.8 mg/kg) is below the Adak Island background concentration of 7.47 mg/kg (URS 1995c). Therefore, detected concentrations of DRO, GRO, benzene, and ethylbenzene above their Alaska DEC soil cleanup levels were used to estimate the potential extent of petroleum contamination in soil. In addition, soil at locations where free product was observed on the groundwater surface is also considered to contain petroleum-related chemicals at concentrations that exceed screening criteria.

The on-site areas estimated to contain petroleum-related chemicals in soil at concentrations greater than the most stringent Alaska DEC Method Two soil cleanup levels are indicated by the

dashed lines in Figure 4-1. Combined, these areas are estimated to encompass approximately 0.2 acre. The volume of soil containing petroleum-related chemicals at concentrations above the Alaska DEC soil cleanup levels was also estimated for the site. The volume estimates are calculated based on the areal distributions shown in Figure 4-1 and an assumed thickness of contaminated media based on a review of boring logs. The potential contaminated soil volume is estimated at 1,200 cubic yards (cy).

The potential extent of petroleum contamination in groundwater was evaluated by comparing analytical results to respective Alaska DEC groundwater cleanup levels established for groundwater considered a potential drinking water source. Because monitoring wells at the site have been sampled multiple times, results from the most recent sampling event through 2002 at each monitoring location are compared to groundwater criteria. Petroleum-related chemicals were reported in the most recent groundwater samples collected from seven locations at concentrations greater than their respective Alaska DEC groundwater cleanup level. The petroleum compounds that exceed criteria at these locations are DRO, GRO, and benzene. The site area estimated to contain petroleum-related chemicals in groundwater at concentrations greater than the Alaska DEC groundwater criteria is indicated by the solid line in Figure 4-1. This area is estimated to be approximately 1.0 acre.

4.2 SA 80, STEAM PLANT NO. 4, USTS 27089 AND 27090

From 1992 through 2002, several environmental field investigations have been performed at or in the vicinity of the SA 80:

- A 1992 investigation to evaluate possible petroleum releases associated with SA 80 and the Main Road pipeline (URS 1994)
- A 1993 site assessment to evaluate site conditions during the removal of UST 27090 from the site (Shannon & Wilson 1993a)
- Two 1995 site assessments to evaluate site conditions during removal of UST 27089 (URS 1995d) and its associated piping (URS 1995e)
- A 1996 summary of site conditions (EMCON 1996b)
- A 1999 site summary report to present all site data collected to that point (URSG 1999a)

- A 2000 free-product recovery closure report to demonstrate that free-product recovery at the site is no longer practicable (URSG 2000A)

- A 2002 groundwater sampling and analyses investigation to evaluate concentrations of petroleum related chemicals and natural attenuation parameters in groundwater at the site (Foster Wheeler 2002)

Results of these investigations indicated that free product was still being detected at the site during August 2002 and that petroleum-related chemicals were confirmed in samples of soil and groundwater collected from several locations at the SA 80 site.

Between November 1992 and October 2002, monitoring wells within the vicinity of SA 80 were gauged periodically for the presence of free product. During this time period, free product was detected in 5 of 15 wells. The maximum measured thickness of free product at SA 80 was 3.26 feet, in well 04-173 on August 29, 1997. A measurable thickness of free product was observed in three monitoring wells at the SA 80 site during groundwater monitoring activities conducted on August 2, 2002. Information on free product monitoring is summarized in Table 4-1 for all sites discussed in this DD including SA 80. Figure 4-2 shows the estimated potential extent of free product remaining at the site based on August 2, 2002 monitoring results.

Passive-style product skimmers were used at this site to recover product when detected in measurable quantities. Skimmers were checked twice monthly, monthly, or quarterly depending on the product recovery rate in the particular well. During the period from initial product recovery (1997) through July 2000, approximately 25 gallons of free product were recovered. Less than 4 gallons of free product were recovered during the last year of product recovery actions (June 1999 through June 2000). Because free-product recovery at the Steam Plant No. 4 site produced less than 4 gallons of recovered product during the 13-month period from June 1999 to June 2000, free product has been recovered at the site to the maximum extent practicable following the requirements of the OU A ROD and 18 AAC 75.325(f)(1)(B) (URSG 2000a). Free-product recovery efforts at the site were terminated during July 2000.

The potential extent of soil and groundwater contamination at SA 80 was estimated in part 2 of the site characterization report (URS 2004a) and is summarized in this DD. This potential extent of contamination is based on a review of analytical results for petroleum-related chemicals in soil samples collected at the site between 1992 and 1998, and in groundwater samples collected at the site between 1992 and 2002. Figures showing these results for GRO, DRO, and BTEX compounds are provided in Appendix B. The total number of samples collected at SA 80 including field duplicates, the number of samples used in the risk assessment, the minimum concentration used in the risk assessment, the maximum concentration used in the risk

assessment, the location of the maximum concentration used in the risk assessment, the detection frequency, and the range of detection limits is provided in Table 4-3 for all contaminants of concern in soil and groundwater. (The contaminants of potential concern were previously identified in Section 3 for the SA 80.) The estimated potential extent of soil and groundwater contamination at SA 80 is shown on Figure 4-2.

Petroleum-related chemicals were reported in 27 soil samples collected from 18 locations at detected concentrations greater than their respective Alaska DEC soil criteria. These 18 locations occur in the vicinity of the former fuel distribution system at the site and at two isolated down-gradient locations. DRO is the only petroleum compound reported at detected concentrations in soil samples collected from these locations that exceed soil criteria. Therefore, detected concentrations of DRO above the Alaska DEC soil cleanup level (230 mg/kg) were used to estimate the potential extent of petroleum contamination in soil. In addition, soil at locations where free product was observed on the groundwater surface is also considered to contain petroleum-related chemicals at concentrations that exceed screening criteria.

The on-site areas estimated to contain petroleum-related chemicals in soil at concentrations greater than the most stringent Alaska DEC Method Two soil cleanup levels are indicated by the short dashed lines on Figure 4-2. Combined, these areas are estimated to encompass approximately 0.4 acre. The volume of soil containing petroleum-related chemicals at concentrations above the Alaska DEC soil cleanup levels was also estimated for the site. The volume estimates are calculated based on the areal distributions shown in Figure 4-2 and an assumed thickness of contaminated media based on a review of boring logs. The potential contaminated soil volume is estimated at 7,400 cy.

The potential extent of petroleum contamination in groundwater was evaluated by comparing analytical results to respective Alaska DEC groundwater cleanup levels established for groundwater considered a potential drinking water source. Because monitoring wells at the site have been sampled multiple times, results from the most recent sampling event through 2002 at each monitoring location were compared to groundwater criteria. DRO was reported in the most recent groundwater samples collected from eight locations at concentrations greater than its respective Alaska DEC groundwater cleanup level. These locations occur over a broad area across the site. The site area estimated to contain petroleum-related chemicals in groundwater at concentrations greater than the Alaska DEC groundwater criteria is indicated by the solid line in Figure 4-2. This area is estimated to be approximately 0.7 acre.

4.3 TANKER SHED, UST 42494

From 1995 to present, several environmental field investigations have been performed at or in the vicinity of the Tanker Shed:

- A 1995 site assessment to evaluate site conditions during the removal of UST 42494 from the site (URS 1996a)
- A 1996 summary of site conditions (EMCON 1996b)
- A 1999 site summary report to present all site data collected to that point (URSG 1999a)
- A supplemental site assessment was conducted during 2001 to address data gaps

Results of these investigations indicated that free product is still being detected at the site and that petroleum-related chemicals were confirmed in samples of soil and groundwater collected from several locations at the Tanker Shed site.

Between October 1996 and November 2001, monitoring wells within the vicinity of Tanker Shed were gauged periodically for the presence of free product. During this time period, free product was detected in 12 of 24 wells. The maximum measured thickness of free product at Tanker Shed was 1.98 feet, in well 04-176 on May 21, 1997. A measurable thickness of free product was observed in five monitoring wells at the Tanker Shed site during 2001 groundwater monitoring activities. Information on free product monitoring is summarized in Table 4-1 for all sites discussed in this DD including Tanker Shed. Figure 4-3 shows the estimated potential extent of free product remaining at the site based on 2001 product monitoring results.

Free-product recovery was conducted at the Tanker Shed site from January 1997 through November 2001. Passive-style product skimmers were used at this site to recover product beginning in 1997. Skimmers were checked weekly, twice monthly, monthly, or quarterly depending on the product recovery rate in the particular well. Passive skimmer operations produced approximately 18 gallons of recovered product at the Tanker Shed site during 1997. Because skimmer reservoirs were consistently filled to capacity in three wells at the Tanker Shed site, a portable active skimmer system test was conducted in March 1997. Based on the extent of free product observed at the site, product recovery rates using passive skimmers, and the active skimmer test, active free-product recovery was warranted at Tanker Shed. Passive skimmer operation stopped at the end of August 1997, and design work for an active skimmer system was performed in the fall of 1997.

Active skimmer system installation began in November 1997, and the active skimmer system started operating in January 1998. Between January 1998 and May 1999, approximately 369 gallons of free product were recovered. No free product was recovered from June through September of 1999 due to insufficient quantities of free product present at the site and the system was taken off line for maintenance. The active system remained off line through April 2000. Passive skimmers were used during the final week of April for product recovery. The active recovery system was restarted on May 2, 2000 and continued operation until November 11, 2000 when it was shut down for the winter. During the 7 months the system operated in year 2000, approximately 133 gallons of free product were recovered at the Tanker Shed. The active product recovery system was restarted on May 11, 2001 and continued operation until November 12, 2001 when it was shut down. During the 7 months the system operated in 2001, approximately 8 gallons of free product were recovered at Tanker Shed. Approximately 528 gallons of free product were recovered at Tanker Shed from 1997 through 2001. The active skimmer system was shut down after November 12, 2001, due to the progressively lower amounts of free product that were being recovered using the system. However, Tanker Shed has not met the practicable endpoint established for the shut down of product recovery as specified in the OU A ROD. As a result, the Navy initiated recovery operations in 2004 to reach the endpoint. This 2004 work has not been completed and is not the subject of this document.

The potential extent of soil and groundwater contamination at Tanker Shed was estimated in part 2 of the site characterization report (URS 2004a) and is summarized in this DD. This potential extent of contamination is based on a review of analytical results for petroleum-related chemicals in soil samples collected at the site between 1996 and 2001, and in groundwater samples collected at the site between 1996 and 2002. Figures showing these results for GRO, DRO, and BTEX compounds are provided in Appendix B. The total number of samples collected at Tanker Shed including field duplicates, samples used in the risk assessment, minimum concentration used in the risk assessment, maximum concentration used in the risk assessment, location of the maximum concentration used in the risk assessment, detection frequency, and the range of detection limits is provided in Table 4-4 for all contaminants of potential concern in soil and groundwater. (The contaminants of potential concern were previously identified in Section 3 for Tanker Shed.) The estimated extent of soil and groundwater contamination at Tanker Shed is shown on Figure 4-3.

Petroleum-related chemicals were reported in 20 soil samples collected from 19 locations at detected concentrations greater than their respective Alaska DEC soil criteria. These 19 locations occur in the vicinity of the former UST at the site and at two isolated down-gradient locations. DRO, GRO, and BTEX compounds are reported at detected concentrations in soil samples collected from these locations that exceed soil criteria. Therefore, detected

concentrations of DRO, GRO, and BTEX compounds above their respective Alaska DEC soil cleanup levels were used to determine the potential extent of petroleum contamination in soil.

The on-site areas estimated to contain petroleum-related chemicals in soil at concentrations greater than the most stringent Alaska DEC Method Two soil cleanup levels are indicated by the short dashed lines on Figure 4-3. Combined, these areas are estimated to encompass approximately 0.4 acre. The total volume of soil containing petroleum-related chemicals at concentrations above the Alaska DEC soil cleanup levels was estimated to be 3,200 cubic yards for the site. The volume estimates are calculated based on the areal distributions shown in Figure 4-3 and an estimated thickness of contaminated soil of 5 feet, obtained based on a review of boring logs.

The potential extent of petroleum contamination in groundwater was evaluated by comparing analytical results to respective Alaska DEC groundwater cleanup levels established for groundwater considered a potential drinking water source. Because monitoring wells at the site have been sampled multiple times, results from the most recent sampling event through 2002 at each monitoring location are compared to groundwater criteria. At two wells (04-176 and 04-282), DRO and/or benzene were reported at concentrations greater than their respective Alaska DEC cleanup levels in groundwater samples collected several years ago (1997 and 1996 respectively). However, these chemicals have not been tested for at these locations since 1996 or 1997. Since these sample results do not reflect current conditions, they are not used to establish the potential extent of contamination at the Tanker Shed site. The presence of a measurable thickness of free product in a well is also considered an exceedance.

Fourteen of the 22 existing on-site wells were sampled during October 2001. This sampling effort provides the most complete snapshot of petroleum-related chemicals in groundwater at the site. Only well 04-601 has been sampled since this comprehensive sampling event. Petroleum-related chemicals (DRO, GRO, and BTEX) were reported in these October 2001 groundwater samples collected from 6 of the 14 locations sampled at concentrations greater than their respective Alaska DEC groundwater cleanup levels. These locations occur in a long narrow area across the site. The site area estimated to contain petroleum-related chemicals in groundwater at concentrations greater than the Alaska DEC groundwater criteria is indicated by the solid line in Figure 4-3. This area is estimated to be approximately 0.7 acre.

4.4 SA 78, OLD TRANSPORTATION BUILDING

From 1990 to present, several environmental field investigations have been performed at or in the vicinity of the SA 78 site:

- A 1990–1992 investigation of soil and groundwater conditions at SA 78 for the purpose of constructing the Bachelors Enlisted Quarters (BEQ) at NSGA (Shannon & Wilson 1991, 1992)
- A 1993 site assessment to evaluate site conditions during the removal of UST 10583 and two mogas ASTs (Quest 1993a)
- A 1994 preliminary source evaluation (PSE) of the SWMU 51, NSGA Transportation Building 10354 Waste Storage Area and SWMU 72, NSGA Transportation Building 10354 (URS 1995f)
- An unsuccessful attempt in 1995 to locate UST 10584 (URS 1995g)
- A summary of site conditions (EMCON 1996b)
- A 1999 site summary report to present all site data collected to that point (URSG 1999a)
- A 2000 free-product recovery closure report to demonstrate that free-product recovery at the site is no longer practicable (URSG 2000a)
- A 2002 groundwater sampling and analyses investigation to evaluate concentrations of petroleum related chemicals and natural attenuation parameters in groundwater at the site (Foster Wheeler 2002)

Results of these investigations indicated that free product was still being detected at the site during August 2002 and that petroleum-related chemicals were confirmed in samples of soil, groundwater, and sediment collected from several locations in the vicinity of the former fuel storage tanks at the SA 78 site.

Between November 1996 and October 2002, monitoring wells within the vicinity of SA 78 have been gauged periodically for the presence of free product. During this time period, free product has been detected five times in only one of 7 wells: 12-145. The maximum measured thickness of free product in this well was 0.2 feet, on September 2, 1997. Free-product thickness did not

exceed 0.02 feet the other four times it was observed. Information on free product monitoring is summarized in Table 4-1 for all sites discussed in this DD including SA 78. Figure 4-4 shows the estimated potential extent of free product remaining at the site based on 2001 product monitoring results.

Because product was observed at this site intermittently and in very small quantities, use of a passive-style product skimmer for product removal was determined to be unnecessary. However, an absorbent product removal device was installed in monitoring well 12-145 during October 1997. To evaluate product recovery rates, the absorbent device was checked monthly until June 2000. In spite of these efforts, a measurable quantity of free product was not recovered at this site. Because a measurable quantity of free product was not recovered at this site during the 33 month period from October 1997 to June 2000, free product has been recovered at the site to the maximum extent practicable following the requirements of the OU A ROD and 18 AAC 75.325(f)(1)(B) (URSG 2000a). Product recovery efforts were discontinued at this site during July 2000.

The potential extent of contamination at SA 78 was estimated in part 2 of the site characterization report (URS 2004a) and is summarized in this DD. This potential extent of contamination is based on a review of analytical results for petroleum-related chemicals, VOCs, SVOCs (semi volatile organic compounds), and inorganics in soil, groundwater, and sediment samples collected at the site between 1994 and 2002. Figures showing these results for GRO, DRO, and BTEX compounds in soil and groundwater are provided in Appendix B. Although known contamination at this site is predominantly petroleum related, selected non-petroleum chemicals are known to exist at very low concentrations in soil and groundwater in the vicinity of the Old Transportation Building. Analytical results obtained for these chemicals are included in the analysis conducted to establish the potential extent of contamination at the site. The total number of samples collected at SA 78 including field duplicates, samples used in the risk assessment, the minimum concentration used in the risk assessment, the maximum concentration used in the risk assessment, the location of the maximum concentration used in the risk assessment, the detection frequency, and the range of detection limits is provided in Table 4-5 for all contaminants of potential concern in soil and groundwater. (The contaminants of potential concern were previously identified in Section 3 for SA 78.) The estimated potential extent of contamination at SA 78 is shown on Figure 4-4.

Detected concentrations of DRO, GRO, or BTEX chemicals were reported in 13 soil samples collected from nine locations at concentrations greater than their respective Alaska DEC soil cleanup levels. These nine locations are concentrated in the vicinity of the former fuel storage tanks, or at scattered locations downgradient from the former tanks. The total inorganic arsenic was reported at detected concentrations greater than its respective Alaska DEC soil cleanup level

at four locations. In addition, total cadmium and total lead were reported at concentrations above their respective Alaska DEC soil cleanup levels in one soil sample. However, total arsenic and total cadmium concentrations reported in soil samples collected at this site were less than background concentrations determined for these inorganic compounds in soil (URS 1995c). Therefore, detected concentrations of DRO, GRO, BTEX, and lead above their Alaska DEC soil Cleanup levels were used to determine the potential extent of petroleum contamination in soil.

The on-site areas estimated to contain detected concentrations of chemicals in soil at concentrations greater than their respective Alaska DEC soil cleanup levels are indicated by the short dashed lines on Figure 4-4. Combined, these areas are estimated to encompass approximately 0.25 acre. The volume of soil containing chemical concentrations above the most stringent Alaska DEC Method Two soil cleanup levels was also estimated for the site. The volume estimates are calculated based on the areal distributions shown in Figure 4-4 and an assumed thickness of contaminated media based on a review of boring logs. The potential contaminated soil volume is estimated at 5,400 cy.

The potential extent of contamination in groundwater was evaluated by comparing analytical results to their respective Alaska DEC groundwater cleanup levels established for groundwater that is not currently used as a drinking water source and is not considered a potential future drinking water source. Because monitoring wells at the site have been sampled multiple times, results from the most recent sampling event through 2002 at each monitoring location are compared to groundwater criteria. Benzene was the only petroleum-related chemical that exceeded these cleanup levels in the most recent groundwater samples collected from the site. Benzene exceeded the cleanup levels in samples collected from two monitoring wells. One VOC, methylene chloride, was reported at a detected concentration greater than its respective Alaska DEC groundwater cleanup level in one sample. The site area estimated to contain detected concentrations of chemicals in groundwater at concentrations greater than the respective Alaska DEC groundwater cleanup levels for groundwater not used as a drinking water source, is indicated by the solid line on Figure 4-4. This area is estimated to be approximately 0.2 acre.

The potential extent of contamination in terrestrial sediments down slope from the site, and marine sediments of Clam Lagoon is evaluated based on review of analytical results obtained for three sediment samples collected during July 1994. Total petroleum hydrocarbons (TPH) was reported at detected concentrations that range from a maximum estimated concentration of 551 mg/kg to a minimum estimated value of 52 mg/kg. GRO was not detected in the terrestrial sediment sample, and it was not tested for in marine sediments. VOCs including BTEX compounds were not detected in any of the three sediment samples collected. SVOCs including PAH compounds were not detected in the terrestrial sediment sample collected. One SVOC (3-methylphenol) was detected in both marine sediment samples at estimated concentrations of

0.45 and 0.46 mg/kg. The only additional SVOCs that were detected in either of the marine sediment samples were fluoranthene, phenanthrene, and pyrene. These chemicals were reported at estimated concentrations that range from 0.087 to 0.11 mg/kg.

4.5 SA 82, P-80/P-81 BUILDINGS

Since 1991, several environmental field investigations have been performed at or in the vicinity of the SA 82, P-80/P-81 Buildings, site:

- A 1991 investigation suggested that USTs 10579 and 10587 had been previously removed (Dames & Moore 1991)
- A 1994 site assessment to evaluate site conditions during the removal of AST 10333 and associated piping (URS 1995h)
- A summary of site conditions (EMCON 1996b)
- A 1999 site summary report to present all site data collected to that point (URSG 1999a)
- A 2000 free-product recovery closure report to demonstrate that free-product recovery at the site is no longer practicable (URSG 2000a)
- A 2002 groundwater sampling and analyses investigation to evaluate concentrations of petroleum related chemicals and natural attenuation parameters in groundwater at the site (Foster Wheeler 2002)

Results of these investigations indicated that petroleum-related chemicals were confirmed in samples of soil and groundwater collected from several locations at SA 82. Free product, although detected historically at the site, has not been detected at SA 82 since 1998.

Between October 1996 and October 2002, monitoring wells within the SA 82 site were gauged periodically for the presence of free product. Free product was observed in two of eight wells monitored at the site. The maximum measured thickness of free product in a monitoring well at the SA 82 site was 0.40 foot, measured in well 12-170 on December 14, 1996. Free product was observed in well 12-180 during 2 of 31 monitoring events. In both instances, the free-product thickness measured was 0.01 foot. Information on free product monitoring is summarized in Table 4-1 for all sites discussed in this DD including SA 82.

Passive-style product skimmers were used at this site to recover product when detected at measurable quantities. The product recovery devices were checked weekly, twice monthly, or monthly depending on the product recovery rate in the particular well. This monitoring produced 0.04 gallon of recovered product at the P-80/P-81 Buildings site during the first 2 months of 1997. No product has been recovered at this site since February 1997 and free product has not been observed in any monitoring well in the vicinity of the SA 82 since July 31, 1998. Because free product has not been found in any monitoring well since July 1998, free product has been recovered at this site to the maximum extent practicable following the requirements of the OU A ROD and 18 AAC 75.325(f)(1)(B) (URSG 2000a). Free-product recovery efforts at the site were terminated during July 2000.

The potential extent of soil and groundwater contamination at SA 82 was estimated in part 2 of the site characterization report (URS 2004a) and is summarized in this DD. This potential extent of contamination was based on a review of analytical results for petroleum-related chemicals in soil samples collected at the site between 1996 and 1998, and in groundwater samples collected at the site between 1996 and 2002. Figures showing these results for GRO, DRO, and BTEX compounds are provided in Appendix B. The total number of samples collected at SA 82 including field duplicates, samples used in the risk assessment, the minimum concentration used in the risk assessment, the maximum concentration used in the risk assessment, the location of the maximum concentration used in the risk assessment, the detection frequency, and the range of detection limits is provided in Table 4-6 for all contaminants of potential concern in soil and groundwater. (The contaminants of potential concern were previously identified in Section 3 for SA 82.) The estimated potential extent of soil and groundwater contamination at SA 82 is shown on Figure 4-5.

DRO was reported in five soil samples collected from three locations at concentrations greater than its Alaska DEC soil criterion. These three locations are in the immediate vicinity of UST 10579 and AST 10333. DRO is the only petroleum compound reported at concentrations in soil samples collected from these locations that exceed soil criteria. Therefore, detected concentrations of DRO above its Alaska DEC soil cleanup level were used to determine the potential extent of petroleum contamination in soil.

The on-site areas estimated to contain petroleum-related chemicals in soil at concentrations greater than the most stringent Alaska DEC Method 2 soil cleanup levels are indicated by the short dashed lines on Figure 4-5. Combined, these areas are estimated to encompass approximately 0.03 acre. The volume of soil containing petroleum-related chemicals at concentrations above the Alaska DEC soil cleanup levels was also estimated for the site. The volume estimates are calculated based on the areal distributions shown in Figure 4-5 and an

assumed thickness of contaminated media based on a review of boring logs. Potential contaminated soil volume is estimated at 400 cy.

The potential extent of contamination in groundwater was evaluated by comparing analytical results to their respective Alaska DEC groundwater cleanup levels established for groundwater that is not currently used as a drinking water source and is not considered a potential future drinking water source (Table 3-5). Because monitoring wells at the site have been sampled multiple times, results from the most recent sampling event through 2002 at each monitoring location are compared to groundwater criteria. During site assessment activities conducted between 1996 and 2002, no petroleum-related chemicals were reported in groundwater samples collected from the site at concentrations greater than their respective Alaska DEC groundwater cleanup levels for groundwater not used as a drinking water source.

4.6 SA 88, P-70 ENERGY GENERATOR (UST 10578)

Several environmental field investigations have been performed at or in the vicinity of the SA 88, P-70 Energy Generator site since 1993:

- A 1993 site assessment to evaluate site conditions during the removal of UST 10578 and associated piping (Quest 1993b)
- A summary of site conditions (EMCON 1996b)
- A 1999 site summary report to present all site data collected to that point (URSG 1999a)
- A 2000 free-product recovery closure report to demonstrate that free-product recovery at the site is no longer practicable (URSG 2000a)
- A 2002 groundwater sampling and analyses investigation to evaluate concentrations of petroleum related chemicals and natural attenuation parameters in groundwater at the site (Foster Wheeler 2002)

Results of these investigations indicated that free product was still being detected at the site during August 2002 and that petroleum-related chemicals were confirmed in samples of soil and groundwater collected from several locations at the SA 88 site.

Monitoring wells within the SA 82 site have been gauged periodically for the presence of free product between October 1996 and August 2002. Free product has been observed in 4 of 10 wells at the site. The maximum measured thickness of free product in a monitoring well at the SA 88 site was 3.10 feet, measured in well 12-162 on October 25, 1996. Information on free product monitoring is summarized in Table 4-1 for all sites discussed in this DD including SA 88. Figure 4-6 shows the estimated potential extent of free product remaining at the site based on August 4, 2002 monitoring results.

Passive-style product skimmers were used at this site to recover product when detected in measurable quantities. The skimmers were checked weekly, biweekly, or monthly, depending on product recovery in the particular well. At least one skimmer operated continually at the site between January and May 1997 and intermittently as product volume decreased (June through December 1997). This recovery effort produced less than 5 gallons of product at the site during 1997. Passive free-product recovery actions continued through June 2000 and a total of approximately 26 gallons of free product were recovered at the site. Because free-product recovery at the SA 88 produced approximately 26 gallons of recovered product during the 42-month period from January 1997 to June 2000, free product has been recovered at the site to the maximum extent practicable following the requirements of the OU A ROD and 18 AAC 75.325(f)(1)(B) (URSG 2000a).

The potential extent of soil and groundwater contamination at SA 88 was estimated in part 2 of the site characterization report (URS 2004a) and is summarized in this DD. This potential extent of contamination is based on a review of analytical results for DRO, GRO, BTEX, and PAH compounds in soil samples collected at the site between 1993 and 1998 and in groundwater samples collected at the site between 1996 and 2002. Figures showing these results for GRO, DRO, and BTEX compounds are provided in Appendix B. The total number of samples collected at SA 88 including field duplicates, the number of samples used in the risk assessment, the minimum concentration used in the risk assessment, the maximum concentration used in the risk assessment, the location of the maximum concentration used in the risk assessment, the detection frequency, and the range of detection limits is provided in Table 4-7 for all contaminants of potential concern in soil and groundwater. (The contaminants of potential concern were previously identified in Section 3 for SA 88.) The potential extent of soil and groundwater contamination at SA 88 is shown on Figure 4-6.

Petroleum-related chemicals were reported in 16 soil samples collected from 11 locations at concentrations greater than their respective Alaska DEC Method Two soil criteria. These 11 locations occur in the vicinity of the former UST 10578 and at two down-gradient locations across Giddins Road. DRO is the only petroleum compound reported at concentrations in soil samples collected from these locations that exceed Method Two soil criteria. Therefore, detected

concentrations of DRO above the Alaska DEC soil cleanup levels were used to determine the potential extent of petroleum contamination in soil.

The on-site areas estimated to contain petroleum-related chemicals in soil at concentrations greater than the most stringent Alaska DEC Method Two soil cleanup levels are indicated by the short dashed lines on Figure 4-6. Combined, these areas are estimated to encompass approximately 0.07 acre. The volume of soil containing petroleum-related chemicals at concentrations above the Alaska DEC Method Two soil cleanup levels was also estimated for the site. The volume estimates are calculated based on the areal distributions shown in Figure 4-6 and an assumed thickness of contaminated media based on a review of boring logs. The potential contaminated soil volume is estimated at 1,300 cy.

The potential extent of contamination in groundwater was evaluated by comparing analytical results to their respective Alaska DEC groundwater cleanup levels established for groundwater that is not currently used as a drinking water source, and is not considered a potential future drinking water source. Because monitoring wells at the site have been sampled multiple times, results from the most recent sampling event at each monitoring location are compared to groundwater criteria. During site assessment activities conducted between 1996 and 2002, no petroleum-related chemicals were reported in groundwater samples collected from the site at concentrations greater than their respective Alaska DEC groundwater cleanup levels for groundwater not used as a drinking water source.

4.7 SWMU 58 AND SA 73, HEATING PLANT NO. 6

From 1993 to present, several environmental field investigations have been performed at or in the vicinity of the SWMU 58/SA 73 site:

- A 1993 site assessment to evaluate site conditions during the removal of UST 10585-A (Quest 1993c).
- A 1994 preliminary source evaluation of the SWMU 71, NSGA Fueling Facility (URS 1995f)
- Four 1995 site assessments to evaluate site conditions during the removal of USTs 10572 and 10573 (URS 1995i), UST V-118 (URS 1995j), AST 10348-A (URS 1995k), and oil water separator 10348B (URS 1995l)

- A 1996 site assessment to evaluate site conditions during the removal of USTs 10570 and 10571 (Shannon & Wilson 1996a, 1996b)
- A summary of site conditions (EMCON 1996b)
- A 1998 aesthetic corrective action to eliminate surface exposure to petroleum related chemicals in fresh-water sediments of a downgradient drainage ditch (BEESC 1998)
- A 1999 site summary report to present all site data collected to that point including results of the product recovery evaluation (URSG 1999a)
- A 2000 free-product recovery closure report to demonstrate that free-product recovery at the site is no longer practicable (URSG 2000a)
- A 2002 groundwater sampling and analyses investigation to evaluate concentrations of petroleum related chemicals and natural attenuation parameters in groundwater at the site (Foster Wheeler 2002)

Results of these investigations indicated that free product was still being detected at the site during August 2002 and that petroleum-related chemicals were confirmed in samples of soil, groundwater, surface water, and freshwater sediment collected from several locations in the vicinity of the former fuel storage tanks and oil water separator at the SWMU 58/SA 73 site.

Between October 1996 and October 2002, monitoring wells within the vicinity of the SWMU 58/SA 73 site have been gauged periodically for the presence of free product. During this time period, free product has been detected in 7 of the 17 wells installed at the site. The frequency of free-product detection in these seven wells ranges from 3 percent to 83 percent. The frequency of free-product detection in three of the seven wells was less than 10 percent. The maximum measured thickness of free product reported at the site was 2.06 feet, measured in well 12-203 on October 11, 1997. Information on free product monitoring is summarized in Table 4-1 for all sites discussed in this DD including SWMU 58/SA 73. Figure 4-7 shows the estimated potential extent of free product remaining at the site based on August 4, 2002 monitoring results.

Passive-style product skimmers were installed in selected monitoring and recovery wells during January of 1997. Because a limited number of skimmers were available, they were rotated among wells containing a measurable product thickness. The skimmers operated continually at the site from January through May 1997, and intermittently as product volume decreased.

Skimmers were checked weekly, twice monthly, monthly, or quarterly depending on the product recovery rate in the subject well. Passive skimmer operations produced approximately 5 gallons of recovered product at the SWMU 58/SA 73 site during the first five months of 1997. The quantity of recovered product decreased to less than 0.25 gallon between June 1997 and October 1999. No product has been recovered at this site since October 1999. Because free-product recovery at the SWMU 58/SA 73 site produced less than 6 gallons of recovered product during the 34-month period from January 1997 to October 1999, free product has been recovered at the site to the maximum extent practicable following the requirements of the OU A ROD and 18 AAC 75.325(f)(1)(B) (URSG 2000a). Product recovery efforts were discontinued at this site during July 2000.

The potential extent of contamination at SWMU 58/SA 73 was estimated in part 2 of the site characterization report (URS 2004a) and is summarized in this DD. This potential extent of contamination is based on a review of analytical results for petroleum-related chemicals in soil, groundwater, ditch sediment, and ditch surface water samples collected at the site between 1994 and 2002. Figures showing these results for GRO, DRO, and BTEX compounds in soil and groundwater are provided in Appendix B. The total number of samples collected at SWMU 58/SA 73 including field duplicates, the number of samples used in the risk assessment, the minimum concentration used in the risk assessment, the maximum concentration used in the risk assessment, the location of the maximum concentration used in the risk assessment, the detection frequency, and the range of detection limits is provided in Table 4-8 for all contaminants of potential concern. The contaminants of potential concern were previously identified in Section 3 for SWMU 58/SA 73. The estimated potential extent of contamination at SWMU 58/SA 73 is shown on Figure 4-7.

Detected concentrations of DRO, GRO, or BTEX chemicals were reported in 28 soil samples collected from 23 locations at concentrations greater than their respective Alaska DEC soil criteria. These 23 locations are concentrated in the vicinity of the former fuel storage tanks and oil water separator, or at scattered locations downgradient from these known source areas. Of the PAH compounds, only naphthalene was detected in one soil sample at a concentration above its Alaska DEC soil criteria. Therefore, detected concentrations of DRO, GRO, benzene, ethylbenzene, and naphthalene above their Alaska DEC soil cleanup levels were used to determine the potential extent of petroleum contamination in soil.

The on-site areas estimated to contain detected concentrations of chemicals in soil at concentrations greater than the most conservative Alaska DEC Method Two soil criteria are indicated on Figure 4-7. The combined site area containing soil with chemical concentrations above Alaska DEC soil criteria is estimated to be approximately 0.5 acre. The volume of soil containing chemical concentrations above the Alaska DEC soil criteria was also estimated for the

site. The volume estimates are calculated based on the areal distributions shown in Figure 4-7 and location-specific thickness of contaminated soil determined based on a review of boring logs, sample depths, and depth to groundwater. Potential contaminated soil volume is estimated at 3,700 cy.

The potential extent of petroleum contamination in groundwater was evaluated by comparing analytical results to their respective Alaska DEC groundwater criteria established for groundwater that is not currently used as a drinking water source and is not considered a potential drinking water source. Because monitoring wells at the site have been sampled multiple times, results from the most recent sampling event through 2002 at each monitoring location are compared to groundwater criteria. Analytical results obtained from the most recent groundwater samples collected at each location during site assessment activities indicated that DRO was reported in one groundwater sample, collected from well 12-121, at a concentration greater than its Alaska DEC criteria for groundwater not used as a drinking water source. The site area estimated to contain detected concentrations of chemicals in groundwater at concentrations greater than the respective Alaska DEC groundwater criteria, is indicated by the solid line on Figure 4-7. The site area estimated to contain exceedances of groundwater screening criteria is estimated to be 825 square feet or 0.02 acre.

The potential extent of contamination in soil includes the evaluation of terrestrial ditch sediments located down slope from the former petroleum release source areas. This evaluation is based on review of analytical results obtained for six surface soil or sediment samples collected from the drainage ditches between November 1996 and May 1997. Ditch sediment or surface soil samples were obtained from 0 to 1.8 feet bgs. Because these drainage ditches contain surface water on an ephemeral basis, reported concentrations of petroleum-related chemicals in ditch sediments or surface soils are compared to Alaska DEC soil criteria to identify an exceedance of cleanup criteria. Detected concentrations of DRO were reported in two samples at concentrations greater than its respective Alaska DEC soil criteria. These two locations are situated, one in each drainage ditch, approximately 120 feet downgradient from known petroleum source areas. An aesthetic corrective action was conducted in the north-south trending drainage ditch during 1998. This corrective action eliminated exposure to concentrations of DRO reported in the surface soil (sediment) from one of these locations. The potential extent of contamination for soil reported above includes the surface soil (sediment) sample from the other drainage ditch which exceeded the Alaska DEC criteria.

The presence of petroleum-related chemicals in surface water within the downgradient drainage ditches is evaluated based on review of analytical results obtained for two surface water samples collected from the drainage ditches on November 4, 1996. Because the drainage ditches contain surface water on an ephemeral basis and water within the ditches probably represents shallow

groundwater daylighting to the ground surface, reported concentrations of petroleum-related chemicals in surface water samples were compared to Alaska DEC criteria for groundwater not used as a drinking water source. No petroleum-related chemical tested for in either of the two surface water samples collected from the drainage ditches was reported at a concentration greater than their respective Alaska DEC criteria for groundwater not used as a drinking water source.

4.8 YAKUTAT HANGAR

From 1993 to present, several environmental field investigations have been performed at or in the vicinity of the Yakutat Hangar site:

- A 1993 site assessment conducted to evaluate site conditions during removal of UST T-2039-A (Shannon and Wilson 1993b)
- A 1995 site assessment conducted to evaluate site conditions during removal of USTs T-2039-B and T-2039-C and their associated piping (URS 1996b)
- A 1996 summary of site conditions (EMCON 1996b)
- A 1996 site investigation to determine the extent of free product and to design and install an interceptor trench to recover free product (Foster Wheeler 1997)
- A 1997 aesthetic corrective action to eliminate surface exposure to petroleum related chemicals in the downgradient drainage ditch (Foster Wheeler 1997)
- A 1999 site summary report to present all site data collected to that point including results of the product recovery evaluation (URSG 1999a)
- A 1999 limited soil removal surrounding monitoring well 05-241 to facilitate site closure for USTs T-2039-B and -C by removing 30 cubic yards of petroleum-affected soil in accordance with the OU A ROD (URSG 2000b)
- Annual and monthly progress reports prepared by U.S. Navy contractors tasked with operation and maintenance of the product recovery system
- A 2002 groundwater sampling and analyses investigation to evaluate concentrations of petroleum related chemicals and natural attenuation parameters in groundwater at the site (Foster Wheeler 2002)

Results of these investigations indicated that petroleum-related chemicals were confirmed in samples of soil and groundwater collected from the area between the hangar building and the product interceptor trench. Surface water samples were not collected from within the on-site drainage ditch prior to its discharge to South Sweeper Creek. However, fate and transport modeling was performed to estimate potential contaminant concentrations in the surface water. Free product, although detected historically at the site, has not been detected at Yakutat Hangar since 2000.

Between October 1996 and October 2002, monitoring wells within the vicinity of Yakutat Hangar have been gauged periodically for the presence of free product. During this time period, free product has been detected in 4 of the 14 wells installed on the site. The frequency of free-product detection in these four wells ranged from 0.5 percent to 71 percent. The maximum measured thickness of free-product at the Yakutat Hangar site was 0.5 feet, in well 05-244 on October 27, 1996. Measurable quantities of free-product have not been observed in on-site wells since February 2000. Information on free product monitoring is summarized in Table 4-1 for all sites discussed in this DD including Yakutat Hangar.

A free-product recovery system was installed at the site during January and February 1997. This system consists of an interceptor trench 140 feet long, 16 feet wide, and 6 feet deep. The product-recovery system was operated from February 1997 through November 2000. Extracted groundwater was discharged to the sanitary sewer system. Free product that accumulated in the sumps was recovered in a 1,100-gallon AST on the site. The recovered product was periodically removed from the tank and disposed of by incineration using a portable incinerator.

Approximately 690 gallons of free product were recovered by the system during this period, with 460 of the 690 gallons recovered during the first 11 months of operation. From January through November 2000, the product recovery system recovered approximately 18 gallons of free product. From June through October 2000, the total recovery for the system was less than 1 gallon. Because the 6-month moving average of free product recovered between February and November 2000 at the Yakutat Hangar site was less than 5 gallons per month, free product has been recovered at the site to the maximum extent practicable following the requirements of the OU A ROD and 18 AAC 75.325(f)(1)(B).

The potential extent of soil and groundwater contamination at Yakutat Hangar was estimated in part 2 of the site characterization report (URS 2004a) and is summarized in this DD. This potential extent of contamination is based on a review of analytical results for petroleum-related chemicals in soil samples collected at the site between 1993 and 1999, and in groundwater samples collected at the site between 1996 and 2002. Figures showing these results for GRO, DRO, and BTEX compounds are provided in Appendix B. The total number of samples

collected at Yakutat Hangar including field duplicates, the number of samples used in the risk assessment, the minimum concentration used in the risk assessment, the maximum concentration used in the risk assessment, the location of the maximum concentration used in the risk assessment, the detection frequency, and the range of detection limits is provided in Table 4-9 for all contaminants of potential concern in soil and groundwater. (The contaminants of potential concern were previously identified in Section 3 for Yakutat Hangar.) The estimated potential extent of contamination at Yakutat Hangar is shown on Figure 4-8.

Petroleum-related chemicals were reported in five soil samples collected from five locations at detected concentrations greater than the most stringent Alaska DEC soil screening criteria. These five locations occur between the northwest corner of Yakutat Hangar and the former drainage ditch. DRO is the primary petroleum compound reported at detected concentrations in soil samples collected from these locations that exceed soil screening criteria. In addition, ethylbenzene exceeded the Alaska DEC criteria in one soil sample. Therefore, detected concentrations of DRO and ethylbenzene above the most stringent Alaska DEC soil cleanup criteria were used to determine the potential area of concern in soil.

The on-site area estimated to contain petroleum-related chemicals in soil at concentrations greater than the most stringent Alaska DEC Method Two soil criteria are indicated by the short dashed line on Figure 4-8. This area is estimated to encompass approximately 0.4 acre. The volume of soil containing petroleum-related chemicals at concentrations above the most stringent Alaska DEC Method Two soil criteria was also estimated for the site. The estimated volume is approximately 2,800 cy. The estimate was based on the areal distributions shown on Figure 4-8 and an assumed thickness of contaminated soil of 4 feet, based on a review of boring logs.

The potential extent of petroleum contamination in groundwater was evaluated by comparing analytical results to their respective Alaska DEC groundwater criteria established for groundwater that is not currently used as a drinking water source and is not reasonably expected to be a potential future drinking water source [18 AAC 75.345(b)(2)(A)]. Because monitoring wells at the site have been sampled multiple times, results from the most recent sampling event through 2002 at each monitoring location are compared to groundwater criteria. In no instances did concentrations of petroleum-related chemicals in groundwater exceed Alaska DEC groundwater criteria established for groundwater not currently used as a drinking water source, or not reasonably expected to be used as a future drinking water source.

Surface water samples were not collected from within the on-site drainage ditch prior to its discharge into South Sweeper Creek. Therefore, a contaminant-loading model was used to estimate concentrations of petroleum-related chemicals in surface water within the open drainage ditch prior to discharge into the creek. The loading model was used to estimate concentrations of

DRO, GRO, and total aromatic hydrocarbons (TAH) within the drainage ditch prior to discharge into South Sweeper Creek (TAH concentrations consist of the sum of benzene, toluene, ethylbenzene, and total xylene concentrations). Contaminant loading concentrations were not estimated for total aqueous hydrocarbons because analytical results for polynuclear aromatic hydrocarbons are not available for groundwater samples from each monitoring well adjacent to the drainage ditch. The concentrations of DRO, GRO, and TAH based on this modeling were estimated to be 232 µg/l, 11 µg/l, and 1.7 µg/l, respectively. These estimates were compared to surface water quality criteria established by Alaska DEC regulation 18 AAC 70 for fresh water bodies. These criteria indicate that the predicted concentration of TAH in the drainage ditch prior to discharge into South Sweeper Creek is below the Alaska DEC water quality standard of 10 µg/l. Numeric water quality criteria are not available for DRO or GRO in surface water.

4.9 NORPAC HILL SEEP AREA

No investigations were conducted in the vicinity of the NORPAC Hill Seep Area prior to 1996. Between 1996 and 2001, several environmental field investigations have been performed at or in the vicinity of the site:

- A 1996 summary of known site conditions (EMCON 1996b)
- A 1998 site investigation to evaluate subsurface conditions and investigate potential sources for petroleum released to the environment (URSG 1998a)
- A 1999 site summary report to present all site data collected to that point (URSG 1999a)
- A 1999 limited subsurface investigation to evaluate if abandoned, buried, fuel transfer pipelines are a source of petroleum released to the environment (URSG 1999c)
- A 2001 geophysical investigation to evaluate the potential for saltwater to intrude into groundwater beneath the downtown area on Adak Island (URS 2001)
- A supplemental site assessment was conducted during 2001 to address data gaps.

Results of these investigations indicated that detected concentrations of petroleum-related chemicals were confirmed in samples of soil, groundwater, and sediment collected from several

locations in the vicinity of the site. Free product has been detected at one location at NORPAC Hill during 2001, the last year that monitoring occurred at the site.

Groundwater monitoring wells within the vicinity of the NORPAC Hill Seep area have been periodically gauged for petroleum product. Gauging commenced in individual wells as they were constructed beginning in September 1996 and proceeded until November 2001. Between September 1996 and November 2001 a measurable product thickness was observed in two of the 11 wells installed in the vicinity of the site. The maximum measurable product thickness of 1.67 feet was reported in well 04-146 on April 25, 2000. Information on free product monitoring is summarized in Table 4-1 for all sites discussed in this DD including NORPAC Hill.

A passive recovery bailer was installed in Well 04-146 on March 18, 1998. This bailer was checked monthly for the presence of product through September 1998 and bi-weekly (every 2 weeks) from October 1998 through June 2000. A review of monthly product recovery status reports indicates that this effort recovered approximately 0.5 gallon of product from Well 04-146 during this 27-month period. Product recovery was discontinued at this location from July 2000 through May 2001. A passive recovery bailer was re-installed in Well 04-146 on June 1, 2001 and checked daily until November 14, 2001. Approximately 0.85 gallon of product was recovered from this well during this 5.5-month period. Product recovery was again discontinued on November 15, 2001, because of the small amount of free product recovered.

The potential extent of contamination at NORPAC Hill was estimated in part 2 of the site characterization report (URS 2004a) and is summarized in this DD. This potential extent of contamination is based on a review of analytical results for petroleum-related chemicals in soil, groundwater, surface water, and marine sediment samples collected at the site between 1996 and 2001. Figures showing these results for GRO, DRO, and BTEX compounds in soil and groundwater are provided in Appendix B. The total number of samples collected at NORPAC Hill including field duplicates, the number of samples used in the risk assessment, the minimum concentration used in the risk assessment, the maximum concentration used in the risk assessment, the location of the maximum concentration used in the risk assessment, the detection frequency, and the range of detection limits is provided in Table 4-10 for all contaminants of potential concern. (The contaminants of potential concern were previously identified in Section 3 for NORPAC Hill.) The estimated potential extent of contamination at NORPAC Hill is shown on Figure 4-9.

Petroleum-related chemicals were reported in 21 soil samples collected from 17 locations at detected concentrations greater than their respective Alaska DEC soil criteria. The 17 locations are situated in an area extending from well NS-2 on the west, east to Bayshore Highway. The petroleum compounds that exceed criteria at these locations are DRO, GRO, benzene, and total

xylenes. All exceedances, except one, were collected from locations at depths greater than 30 feet. A soil sample containing DRO at a concentration above the most stringent Alaska DEC Method Two criteria was collected between 4 to 6 feet bgs from location NS-2. Detected concentrations of DRO, GRO, benzene, and total xylenes above their Alaska DEC soil cleanup levels were used to determine the potential extent of petroleum contamination in soil.

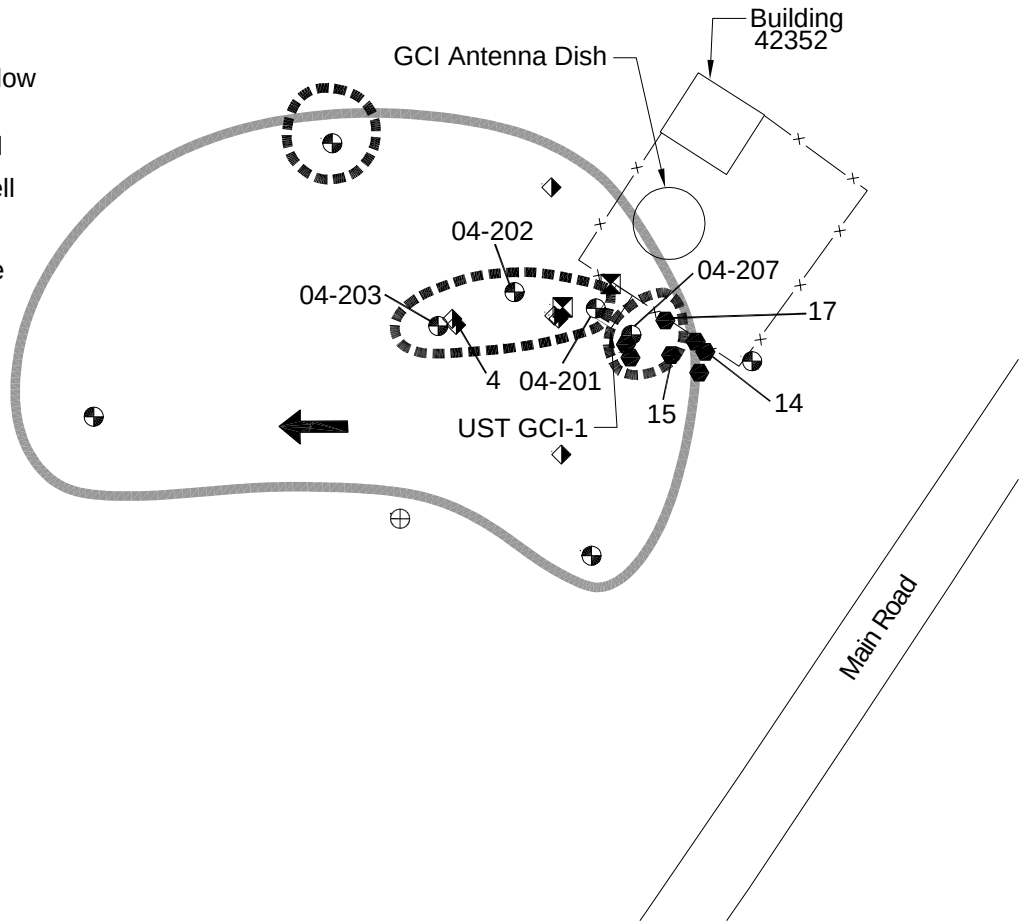
The on-site area estimated to contain petroleum-related chemicals in soil at concentrations greater than the most stringent Alaska DEC Method Two soil criteria is indicated on Figure 4-9. This area is estimated to encompass approximately 4.4 acres. The volume of soil containing petroleum-related chemicals at concentrations above the Alaska DEC soil cleanup levels was also estimated for the site. The volume estimate is calculated based on the areal distribution shown on Figure 4-9 and an assumed thickness of contaminated soil based on a review of boring logs and groundwater elevation data. The potential volume of soil was estimated to be approximately 49,500 cy.

The potential extent of contamination in groundwater was evaluated by comparing analytical results to their respective Alaska DEC groundwater cleanup criteria established for groundwater that is not currently used as a drinking water source and is not considered a potential drinking water source. Because monitoring wells at the site have been sampled multiple times, results from the most recent sampling event through 2002 at each monitoring location are compared to groundwater criteria. During site assessment activities conducted between 1996 and 2001, no petroleum-related chemicals were reported in groundwater samples collected from the site at concentrations greater than their respective groundwater cleanup criteria for groundwater not used as a drinking water source.

The potential extent of petroleum related chemicals in marine sediment and surface water at this site was evaluated based on review of analytical results obtained for two samples of each medium collected during 1998 in Kuluk Bay. These analyses did not detect any petroleum related chemicals in either surface water sample at concentrations above their respective practical quantitation limits (PQLs). Only DRO was reported at a detected concentration of 19 mg/kg in the marine sediment sample collected from location 04-401. No other petroleum related chemicals were reported at concentrations above their respective PQLs in either sediment sample.

LEGEND

- Road
- Fence
- Estimated Potential Extent of Contaminated Soil
  - Depth Range: 2.5-27 ft bgs
  - Areal Extent: 0.2 acre
  - Volume: 1,200 cy
- Estimated Potential Extent of Contaminated Groundwater
  - Areal Extent: ~1 acre
- Groundwater Flow Direction
- Monitoring Well
- Abandoned Well
- Borehole
- Ground Surface
- Geoprobe Well



Notes:

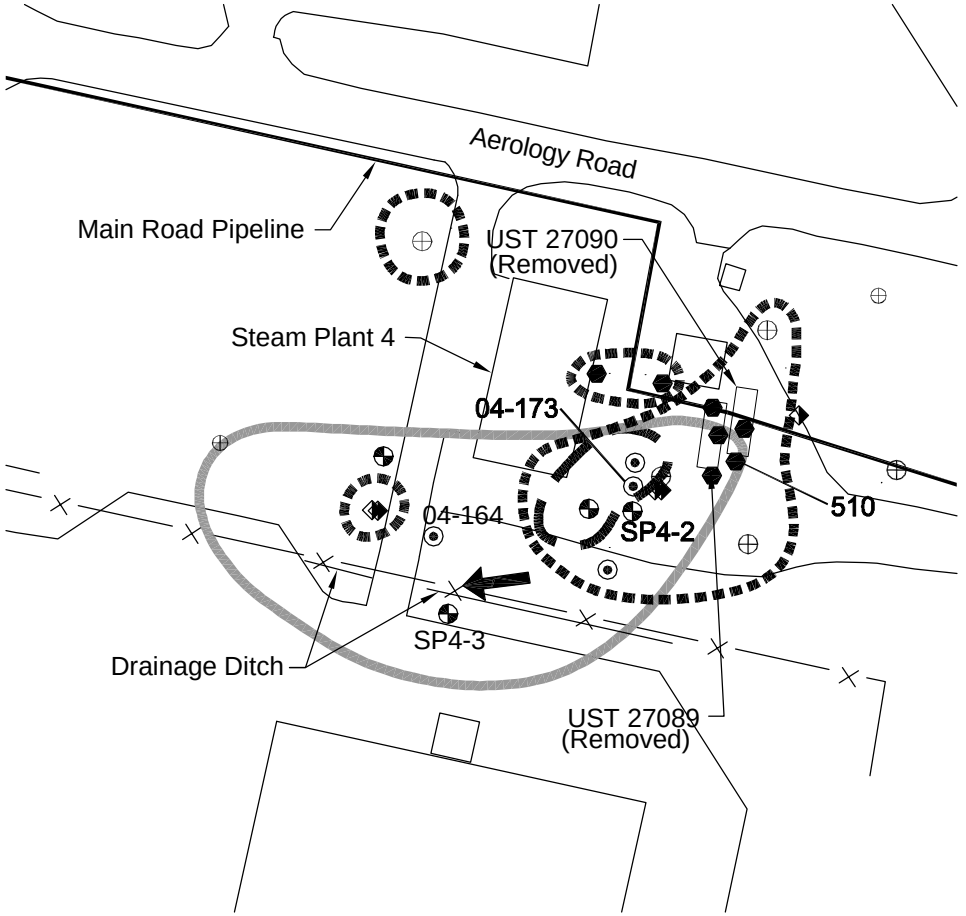
1. Only locations with maximum detected concentrations of one or more contaminants of concern labeled on this figure.
2. The extent of contamination presented on this figure includes data collected through 2002.
3. Extent of contamination in soil is based on Method 2 soil cleanup levels established to prevent migration of contaminants from soil to groundwater in the over 40 inches of rainfall zone as determined by Alaska Regulation 18 AAC 75.341(c)[Tables B1 and B2].
4. Extent of contaminated groundwater is based on groundwater cleanup levels established for groundwater used as a drinking water source as determined by Alaska Regulation 18 AAC 75.345(b)(1)[Table C].

U.S. NAVY	N; 0 20 40 80 SCALE IN FEET	**Figure 4-1** **Estimated Potential Extent of Contaminated Media at GCI Compound**	Delivery Order 0037 Adak Island, AK DECISION DOCUMENT

FILENAME: T:\ADAK\IDIQ\Sub-Tasks\DO 37\DD\FIG 4-1 GCI.dwg
EDIT DATE: 03/18/05 AT: 12:26

LEGEND

- Road
- Fence
- Estimated Potential Extent of Contaminated Soil
  - Depth Range: 2.5-27 ft bgs
  - Areal Extent: 0.4 acre
  - Volume: 7,400 cy
- Estimated Potential Extent of Contaminated Groundwater
  - Areal Extent: 0.7 acre
- Estimated Extent of Free Product
- Groundwater Flow Direction
- Monitoring Well
- Abandoned Well
- Recovery Well
- Borehole
- Ground Surface



Notes:

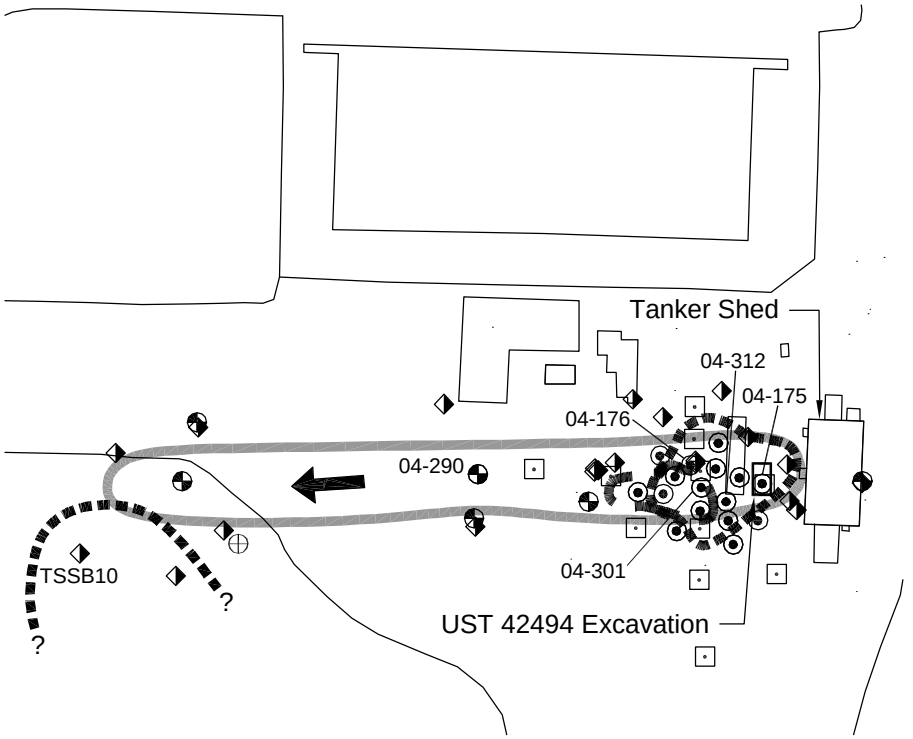
1. Only locations with maximum detected concentrations of one or more contaminants of concern labeled on this figure.
2. The extent of contamination presented on this figure includes data collected through 2002.
3. Extent of contamination in soil is based on Method 2 soil cleanup levels established to prevent migration of contaminants from soil to groundwater in the over 40 inches of rainfall zone as determined by Alaska Regulation 18 AAC 75.341(c)[Tables B1 and B2].
4. Extent of contaminated groundwater is based on groundwater cleanup levels established for groundwater used as a drinking water source as determined by Alaska Regulation 18 AAC 75.345(b)(1)[Table C].

U.S. NAVY	N; 0 50 100 SCALE IN FEET	**Figure 4-2** **Estimated Potential Extent of Contaminated Media at SA 80, Steam Plant No. 4**	Delivery Order 0037 Adak Island, AK DECISION DOCUMENT

FILENAME: T:\ADAK\IDIQ\Sub-Tasks\DO 37\DD\Figure 4-2 SA 80.dwg
EDIT DATE: 03/17/05 AT: 16:25

LEGEND

- Road
- Fence
- Estimated Potential Extent of Contaminated Soil
  - Depth Range: 1-10 ft bgs
  - Areal Extent: 0.4 acre
  - Volume: 3,200 cy
- Estimated Potential Extent of Contaminated Groundwater
  - Areal Extent: 0.7 acre
- Estimated Potential Extent of Free Product
- Groundwater Flow Direction
- Monitoring Well
- Abandoned Well
- Recovery Well
- Borehole
- Geoprobe Boring



Notes:

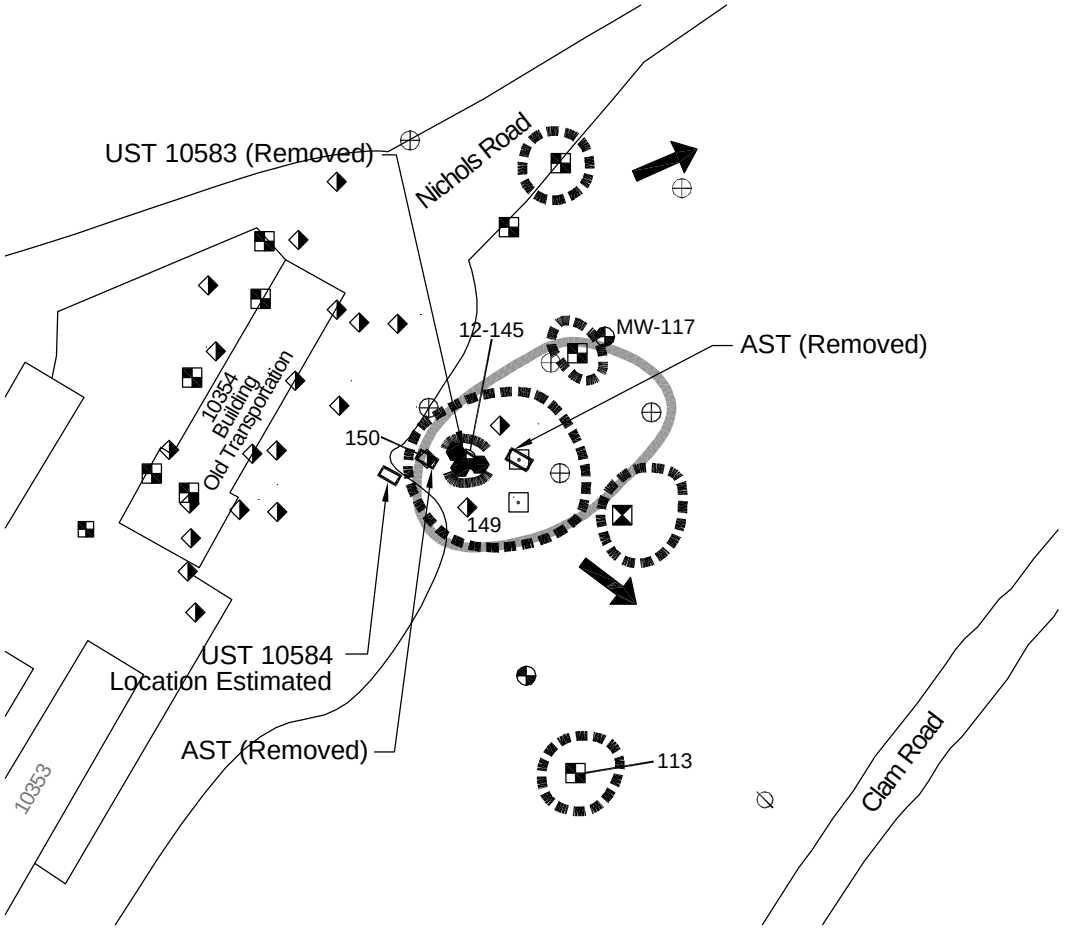
1. Only locations with maximum detected concentrations of one or more contaminants of concern labeled on this figure.
2. The extent of contamination presented on this figure includes data collected through 2002.
3. Extent of contamination in soil is based on Method 2 soil cleanup levels established to prevent migration of contaminants from soil to groundwater in the over 40 inches of rainfall zone as determined by Alaska Regulation 18 AAC 75.341(c)[Tables B1 and B2].
4. Extent of contaminated groundwater is based on groundwater cleanup levels established for groundwater used as a drinking water source as determined by Alaska Regulation 18 AAC 75.345(b)(1)[Table C].

U.S. NAVY	N; 0 75 150; SCALE IN FEET	**Figure 4-3** **Estimated Potential Extent of Contaminated Media at Tanker Shed**	Delivery Order 0037 Adak Island, AK DECISION DOCUMENT

FILENAME: T:\ADAK\IDIQ\Sub-Tasks\DO 37\DD\Figure 4-3 Tanker Shed.dwg
EDIT DATE: 03/17/05 AT: 16:24

LEGEND

- Road
- Fence
- Estimated Potential Extent of Contaminated Soil
  - Depth Range: 0-25 ft bgs
  - Areal Extent: 0.25 acre
  - Volume: 5,400 cy
- Estimated Potential Extent of Contaminated Groundwater
  - Areal Extent: 0.2 acre
- Estimated Potential Extent of Free Product
- Groundwater Flow Direction
- Monitoring Well
- Abandoned Well
- Borehole
- Surface Water
- Ground Surface
- Geoprobe Boring
- Geoprobe Well
- Test Pit



Notes:

1. Only locations with maximum detected concentrations of one or more contaminants of concern labeled on this figure.
2. The extent of contamination presented on this figure includes data collected through 2002.
3. Extent of contamination in soil is based on Method 2 soil cleanup levels established to prevent migration of contaminants from soil to groundwater in the over 40 inches of rainfall zone as determined by Alaska Regulation 18 AAC 75.341(c)[Tables B1 and B2].
4. Extent of contaminated groundwater is based on groundwater cleanup levels established for groundwater that is not used as a drinking water source or is not a reasonably expected potential future drinking water source as determined by Alaska Regulation 18 AAC 75.345(b)(2)[10 times Table C levels].

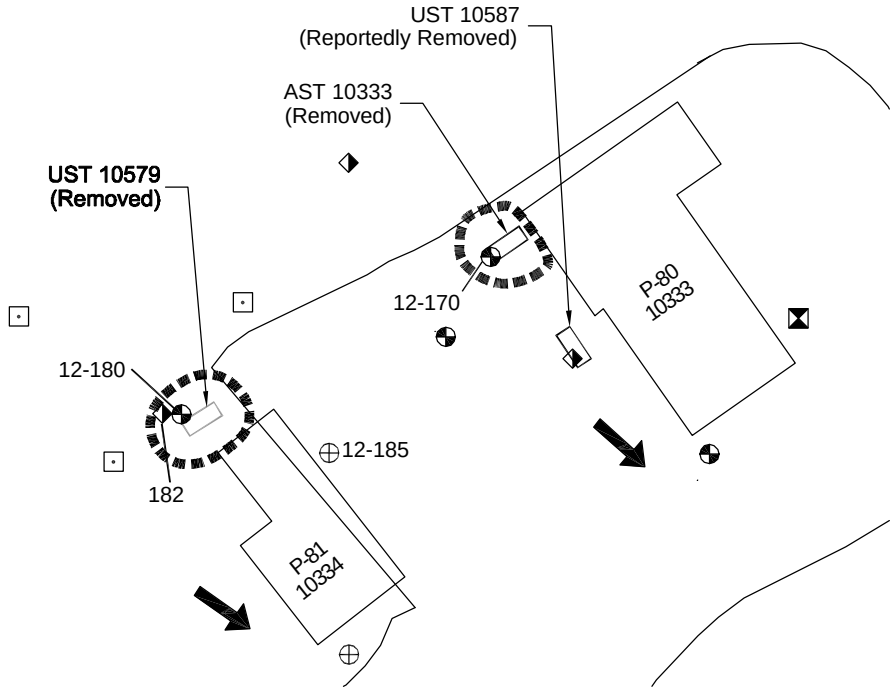
U.S. NAVY	N; 0 50 100 SCALE IN FEET	**Figure 4-4** **Estimated Potential Extent of Contaminated Media at SA 78**	Delivery Order 0037 Adak Island, AK DECISION DOCUMENT

FILENAME: T:\ADAK\IDIQ\Sub-Tasks\DO 37\DD\Figure 4-4 SA 78.dwg
EDIT DATE: 03/17/05 AT: 16:30

LEGEND

- Road
- Fence
- Estimated Potential Extent of Contaminated Soil

  Depth Range: 2.5-12 ft bgs
  Areal Extent: 0.03 acre
  Volume: 400 cy
- Groundwater Flow Direction
- Monitoring Well
- Abandoned Well
- Borehole
- Geoprobe Boring
- Geoprobe Well



Notes:

1. Only locations with maximum detected concentrations of one or more contaminants of concern labeled on this figure.

2. The extent of contamination presented on this figure includes data collected through 2002.

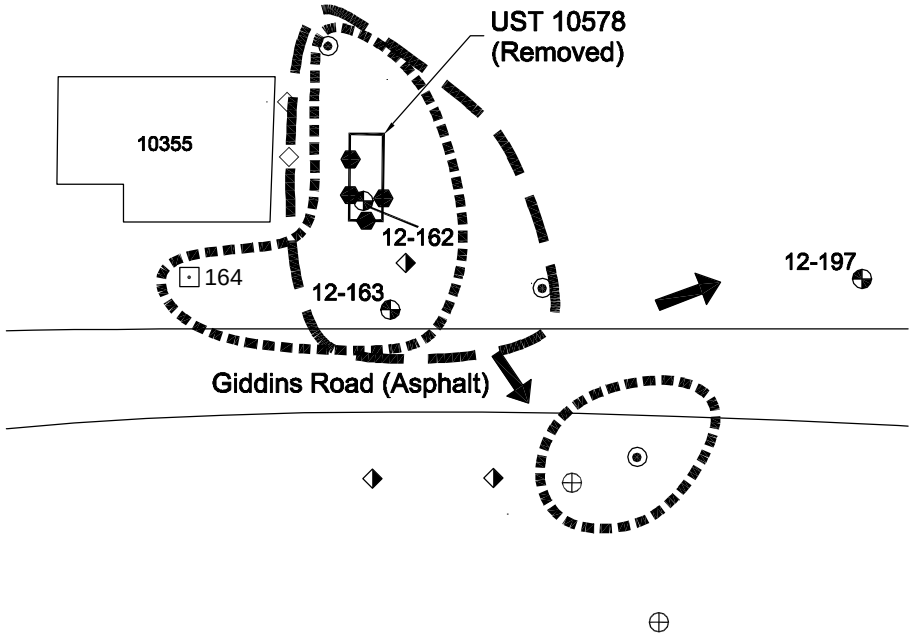
3. Extent of contamination in soil is based on Method 2 soil cleanup levels established to prevent migration of contaminants from soil to groundwater in the over 40 inches of rainfall zone as determined by Alaska Regulation 18 AAC 75.341(c)[Tables B1 and B2].

U.S. NAVY	N; 0 10 20 40 SCALE IN FEET	**Figure 4-5** **Estimated Potential Extent of Contaminated Media at SA 82**	Delivery Order 0037 Adak Island, AK DECISION DOCUMENT

FILENAME: T:\ADAK\IDIQ\Sub-Tasks\DO 37\DD\Figure 4-5 SA 82.dwg
EDIT DATE: 03/17/05 AT: 16:00

LEGEND

- Road
- Fence
- Estimated Potential Extent of Contaminated Soil
  - Depth Range: 9-21 ft bgs
  - Areal Extent: 0.07 acre
  - Volume: 1,300 cy
- Estimated Potential Extent of Free Product
- Groundwater Flow Direction
- Monitoring Well
- Abandoned Well
- Recovery Well
- Hand Auger
- Borehole
- Ground Surface
- Geoprobe Boring



Notes:

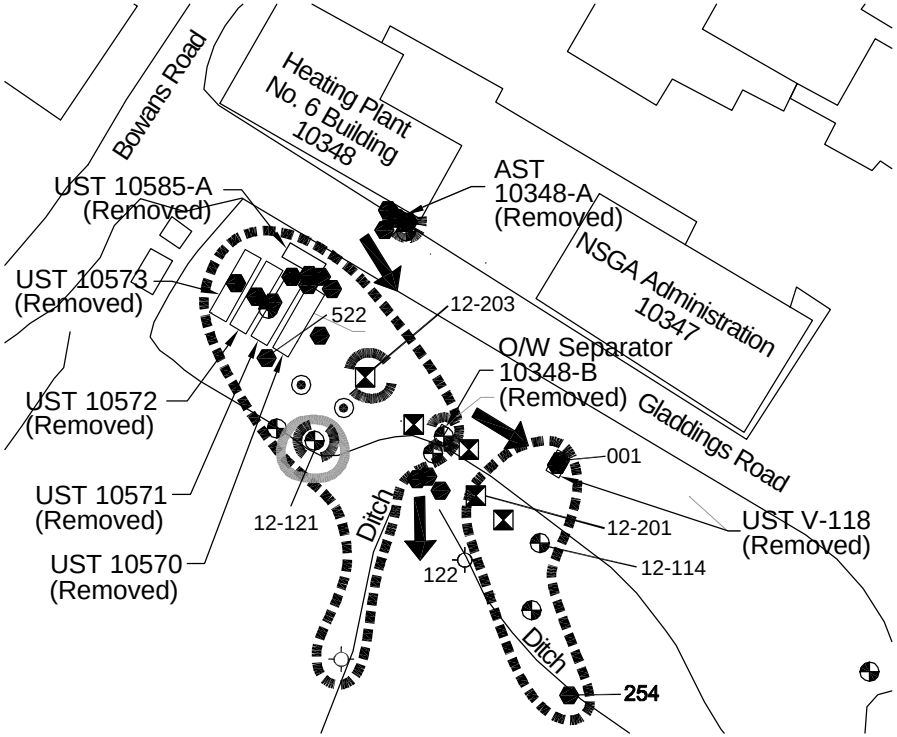
1. Only locations with maximum detected concentrations of one or more contaminants of concern labeled on this figure.
2. The extent of contamination presented on this figure includes data collected through 2002.
3. Extent of contamination in soil is based on Method 2 soil cleanup levels established to prevent migration of contaminants from soil to groundwater in the over 40 inches of rainfall zone as determined by Alaska Regulation 18 AAC 75.341(c)[Tables B1 and B2].

U.S. NAVY	N; 0 10 20 40 SCALE IN FEET	**Figure 4-6** **Estimated Potential Extent of Contaminated Media at SA 88**	Delivery Order 0037 Adak Island, AK DECISION DOCUMENT

FILENAME: T:\ADAK\IDIQ\Sub-Tasks\DO 37\DD\Figure 4-6 SA 88.dwg
EDIT DATE: 03/17/05 AT: 16:01

LEGEND

- Road
- Fence
- Estimated Potential Extent of Contaminated Soil
  - Depth Range: 0-15 ft bgs
  - Areal Extent: 0.5 acre
  - Volume: 3,700 cy
- Estimated Potential Extent of Contaminated Groundwater
  - Areal Extent: 0.02 acre
- Estimated Potential Extent of Free Product
- Groundwater Flow Direction
- Monitoring Well
- Recovery Well
- Surface Water and Ditch Sediment
- Ground Surface
- Geoprobe Well



Notes:

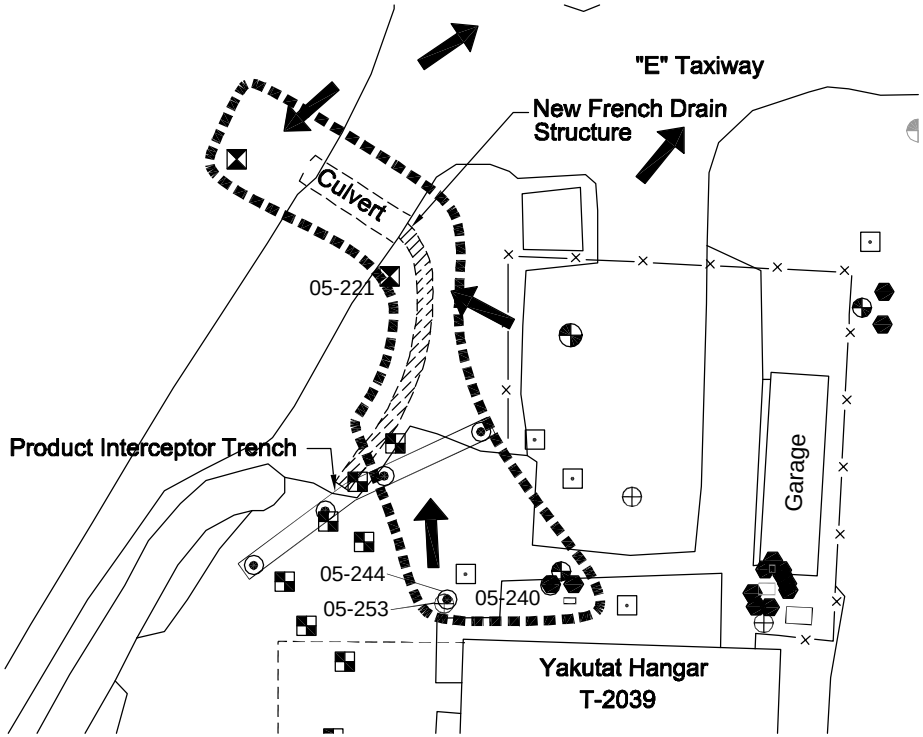
1. Only locations with maximum detected concentrations of one or more contaminants of concern labeled on this figure.
2. The extent of contamination presented on this figure includes data collected through 2002.
3. Extent of contamination in soil is based on Method 2 soil cleanup levels established to prevent migration of contaminants from soil to groundwater in the over 40 inches of rainfall zone as determined by Alaska Regulation 18 AAC 75.341(c)[Tables B1 and B2].
4. Extent of contaminated groundwater is based on groundwater cleanup levels established for groundwater that is not used as a drinking water source or is not a reasonably expected potential future drinking water source as determined by Alaska Regulation 18 AAC 75.345(b)(2)[10 times Table C levels].

U.S. NAVY	N; 0 25 50 100 SCALE IN FEET	**Figure 4-7** **Estimated Potential Extent of Contaminated Media at SWMU 58/SA 73**	Delivery Order 0037 Adak Island, AK DECISION DOCUMENT

FILENAME: T:\ADAK\IDIQ\Sub-Tasks\DO 37\DD\Figure 4-7 SWMU 58-SA 73.dwg
EDIT DATE: 03/17/05 AT: 16:30

LEGEND

- Road
- Fence
- Estimated Potential Extent of Contaminated Soil
  - Depth Range: 0-4 ft bgs
  - Areal Extent: 0.4 acre
  - Volume: 2,800 cy
- Groundwater Flow Direction
- Monitoring Well
- Abandoned Well
- Recovery Well
- Ground Surface
- Geoprobe Boring
- Geoprobe Well
- Test Pit



Notes:

1. Only locations with maximum detected concentrations of one or more contaminants of concern labeled on this figure.

2. The extent of contamination presented on this figure includes data collected through 2002.

3. Extent of contamination in soil is based on Method 2 soil cleanup levels established to prevent migration of contaminants from soil to groundwater in the over 40 inches of rainfall zone as determined by Alaska Regulation 18 AAC 75.341(c)[Tables B1 and B2].

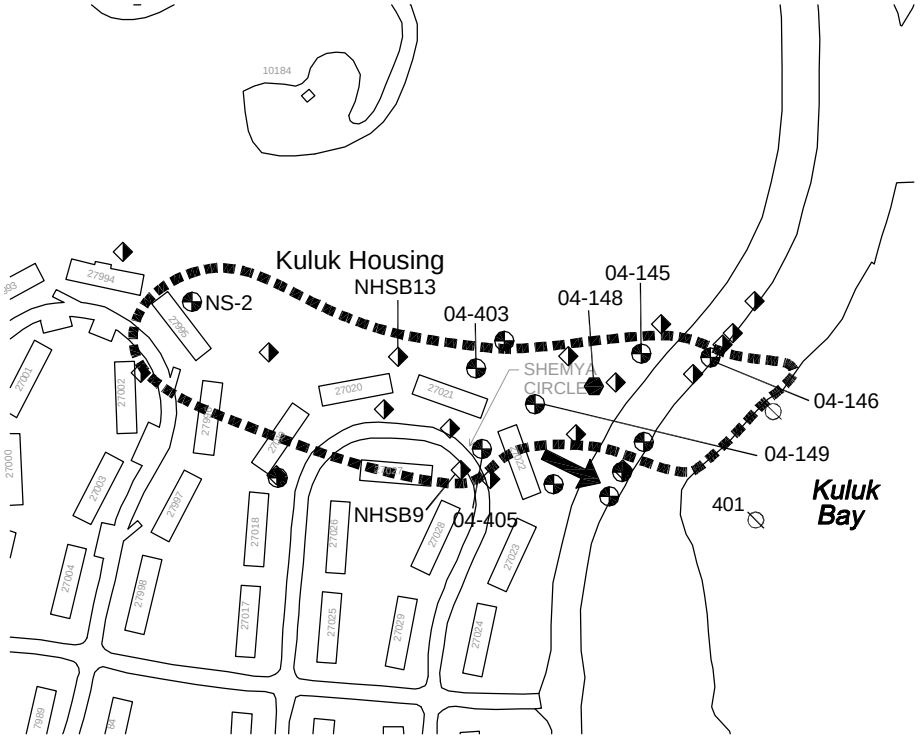
U.S. NAVY	N; 0 25 50 100 SCALE IN FEET	**Figure 4-8** **Estimated Potential Extent of Contaminated Media at Yakutat Hangar**	Delivery Order 0037 Adak Island, AK DECISION DOCUMENT

FILENAME: T:\ADAK\IDIQ\Sub-Tasks\DO 37\DD\Figure 4-8 Yakutat.dwg
EDIT DATE: 03/17/05 AT: 15:53

LEGEND

- Road
- Fence
- Estimated Potential Extent of Contaminated Soil

  Depth Range: 4-47 ft bgs
  Areal Extent: 4.4 acres
  Volume: 49,500 cy
- Groundwater Flow Direction
- Monitoring Well
- Borehole
- Surface Water
- Ground Surface



Notes:

1. Only locations with maximum detected concentrations of one or more contaminants of concern labeled on this figure.

2. The extent of contamination presented on this figure includes data collected through 2002.

3. Extent of contamination in soil is based on Method 2 soil cleanup levels established to prevent migration of contaminants from soil to groundwater in the over 40 inches of rainfall zone as determined by Alaska Regulation 18 AAC 75.341(c)[Tables B1 and B2].

U.S. NAVY

N

0 75 150 300

SCALE IN FEET

Figure 4-9
Estimated Potential Extent of Contaminated Media at NORPAC Hill Seep Area

Delivery Order 0037
Adak Island, AK
DECISION DOCUMENT

FILENAME: T:\ADAK\IDIQ\Sub-Tasks\DO 37\DD\Figure 4-9 NORPAC.dwg
EDIT DATE: 03/18/05 AT: 10:59

Table 4-1
Summary of Free Product Monitoring

Site	Dates Monitored	No. of Wells Monitored	No. of Wells Detected	Maximum Measured Thickness (ft)	Location of Maximum Measured Thickness	Date of Maximum Measured Thickness	Date Free Product Last Observed
GCI Compound	Sept 96 - Aug 02	11	2	1.93	04-201	Nov-96	Nov-97
SA 80	Nov 92 - Oct 02	15	5	3.26	04-173	Aug-97	Aug-02
Tanker Shed[a]	Oct 96 - Nov 01	24	12	1.98	04-176	May-97	Oct-01
SA 78	Nov 96 - Oct 02	7	1	0.2	12-145	Sep-97	Aug-02
SA 82	Oct 96 - Oct 02	8	2	0.4	12-170	Dec-96	Jul-98
SA 88	Oct 96 - Aug 02	10	4	3.10	12-162	Oct-96	Aug-02
SWMU 58/SA 73	Oct 96 - Oct 02	17	7	2.06	12-203	Oct-97	Aug-02
Yakutat Hangar	Oct 96 - Oct 02	14	4	0.5	05-244	Oct-96	Feb-00
NORPAC Hill	Sept 96 - Nov 01	11	2	1.67	04-146	Apr-00	Nov-01

[a]Free product recovery is continuing at this site. This report only includes data collected through 2002.

Table 4-2
Summary of Analytical Results for Contaminants of Potential Concern
GCI Compound, UST GCI-1

Chemical	Total Number of Samples Collected (1)	Number of Samples Used in Risk Assessment (2)(3)(4)	Minimum Concentration (5)	Minimum Qualifier	Maximum Concentration (5)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits
Soil										
Volatile Organic Compounds (VOCs)										
Benzene	52	14	0.06		0.06		mg/kg	4	1/14	0.006 - 0.049
Ethylbenzene	52	14	0.067		3.1		mg/kg	17	4/14	0.006 - 0.033
Total Inorganics										
Arsenic	8	7	1.2	J	2.3	J	mg/kg	17	6/7	1.1
Total Petroleum Hydrocarbons (TPHs)										
Diesel Range Organics	56	14	13		11000	J	mg/kg	15	13/14	11
Gasoline Range Organics	52	14	1.3		570		mg/kg	17	9/14	0.3 - 1.3
Surface Soil										
Inorganics										
Lead	10	9	2	J	751		mg/kg	14	8/9	11.2
Groundwater										
Volatile Organic Compounds (VOCs)										
Benzene	34	19	2.3		360		ug/L	04-201	15/19	1 - 20
Ethylbenzene	34	19	5.4		550		ug/L	04-203	16/19	0.5 - 1
Naphthalene	12	9	0.09	J	36		ug/L	04-201	9/9	--
Toluene	34	19	0.57		460		ug/L	04-203	15/19	1 - 20
Xylenes	34	19	2.6		2500		ug/L	04-203	17/19	1 - 3
Semivolatile Organic Compounds (SVOCs)										
2-Methylnaphthalene (6)	9	7	0.12	J	8.17	J	ug/L	04-202	7/7	--
Total Petroleum Hydrocarbons(TPHs)										
Diesel Range Organics	34	22	150	J	2700		ug/L	04-207	19/22	170 - 260
Gasoline Range Organics	34	22	110		20000		ug/L	04-201	21/22	100

Notes:
(1) Number includes field duplicates.
(2) Number does not include groundwater or soil samples collected at Location 701 (04-701), which is downgradient of the site (see Figures B-1 and B-2).
(3) Number does not include groundwater or soil samples collected at Location 109 (MRP-9), which is upgradient of the site (see Figures B-1 and B-2).
(4) Number does not include soil samples collected at depths greater than 15 feet below ground surface.
(5) Minimum/maximum detected concentration in samples used for the risk assessment.
(6) Evaluated as a volatile in the risk assessment because it meets EPA's definition of a volatile.

Definitions:
-- - Compound has 100% detection frequency
J - estimated value
mg/kg - milligrams per kilograms
ug/L - micrograms per liter
UST - underground storage tank

Table 4-3
Summary of Analytical Results for Contaminants of Potential Concern
SA 80, Steam Plant No. 4, USTs 27089 and 27090

Chemical	Total Number of Samples Collected (1)	Number of Samples Used in Risk Assessment (2)(3)(4)	Minimum Concentration (5)	Minimum Qualifier	Maximum Concentration (5)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Limits
Soil										
Total Petroleum Hydrocarbons (TPHs)										
Diesel-Range Organics	60	37	6.4		15000		mg/kg	510	24/37	4.5 - 100
Groundwater										
Volatile Organic Compounds (VOCs)										
Benzene	36	24	0.38	J	9.5		ug/L	SP4-3	10/24	0.2 - 1
Ethylbenzene	36	24	1.4	J	49		ug/L	04-164	16/24	0.2 - 1
Naphthalene	15	14	0.12		310	J	ug/L	SP4-3	12/14	0.02
Xylenes	36	24	1.3		261		ug/L	SP4-3	18/24	0.4 - 1
Semivolatile Organic Compounds (SVOCs)										
2-Methylnaphthalene (6)	15	14	0.16		290		ug/L	SP4-2	11/14	0.02
Benzo(a)anthracene	15	14	0.12		0.12		ug/L	SP4-2	1/14	0.02
Benzo(a)pyrene	15	14	0.04		0.04		ug/L	SP4-2	1/14	0.02
Dibenz(a,h)anthracene	15	14	0.02		0.02		ug/L	04-164	1/14	0.02
Total Petroleum Hydrocarbons (TPHs)										
Diesel-Range Organics	35	27	320		110000	J	ug/L	SP4-2	23/27	50 - 250
Gasoline-Range Organics	36	27	110		1200		ug/L	SP4-2	19/27	5 - 100

Notes:

(1) Number includes field duplicates.
(2) Number does not include groundwater or soil samples collected at Location 801 (04-801), which is downgradient of the site (see Figures B-3 and B-4).
(3) Number does not include soil samples collected at depths greater than 17 feet below ground surface.
(4) Number does not include groundwater samples analyzed using VPH or AK-102-AA.
(5) Minimum/maximum detected concentration in samples used for the risk assessment.
(6) Evaluated as a volatile in the risk assessment because it meets EPA's definition of a volatile.

Definitions:
J - estimated value
mg/kg - milligrams per kilograms
ug/L - micrograms per liter
SA - source area
UST - underground storage tank

Table 4-4
Summary of Analytical Results for Contaminants of Potential Concern
Tanker Shed, UST 42494

Chemical	Total Number of Samples Collected (1)	Number of Samples Used in Risk Assessment (1)(2)	Minimum Concentration (4)	Minimum Qualifier	Maximum Concentration (4)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits
Soil										
Volatile Organic Compounds (VOCs)										
Benzene	80	71	0.063	J	2.9		mg/kg	04-301	9/71	0.0054-0.57
Ethylbenzene	80	71	0.029		50		mg/kg	04-312	16/71	0.0054-0.308
Toluene	80	71	0.028	J	81		mg/kg	04-312	14/71	0.0054-0.308
Xylenes	80	71	0.0858		250		mg/kg	04-312	21/71	0.026-0.125
Total Petroleum Hydrocarbons (TPHs)										
Diesel-Range Organics	85	77	4.85		23,300		mg/kg	TSSB10	43/77	4-11
Gasoline-Range Organics	87	79	3.5		1,000		mg/kg	04-312	19/79	0.3-6.27
Groundwater										
Volatile Organic Compounds (VOCs)										
1,2,4-Trimethylbenzene	9	2	49.1		73.1		ug/L	04-175	2/2	--
1,3,5-Trimethylbenzene	9	2	14.7		18.3		ug/L	04-175	2/2	--
Benzene	47	34	1.03		250		ug/L	04-176	24/34	0.2-1
Ethylbenzene	47	34	0.589		142		ug/L	04-290	23/34	0.5-5.3
Naphthalene	22	16	0.83	J	180	J	ug/L	04-176	14/16	2
Toluene	47	34	0.3		920		ug/L	04-176	19/34	0.3-1
Xylenes	37	30	3.1		670		ug/L	04-176	22/30	0.2-1
Semivolatile Organic Compounds (SVOCs)										
2-Methylnaphthalene (5)	12	11	0.05	J	100		ug/L	04-175	11-Aug	2
Total Petroleum Hydrocarbon (TPH)										
Diesel-Range Organics	40	33	137	B	16,900		ug/L	04-175	29/33	100-250
Gasoline-Range Organics	40	36	26		4,400		ug/L	04-176	22/36	50-100

Notes:
(1) Number includes field duplicates
(2) Number does not include soil samples collected at depths greater than 15 feet below ground surface.
(3) Number does not include groundwater samples analyzed using VPH or AK-102-AA.
(4) Minimum/maximum detected concentration in samples used for risk assessment.
(5) Evaluated as a volatile in the risk assessment because it meets EPA's definition of a volatile.

Definitions:
-- - compound has 100% detection frequency
J - estimated value
mg/kg - milligram per kilogram
ug/L - micrograms per liter
UST - underground storage tank

Table 4-5
Summary of Analytical Results for Contaminants of Potential Concern
SA 78, Old Transportation Building

Chemical	Total Number of Samples Collected (1)	Number of Samples Used in Risk Assessment (2)(3)	Minimum Concentration (4)	Minimum Qualifier	Maximum Concentration (4)	Maximum Qualifier	Unit	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits
Soil										
Volatile Organic Compounds (VOCs)										
Benzene	61	52	0.39		12	J	mg/kg	150	3/52	0.003-0.052
Ethylbenzene	61	52	0.001	J	70	J	mg/kg	150	6/52	0.005-0.052
Toluene	61	52	0.004		220	J	mg/kg	150	4/52	0.005-0.052
Xylenes	61	52	0.076		660		mg/kg	150	8/52	0.011-0.08
Total Petroleum Hydrocarbons (TPHs)										
Diesel-Range Organics	25	18	6.2	J	79,000		mg/kg	149	12/18	5.4-15
Gasoline-Range Organics	37	28	5.4		2,300	J	mg/kg	150	7/28	0.3-13
Inorganics										
Arsenic (5)	9	0	0.96	J	7.3		mg/kg	113	9/9	--
Cadmium (5)	9	0	0.04	J	8.2		mg/kg	113	8/9	0.04
Lead (5)	9	0	1.5		1240		mg/kg	113	9/9	--
Groundwater										
Volatile Organic Compounds (VOCs)										
Benzene	37	31	5		2,800	J	ug/l	12-145	12/31	0.2-10
Ethylbenzene	37	31	1		1,100	J	ug/l	12-145	11/31	0.2-10
Methylene Chloride (5)	5	0	100		100		ug/l	MW-117	1/5	10-21
Naphthalene	10	8	7		150		ug/l	12-145	3/8	0.02-10
Toluene	37	31	0.4		2,100	J	ug/l	12-145	12/31	0.3-10
Xylenes	37	37	0.2		3,800	J	ug/l	12-145	11/37	0.2-10
Semivolatile Organic Compounds (SVOCs)										
2-Methylnaphthalene (6)	10	8	0.02		71		ug/l	12-145	4/8	2-10
Total Petroleum Hydrocarbons (TPHs)										
Diesel-Range Organics	30	19	77	J	8,800		ug/l	12-145	12/19	160-500
Gasoline-Range Organics	34	29	6.8	J	16,000	J	ug/l	12-145	14/29	20-100

Table 4-5 (Continued)
Summary of Analytical Results for Contaminants of Potential Concern
SA 78, Old Transportation Building

Notes:

(1) Number includes field duplicates.

(2) Number does not include soil samples collected at depths greater than 15 feet.

(3) Number does not include groundwater samples analyzed using AK-102-AA.

(4) Minimum/maximum detected concentration in samples used for risk assessment except as noted in note (5).

(5) Chemical not evaluated in risk assessment. Statistical information provided based on the total samples collected and not the number of samples used in the risk assessment.

(6) Evaluated as a volatile in the risk assessment because it meets EPA's definition of a volatile.

Definitions:

-- compound has 100% detection frequency
J - estimated value
mg/kg - milligrams per kilogran
ug/L - micrograms per liter
SA - source area

Table 4-6
Summary of Analytical Results for Contaminants of Potential Concern
SA 82, P-80/P-81 Buildings

Chemical	Total Number of Samples Collected (1)	Number of Samples Used in Risk Assessment (2)(3)(4)	Minimum Concentration (5)	Minimum Qualifier	Maximum Concentration (5)	Maximum Qualifier	Unit	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits
Soil										
Semivolatile Organic Compounds (SVOCs)										
2-Methylnaphthalene (6)	3	3	2.9		30		mg/kg	182	3/3	--
Total Petroleum Hydrocarbons (TPHs)										
Diesel-Range Organics	24	18	7.3		25,000		mg/kg	182	10/18	4.9 - 9
Groundwater										
Volatile Organic Compounds (VOCs)										
Ethylbenzene	15	15	3		13		ug/l	12-170	3/15	0.2 - 2
Naphthalene	7	7	0.16		23		ug/l	12-170	4/7	2 - 2.06
Semivolatile Organic Compounds (SVOCs)										
2-Methylnaphthalene (6)	7	7	0.18		26		ug/l	12-170	4/7	2 - 2.06
Total Petroleum Hydrocarbons (TPHs)										
Diesel-Range Organics	18	15	110	J	4,000		ug/l	12-185	9/15	160 - 270

Notes:
(1) Number includes field duplicates.
(2) Number does not include soil samples collected at depths greater than 15 feet.
(3) Number does not include soil samples collected at locations 174, 181, and 183, which are upgradient of the site (see Figure B-8).
(4) Number does not include groundwater samples analyzed using AK-102-AA.
(5) Minimum/maximum detected concentration in samples used for risk assessment.
(6) Evaluated as a volatile in the risk assessment because it meets EPA's definition of a volatile.

Definitions:
-- compound has 100% detection frequency
J - estimated value
mg/kg - milligrams per kilogram
ug/L - micrograms per liter
SA - source area

Table 4-7
Summary of Analytical Results for Contaminants of Potential Concern
SA 88, P-70 Energy Generator (UST 10578)

Chemical	Total Number of Samples Collected (1)	Number of Samples Used in Risk Assessment (2)(3)	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Unit	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits
Soil										
Total Petroleum Hydrocarbons (TPHs)										
Diesel-Range Organics	31	16	6.7	J	7,100	J	mg/kg	164	12/16	6.7 - 19
Groundwater										
Volatile Organic Compounds (VOCs)										
Ethylbenzene	20	18	1		27		ug/l	12-163	6/18	0.2 - 2
Naphthalene	9	8	0.76	J	33.1	J	ug/l	12-162	7/8	2
Semivolatile Organic Compounds (SVOCs)										
2-Methylnaphthalene (5)	9	8	1.9	J	23.9	J	ug/l	12-197	7/8	2
Total Petroleum Hydrocarbons (TPHs)										
Diesel-Range Organics	20	16	180		12,000		ug/l	12-162	13/16	50 - 160

Notes:
(1) Number includes field duplicates.
(2) Number does not include soil samples collected at depths greater than 15 feet.
(3) Number does not include groundwater samples analyzed using AK-102-AA.
(4) Minimum/maximum detected concentration in samples used for risk assessment.
(5) Evaluated as a volatile in the risk assessment because it meets EPA's definition of a volatile.

J - estimated value
mg/kg - milligrams per kilogram
ug/L - micrograms per liter
SA - source area
UST - underground storage tank

Table 4-8
Summary of Analytical Results for Contaminants of Potential Concern
SWMU 58 and SA 73, Heating Plant No. 6

Chemical	Total Number of Samples Collected (1)	Number of Samples Used in Risk Assessment (2)(3)(5)	Minimum Concentration (6)	Minimum Qualifier	Maximum Concentration (6)	Maximum Qualifier	Unit	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits
Soil										
Volatile Organic Compounds (VOCs)										
Benzene	47	41	0.4	J	0.4	J	mg/kg	001	1/41	0.017 - 1.3
Ethylbenzene	47	41	0.049		9.1	J	mg/kg	001	18/41	0.019 - 1.3
Naphthalene	10	6	3		31		mg/kg	522	2/6	0.2 - 2.1
Semivolatile Organic Compounds (SVOCs)										
Benzo(a)anthracene	10	6	0.55	J	2.9	J	mg/kg	522	3/6	0.2 - 0.2
Benzo(a)pyrene	10	6	0.39	J	2.2	J	mg/kg	522	3/6	0.2 - 0.2
Benzo(b)fluoranthene	10	6	0.6		4.3	J	mg/kg	522	3/6	0.2 - 0.2
Total Petroleum Hydrocarbons (TPHs)										
Diesel-Range Organics	58	50	6.9		35,000		mg/kg	522	45/50	4 - 13
Gasoline-Range Organics	47	41	5		740		mg/kg	522	22/41	0.75 - 7.6
Residual-Range Organics	13	9	150	J	2,500		mg/kg	522	8/9	25
Groundwater										
Volatile Organic Compounds (VOCs)										
Benzene (4)	44	43	0.53	J	39		ug/l	12-114	15/43	0.2 - 100
Ethylbenzene (4)	44	43	1.8		580		ug/l	12-201	25/43	0.2 - 10
Naphthalene (4)	16	16	0.06	J	119	J	ug/l	12-201	13/16	0.02 - 2.08
Xylenes (4)	44	51	1.6		3,300		ug/l	12-201	25/51	0.2 - 20
Semivolatile Organic Compounds (SVOCs)										
2-Methylnaphthalene (4,7)	16	16	0.02		65	J	ug/l	12-201	14/16	2.04 - 2.08
Total Petroleum Hydrocarbons (TPHs)										
Diesel-Range Organics (4)	47	38	100	J	19,000		ug/l	12-121	36/38	160 - 200
Gasoline-Range Organics (4)	47	46	6.3	J	11,000		ug/l	12-201	24/46	5 - 100

Table 4-8 (Continued)
Summary of Analytical Results for Contaminants of Potential Concern
SWMU 58 and SA 73, Heating Plant No. 6

Chemical	Total Number of Samples Collected (1)	Number of Samples Used in Risk Assessment (2)(3)(5)	Minimum Concentration (6)	Minimum Qualifier	Maximum Concentration (6)	Maximum Qualifier	Unit	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits
Surface Water										
Total Petroleum Hydrocarbons (TPHs)										
Diesel-Range Organics	2	1	3,000		3,000		ug/l	122	1/1	--
Gasoline-Range Organics	2	1	300	J	300	J	ug/l	122	1/1	--
Freshwater Sediment										
Volatile Organic Compounds (VOCs)										
Xylenes	1	1	4.4		4.4		mg/kg	254	1/1	--
Total Petroleum Hydrocarbons (TPHs)										
Diesel-Range Organics	3	2	13		320		mg/kg	254	1/2	--
Gasoline-Range Organics	1	1	43		43		mg/kg	254	1/1	--

Notes:

(1) Number includes field duplicates.

(2) Number does not include location 123 for soil, surface water, or sediment because soil/sediment from this location has been removed and surface water data included for groundwater (see Figures B-12 and B-13).

(3) Number does not include soil samples collected at depths greater than 15 feet.

(4) Number includes locations 122 and 123 for groundwater, even though these were surface water sample locations (see Figure B-13).

(5) Number does not include groundwater samples analyzed using AK-102-AA.

(6) Minimum/maximum detected concentration in samples used for risk assessment.

(7) Evaluated as a volatile in the risk assessment because it meets EPA's definition of a volatile.

Definitions:

-- compound has 100% detection frequency

J - estimated value

mg/kg - milligrams per kilogram

ug/L - micrograms per liter

SA - source area

Table 4-9
Summary of Analytical Results for Contaminants of Potential Concern
Yakutat Hangar

Chemical	Total Number of Samples Collected (1)(2)	Number of Samples Used in Risk Assessment (2)(3)(4)	Minimum Concentration (5)	Minimum Qualifier	Maximum Concentration (5)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits
Soil										
Volatile Organic Compounds (VOCs)										
Ethylbenzene	17	11	0.036		5.3	J	mg/kg	05-244	4/11	0.01 - 0.031
Total Petroleum Hydrocarbons (TPH)										
Diesel-Range Organics	17	11	6.5		11000	J	mg/kg	05-221	10/11	5
Pesticides and Aroclors										
Aroclor 1260	9	8	0.007		0.7		mg/kg	05-240	3/8	0.1
Groundwater										
Volatile Organic Compounds (VOCs)										
Benzene	25	10	1.2		6.1		ug/L	05-253	4/10	0.2 - 1
Ethylbenzene	25	10	1.6		26		ug/L	05-253	5/10	0.2 - 1
Naphthalene	8	7	0.1		13		ug/L	05-253	5/7	0.02 - 2.11
Semivolatile Organic Compounds (SVOCs)										
2-Methylnaphthalene (6)	8	7	0.06	J	11		ug/L	05-253	4/7	0.02 - 2.11
Total Petroleum Hydrocarbons (TPH)										
Diesel-Range Organics	28	14	100		4300		ug/L	05-240	9/14	50 - 200

Notes:
(1) Number includes field duplicates.
(2) Number only includes samples associated with UST T-2039-A.
(3) Number does not include groundwater samples collected at 05-389 or 05-801, which are downgradient of the site (see Figure B-15).
(4) Number does not include groundwater samples analyzed by Method VPH or AK-102-AA.
(5) Minimum/maximum detected concentration in samples used for risk assessment.
(6) Evaluated as a volatile in the risk assessment because it meets EPA's definition of a volatile.

Definitions:
J - estimated value
mg/kg - milligrams per kilogram
ug/L - micrograms per liter

Table 4-10
Summary of Analytical Results for Contaminants of Potential Concern
NORPAC Hill Seep Area

Chemical	Total Number of Samples Collected (1)	Number of Samples Used in Risk Assessment (2)	Minimum Concentration (3)	Data Qualifier	Maximum Concentration (3)	Data Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits
Soil										
Volatile Organic Compounds (VOCs)										
Benzene	68	26	0.0338		0.0338		mg/kg	NHSB9	1/26	0.01 - 0.05
Xylenes	68	26	0.045		0.788		mg/kg	NS-2	6/26	0.03-0.148
Total Petroleum Hydrocarbons (TPH)										
Diesel-range organics	65	23	4.52		16,000		mg/kg	04-405	14/23	4-10
Gasoline-range organics	68	26	5.15		45.9	J	mg/kg	NHSB13	5/26	0.3-7.39
Surface Soil										
Volatile Organic Compounds (VOCs)										
Toluene	5	1	0.04		0.04		mg/kg	04-148	1/1	--
Xylenes	5	1	0.045		0.045		mg/kg	04-148	1/1	--
Total Petroleum Hydrocarbons (TPH)										
Diesel-range organics	5	1	80		80		mg/kg	04-148	1/1	--
Residual-range organics	5	1	1,400		1,400		mg/kg	04-148	1/1	--
Groundwater										
Volatile Organic Compounds (VOCs)										
Naphthalene	11	12	1.6		2		ug/L	04-149	3/12	0.02-1
Semivolatile Organic Compounds (SVOCs)										
2-Methylnaphthalene (4)	9	8	6.3		6.3		ug/L	04-403	1/8	0.02-2
Total Petroleum Hydrocarbons (TPH)										
Diesel-range organics	24	23	168	J	11900	J	ug/L	04-145	22/23	100
Marine Sediment										
Total Petroleum Hydrocarbons (TPH)										
Diesel-range organics	3	2	19		19		mg/kg	401	1/2	10

Table 4-10 (Continued)
Summary of Analytical Results for Contaminants of Potential Concern
NORPAC Hill Seep Area

Notes:
(1) Number includes field duplicates.
(2) Number does not include soil samples collected at depths greater than 34 feet. Soil samples collected at depths less than 34 feet were used for selection of COPCs.
(3) Minimum/maximum detected concentration in samples used for risk assessment.
(4) Evaluated as a volatile in the risk assessment because it meets EPA's definition of a volatile.

Definitions:
J - estimated value
mg/kg - milligrams per kilogram
ug/L - micrograms per liter

5.0 SUMMARY OF RISK ASSESSMENT

Nine human health and ecological risk assessments were conducted to determine if residual petroleum at the 10 free-product petroleum sites would pose an unacceptable risk to human health or the environment if no cleanup actions were to take place. Note that a single risk assessment was performed for the combined SWMU 58 and SA 73 sites. Contaminant concentrations reported in Section 4 were used to calculate risks at the 10 sites. Sites pose no unacceptable risk if the cumulative risk is less than or equal to the target health goals established by Alaska DEC. The target health goals established for free-product petroleum sites at the former Adak Naval Complex are the following:

- Human health cancer risk (CR) of 1×10^{-5}
- Human health hazard index (HI) of 1 based on non-TPH compounds
- Human health HI of 1 based on TPH
- Ecological HI of 1

5.1 HUMAN HEALTH

Risks and hazards from exposure to petroleum compounds in soil, sediment, surface water, and groundwater were estimated for each complete, significant exposure pathway. Exposure pathways were determined to be complete and significant based on the site-specific human health conceptual site model (CSM). CSMs for each of the sites are included in part 2 of the site characterization report (URS 2004a). CSM cross-sections are provided in Section 3 of part 2 of the site characterization report, and human health CSMs are provided in Section 4. For human health, risks and hazards were estimated based on current land use patterns (presented on Table 2-4) and groundwater not being used as drinking water because institutional controls prohibiting the use of groundwater are in place. The complete exposure pathways for human health and the types of human populations evaluated in the risk assessments (e.g., worker populations with only healthy adults versus residential populations that include children and the elderly) are presented on Table 5-1.

Cumulative human health risks and hazards estimated for each of the free-product petroleum sites are also summarized in Table 5-1. In accordance with Alaska DEC guidance (ADEC 2000), cumulative human health hazards are reported separately for the TPH compounds (i.e., DRO and GRO) and the non-TPH compounds. There were no risks or hazards above target

health goals at any of these sites; therefore, existing petroleum-related chemicals pose no risks provided that institutional controls prohibiting the use of groundwater as a drinking water source remain in effect. Site-specific risk assessments prepared for each of these sites are included as part 2 of the site characterization report (URS 2004a).

An addendum to the Tanker Shed risk assessment was prepared based on new information regarding site development plans (URS 2004c). The original risk assessment had not included soil samples collected from beneath the concrete apron because the concrete apron was assumed to remain in place. Alaska DOT has indicated that redevelopment plans include removal of the concrete apron. Therefore, the risk assessment was updated to include soil samples collected beneath the concrete apron. The results from the addendum are reported in this DD. The conclusions of the risk assessment were not impacted by the change in assumptions.

5.1.1 Human Health Risk Assessment Procedures

A baseline risk assessment typically consists of four major steps: (1) data evaluation, (2) exposure assessment, including development of a conceptual site model, (3) toxicity assessment, and (4) risk characterization and calculation of cleanup levels. A final step is a qualitative analysis of the major uncertainties involved in risk assessment calculations. At step one, the data applicable to human health exposures are selected and compared to de minimis health-based screening levels. Chemicals with concentrations greater than the de minimis levels are selected as "chemicals of potential concern" for evaluation in the risk assessment. At the end of the risk assessment, if any chemicals have health risks in excess of the target health goals, the chemicals become "chemicals of concern (COCs)" and site-specific alternative cleanup levels may be calculated for the COCs. At the sites addressed in this decision document, no health risks exceeded target health goals; thus, there are no COCs and alternative cleanup levels were not calculated. Details of the exposure factors and toxicity criteria used to calculate the health risks presented on Table 5-1 are summarized below.

Exposure Factors

Table 5-1 shows the cumulative health risks for the complete pathways for each of the nine sites. These health risks were estimated by assuming that construction workers (evaluated at all nine sites) would be exposed to chemicals in soil and groundwater by the following exposure routes:

- Incidental ingestion, inhalation, and dermal exposure to chemicals in subsurface soil (note impacted surface soil was not present at any of these sites)

- Inhalation (volatile compounds only) and dermal exposure (semi-volatile compounds only) to chemicals in groundwater

The exposure factors used in the risk calculations for construction worker exposures to soil and groundwater are presented on Tables 5-2 and 5-3, respectively.

At four industrial sites (SA 80, Tanker Shed, SA 82, and Yakutat Hangar) and one residential site (NORPAC Hill), volatile compounds were detected in groundwater beneath buildings, potentially resulting in vapors moving from groundwater into indoor air. At these sites the inhalation of vapors in indoor air was also quantitatively evaluated. The exposure factors used in the risk calculations for indoor residents and indoor workers are presented on Tables 5-4 and 5-5, respectively.

Toxicity Criteria

Chemical toxicity in risk assessment is evaluated by an assessment of the relationship between the dose of a chemical and the occurrence of toxic effects. Toxicity criteria for chemicals, which are based on this relationship, consider both noncarcinogenic and carcinogenic effects. Toxicity criteria are numerical expressions of the chronic or subchronic toxicity of the individual chemical. Subchronic criteria were used to evaluate construction worker exposures because the duration of exposure for this population is less than one year. While the source of chemicals at all nine sites was petroleum, slightly different groups of chemicals were evaluated at each site, depending on the site-specific data. A total of 15 different chemicals were evaluated, from three to 10 chemicals per site, depending on the site-specific conditions. Six chemicals were evaluated for carcinogenic effects, and nine additional chemicals were evaluated for noncarcinogenic effects. Some of the carcinogenic chemicals were also evaluated for non-cancer health endpoints. Tables 5-6 and 5-7 present the cancer and non-cancer criteria, respectively. The toxicity criteria are combined with the exposure factors when quantifying potential health risks for each chemical.

5.1.2 Uncertainties in Human Health Risk Assessment

Estimating and evaluating health risk from exposure to environmental chemicals is a complex process with inherent uncertainties. Uncertainty reflects limitations in knowledge, and simplifying assumptions that must be made in order to quantify health risks. The major areas of uncertainty in risk assessment are uncertainties relating to (1) the data and selection of chemicals of potential concern, (2) the assumptions about exposure, (3) the assumptions about toxicity, and (4) the characterization of health risks. Because the exact amount of uncertainty cannot be quantified, the risk assessment process is intended to overestimate rather than underestimate probable risk in order that public health is protected. Therefore, on balance, the results of risk assessment are likely to be protective of health (overestimate risks) despite the inherent uncertainties in the process.

Some major uncertainties common to most of the nine sites are listed below. Detailed uncertainty discussions for each individual site can be found in part 2 of the site characterization report.

- In general, soil data for the majority of sites were old (1997 or earlier) and limited in extent. However, because petroleum in soil is biodegradable, current concentrations of chemicals in soil would be less than those used in the risk assessments. Consequently, current risks would be lower than those presented on Table 5-1.

- Hazards for the TPH compounds (DRO, GRO, and RRO) are likely overestimated because exposure concentrations for the petroleum fractions were calculated using Alaska DEC's default percent compositions for the different fuel fractions. Alaska DEC default percent compositions add up to more than 100 percent to account for uncertainties in the assessment of health effects from petroleum compounds. The result of using these defaults is that TPH hazards are calculated assuming TPH concentrations are 20 percent higher than actual site concentrations, as per Alaska DEC guidance (ADEC 2000). Therefore, hazards are likely overestimated.

- For the five sites where indoor air was evaluated, a model was used to estimate the transport of vapors from groundwater to indoor air. The model may underestimate indoor air concentrations if the soil type under a building is more permeable to vapors than sand (the most permeable soil type used in the risk

assessments), for example, if subsurface soil was crushed rock fill. In addition, the model does not take into account the possibility of "preferential pathways," i.e., places where vapors would be more likely to migrate, such as along underground utility corridors and along a sand or gravel "string" that might be present under a building. The data for the individual sites does not indicate that very permeable soil types or preferential pathways were a concern at any of the nine sites, but in some cases data are limited. Although there is a possibility that the indoor air model could under-predict vapor concentrations, the much more likely scenario in the case of petroleum compounds is that the model over-predicts vapor concentrations. The developers of the indoor air model (Johnson-Ettinger model; Johnson *et al*. 1999, Johnson and Ettinger 2000) state that their model generally over-predicts, rather than under predicts, indoor air concentrations for most scenarios. Their opinion is that the Johnson-Ettinger model likely over-predicts for hydrocarbon scenarios due to the importance of *in situ* biodegradation.

- At all sites, sampling locations for soil were preferentially biased to locations containing the highest concentrations of chemicals and sampling was neither random nor systematic within a defined grid. The effect of the biased sampling on the risk assessment is an overestimation of the exposure concentration in soil, thus potentially overestimating the risks and hazards of chemicals in soil for construction workers.

- Toxicity criteria are associated with different levels of uncertainty, depending on the available toxicological data. Toxicity criteria frequently involve high-to-low-dose extrapolations and are often derived from animal rather than human data. In addition, there may be few studies available for a particular chemical. As the unknowns increase, the uncertainty of the value increases. Uncertainty is addressed by reducing non-cancer reference doses using uncertainty factors and by deriving cancer slope factors using a conservative model. The greater the uncertainty, the greater the uncertainty factors and tendency to overestimate the toxicity (e.g., see naphthalene's listed uncertainty factor on Table 5-7).

- Hazards are potentially underestimated for construction worker groundwater exposures because dermal hazards could not be evaluated for DRO.

5.2 ECOLOGICAL

Hazards to terrestrial and aquatic biota due to exposure to petroleum compounds in surface soil, surface water, and sediment were estimated for each complete, significant exposure pathway. Exposure pathways were determined to be complete and significant based on the site-specific ecological conceptual site model (CSM). Ecological CSMs for each of the sites are included in Section 5 of part 2 of the site characterization report (URS 2004a). The complete and significant ecological exposure pathways for each site are presented on Table 5-8.

Ecological hazards estimated for each of the free-product petroleum sites are also summarized in Table 5-8. Hazards are reported separately for surface soil, surface water, and sediment. There were no hazards above target health goals for terrestrial or aquatic biota exposed to petroleum compounds in surface soil, surface water, or sediment at any of these sites. In addition, there are no threatened or endangered species affected by any of the petroleum releases. Site-specific risk assessments prepared for each of these sites are included as part 2 of the site characterization report (URS 2004a).

Ecological Risk Assessment Procedures

Ecological risk assessment procedures begin with determining whether a detailed ecological risk assessment of that site is required. A detailed ecological risk assessment of a given site is required whenever the potential for an ecological threat from chemicals exists. The decision on whether to perform a detailed ecological risk assessment or not is made during the problem formulation stage of the risk assessment process. Before a decision can be made on the need for a detailed ecological risk assessment of a given site, a determination is made regarding the following:

1. The presence of sensitive environments, critical habitats, or sensitive species at a site

2. The presence of complete exposure pathways which result in the exposure of ecological receptors to site contaminants

If it is determined that no sensitive environments, critical habitats or sensitive species are present at a given site, and complete exposure pathways cannot be identified, Alaska DEC guidance permits the ecological risk assessment process for that site to be terminated. For five of the nine sites evaluated, the answers to either or both of the above questions was no; therefore, detailed

risk assessments were not required and the sites do not represent an ecological hazard. These sites are identified as "No pathways" sites on Table 5-8.

For four sites, complete exposure pathways were identified and detailed ecological risk-assessment procedures were conducted. Specifically, an ecological effects evaluation of on-site chemicals was conducted. Very little ecological toxicity data (i.e., toxicity reference values) are available for petroleum mixtures and there are no published values. The petroleum TRVs used for these risk assessments were taken from previous Adak ecological risk assessments conducted for Navy facilities on the island. These TRVs were previously approved by Alaska DEC and EPA (URS 1996c, 1996d, 1996e). No adverse ecological effects were identified.

Table 5-1
Summary of Human Health Risks, Free-Product Recovery Petroleum Sites
Former Adak Naval Complex, Adak Island, Alaska

Site Name	Complete and Significant Exposure Scenario			Medium Evaluated		Non-TPH Compounds		TPH Compounds
	Residential	Site Worker	Construction Worker	Soil[a]	Groundwater[b]	Cumulative Cancer Risk	Cumulative Hazard Index	Cumulative Hazard Index
GCI Compound (UST GCI-1)			●	●	●	3×10^{-7}	0.1	0.2
SA 80, Steam Plant No. 4 (USTs 27089 and 27090)		●			●	2×10^{-8}	0.001	0.008
			●	●	●	6×10^{-7}	0.05	0.3
Tanker Shed (UST 42494)		●			●	5×10^{-7}	0.05	0.05
			●	●	●	2×10^{-7}	0.08	0.3
SA 78, Old Transportation Building (USTs 10583, 10584, and ASTs)			●	●	●	1×10^{-8}	0.004	0.9
SA 82, P-80/P-81 Buildings (UST 10579, 10587, and AST 10333)		●			●	7×10^{-9}	0.0005	—
			●	●	●	2×10^{-10}	0.02	0.3
SA 88, P-70 Energy Generator (UST 10578)			●	●	●	6×10^{-10}	0.01	0.1
SWMU 58 and SA 73, Heating Plant No. 6			●	●	●	1×10^{-6}	0.1	0.5
Yakutat Hangar (UST T-2039A)		●			●	2×10^{-7}	0.003	—
			●	●	●	8×10^{-8}	0.008	0.2
NORPAC Hill Seep Area	●				●	—	0.002/0.0009[c]	—
			●	●	●	—	0.0000008	0.04

Table 5-1 (Continued)
Summary of Human Health Risks, Free-Product Recovery Petroleum Sites
Former Adak Naval Complex, Adak Island, Alaska

[a]Soil exposure for construction workers assumed workers would encounter site chemicals via ingestion, dermal contact, and inhalation. There are no soil exposures for residents. Regular site workers would be exposed to soil only at SA 80 via ingestion and dermal exposure pathways.
[b]Groundwater exposure for construction workers included the dermal contact and inhalation exposure pathways. Groundwater exposure for residents and site workers assumed to occur only via the inhalation of vapors moving from groundwater to indoor air. Ingestion of groundwater as drinking water is not considered to be a complete pathway because insufficient yield, saltwater intrusion, or existing institutional controls prevent ingestion of groundwater as a drinking water source on Adak Island.
[c] Child/adult hazard index
— No compounds of potential concern in this medium were associated with carcinogenic effects.

Notes:
AST - aboveground storage tank
SA - source area
SWMU - solid waste management unit
TPH - total petroleum hydrocarbons
UST - underground storage tank

Table 5-2
Construction Worker Exposures to Soil
Exposure Assumptions

Parameter	Definition	Value	Units	Source
CS	Chemical concentration in soil	chemical specific	mg/kg	Analytical data
IR	Ingestion rate	330	mg/day	Default value (USEPA 2001a)
CF	Conversion factor	1.00E-06	kg/mg	Not applicable
SA	Surface area	3300	cm^2	Default value (USEPA 2001a)
AF	Soil to skin adherence factor	0.3	mg/cm^2-day	Default value (USEPA 2001a)
ABS	Absorption factor	chemical specific	unitless	USEPA 2001b
InhR	Inhalation rate	20	m^3/day	Default value (USEPA 2001a)
PEF	Particulate emission factor	1.20E+09	m^3/kg	Site-specific (USEPA 2001a)
VF	Volatilization factor	chemical specific	m^3/kg	Site-specific (USEPA 2001a)
EF	Exposure frequency	190	days/year	Site-specific
ED	Exposure duration	1	year	Default value (USEPA 2001a)
BW	Body weight	70	kg	Default value (USEPA 2001a)
ATnc	Averaging time for noncarcinogenic effects	ED x 365 days/year	days	Default value (USEPA 1991)
ATca	Averaging time for carcinogenic effects	25,550	days	Default value (USEPA 1991)

Notes:
cm^2 - square centimeters
kg - kilograms
m^3 - cubic meters
mg - milligrams

Table 5-3
Construction Worker Exposures to Groundwater
Exposure Assumptions

Parameter	Definition	Value	Units	Source
CW	Chemical concentration in groundwater	chemical specific	ug/L	Analytical data
CF1	Conversion factor	1.00E-03	mg/ug	Not applicable
CF2	Conversion factor	1.00E-03	L/cm^3	Not applicable
SA	Skin surface area	3300	cm^2	Default value (USEPA 2001a)
PC	Dermal permeability constant	chemical specific	cm/hr	USEPA 2001b
InhR	Inhalation rate	20	m^3/day	Default value (USEPA 2001a)
VFw	Volatilization factor for water	0.01	L/m^3	Site-specific (USEPA 1999a)
EF	Exposure frequency	190	days/year	Site-specific
ET	Exposure time	8	hours/day	Default value (USEPA 2001a)
ED	Exposure duration	1	year	Default value (USEPA 2001a)
BW	Body weight	70	kg	Default value (USEPA 2001a)
ATnc	Averaging time for noncarcinogenic effects	ED x 365 days/year	days	Default value (USEPA 1991)
ATca	Averaging time for carcinogenic effects	25,550	days	Default value (USEPA 1991)

Notes:
cm^2 - square centimeter
cm^3 - cubic centimeter
hr - hour
kg - kilogram
L - liter
m^3 - cubic meter
mg - milligram
ug - microgram

Table 5-4
Residential Exposures to Vapors in Indoor Air
Exposure Assumptions

Parameter	Definition	Value	Units	Source
CA	Chemical concentration in air	Chemical-specific	ug/m^3	Calculated using the Johnson-Ettinger (1991) Model to estimate chemical movement from affected media (i.e., soil or groundwater) to air.
CF1	Conversion factor	1.00E-03	mg/ug	Not applicable
InhRc	Inhalation rate—child	10	m^3/day	Default value (USEPA 1998)
InhRa	Inhalation rate—adult	20	m^3/day	Default value (USEPA 1998)
EF	Exposure frequency	350	days/year	Default value (USEPA 1991)
EDc	Exposure duration—child	6	years	Default value (USEPA 1991)
EDa	Exposure duration—adult	24	years	Default value (USEPA 1991)
BWc	Body weight—child	15	kg	Default value (USEPA 1991)
Bwa	Body weight—adult	70	kg	Default value (USEPA 1991)
ATnc	Averaging time for noncarcinogenic effects	ED x 365 days/year	days	Default value (USEPA 1991)
ATca	Averaging time for carcinogenic effects	25,550	days	Default value (USEPA 1991)

Notes:
cm^2 - square centimeter
cm^3 - cubic centimeter
hr - hour
kg - kilogram
L - liter
m^3 - cubic meter
mg - milligram
ug - microgram

Table 5-5
On-Site Worker Exposures to Vapors in Indoor Air
Exposure Assumptions

Parameter	Definition	Value	Units	Source
CA	Chemical concentration in air	chemical specific	ug/m^3	Calculated using the Johnson-Ettinger (1991) Model to estimate chemical movement from affected media (i.e., soil or groundwater) to air.
CF1	Conversion factor	1.00E-03	mg/ug	Not applicable
InhR	Inhalation rate	1.3	m^3/hour	Default value (USEPA 1997a)
EF	Exposure frequency	250	days/year	Default value (USEPA 1991)
ET	Exposure time	8	hours/day	Default value (USEPA 2001a)
ED	Exposure duration	25	years	Default value (USEPA 1991)
BW	Body weight	70	kg	Default value (USEPA 2001a)
ATnc	Averaging time for noncarcinogenic effects	ED x 365 days/year	days	Default value (USEPA 1991)
ATca	Averaging time for carcinogenic effects	25,550	days	Default value (USEPA 1991)

Notes:
cm^2 - square centimeter
cm^3 - cubic centimeter
hr - hour
kg - kilogram
L - liter
m^3 - cubic meter
mg - milligram
ug - microgram

Table 5-6
Toxicity Criteria for the Carcinogenic Chemicals Selected for Quantitative Evaluation in the Risk Assessments

Chemical	Oral Cancer: Slope Factor $(mg/kg\text{-}day)^{-1}$	Inhalation Cancer: Slope Factor $(mg/kg\text{-}day)^{-1}$	Tumor Type	EPA Cancer Classification[a]	Reference
Benzene	0.055	0.029	Leukemia (human)	EPA Group A carcinogen	USEPA 2002
Benzo(a)anthracene	0.73	0.31	Forestomach, larynx, and esophagus tumors (oral); Pharynx, larynx tumors (inhalation)	EPA Group B2 carcinogen	USEPA 2003 (oral) USEPA 1994 (inhalation)
Benzo(a)pyrene	7.3	3.1	Forestomach, larynx, and esophagus tumors (oral); Pharynx, larynx tumors (inhalation)	EPA Group B2 carcinogen	USEPA 2003 (oral) USEPA 1994 (inhalation)
Benzo(b)fluoranthene	0.73	0.31	Forestomach, larynx, and esophagus tumors (oral); Pharynx, larynx tumors (inhalation)	EPA Group B2 carcinogen	USEPA 2003 (oral) USEPA 1994 (inhalation)
Dibenzo(a,h)anthracene	7.3	3.1	Forestomach, larynx, and esophagus tumors (oral); Pharynx, larynx tumors (inhalation)	EPA Group B2 carcinogen	USEPA 2003 (oral) USEPA 1994 (inhalation)
Ethylbenzene	None	0.0039	Renal and testicular cancer (male rates)	EPA Group D carcinogen[c]	USEPA 2002

[a] EPA's Weight-of-Evidence Classification System:
Group A - human carcinogen (sufficient evidence in humans)
Group B1 - probable human carcinogen (limited human data available)
Group B2 - probable human carcinogen (sufficient evidence in animals, inadequate or no evidence in humans)
Group C - possible human carcinogen (limited evidence in animals)
Group D - not classifiable as to human carcinogenicity

Table 5-6 (Continued)
Toxicity Criteria for the Carcinogenic Chemicals Selected for Quantitative Evaluation in the Risk Assessments

[b]The IRIS file has not been updated yet to reflect the carcinogenicity of ethylbenzene. Therefore, the cancer classification will likely change.
[c] EPA recommends a range of cancer slope factors for trichloroethene from 0.02 $(mg/kg\text{-}day)^{-1}$ to 0.4 $(mg/kg\text{-}day)^{-1}$. The high end of the range, 0.4 $(mg/kg\text{-}day)^{-1}$, was selected as the slope factor because it is based on occupational studies.

Notes:
mg/kg-day - milligram per kilogram per day
NA - not applicable
SF - slope factor

Table 5-7
Toxicity Criteria for the Non-Carcinogenic Effects of Chemicals Selected for Quantitative Evaluation in the Risk Assessments

Chemical	Chronic RfD (mg/kg-day)	Toxic Endpoint	Critical Study	Chronic RfD UF	RfD Source	Subchronic RfD (mg/kg-day)
Inhalation Exposures						
1,2,4-Trimethylbenzene	0.0017	CNS symptoms	subchronic human occupational	3,000	NCEA	0.017
1,3,5-Trimethylbenzene	0.0017	CNS symptoms	subchronic human occupational	3,000	NCEA	0.017
2-Methylnaphthalene	none[c]	--	--	--	NCEA-S-1400 (April 2003)	--
Benzene	0.009	Decreased lymphocyte count	subchronic human occupational	300	IRIS	0.009
Ethylbenzene	0.29	Developemental toxicity	subchronic female rats	300	IRIS	0.29
Naphthalene	0.00086	Nasal effects	chronic mouse	3,000	IRIS	0.0043
Toluene	0.11	Neurological effects	chronic human occupational	300	IRIS	0.11
Xylenes	0.029	Hyperactivity, decreased body weight, and increased mortality	subchronic male rats	300	IRIS	0.09
DRO aliphatics	0.29	hepatic and hematological changes	NA	NA	ADEC 2000	0.29
DRO aromatics	0.06	Decreased body weight	NA	NA	ADEC 2000	0.06
GRO aliphatics	5.3	Neurotoxicity	NA	NA	ADEC 2000	5.3
GRO aromatics	0.11	Hepatotoxicity and nephrotoxicity	NA	NA	ADEC 2000	0.11
RRO aliphatics	none [a]	--	--	--	--	--
RRO aromatics	none [a]	--	--	--	--	--
Oral Exposures						
1,2,4-Trimethylbenzene	0.05	Decreased body weight	suchronic rats	3,000	NCEA	0.5
1,3,5-Trimethylbenzene	0.05	Decreased body weight	suchronic rats	3,000	NCEA	0.5
2-Methylnaphthalene	0.009	pulmonary alveolar proteinosis	chronic male mice	1,000	NCEA-S-1400 (April 2003)	0.009
Benzene	0.004	Decreased lymphocyte count	subchronic human occupational	300	IRIS	0.004
Ethylbenzene	0.10	Liver and kidney toxicity	subchronic mouse	1,000	IRIS	1

Table 5-7 (Continued)
Toxicity Criteria for the Non-Carcinogenic Effects of Chemicals Selected for Quantitative Evaluation in the Risk Assessments

Chemical	Chronic RfD (mg/kg-day)	Toxic Endpoint	Critical Study	Chronic RfD UF	RfD Source	Subchronic RfD (mg/kg-day)
Oral Exposures (Continued)						
Naphthalene	0.02	Decreased body weight	subchronic rat	3,000	IRIS	0.2
Toluene	0.2	Changes in liver and kidney weights	subchronic rats	1,000	IRIS	2
Xylenes	0.2	Hyperactivity, decreased body weight, and increased mortality	chronic rat	1,000	IRIS	0.25
DRO aliphatics	0.1	hepatic and hematological changes	NA	NA	ADEC 2000	0.1
DRO aromatics	0.04	Decreased body weight	NA	NA	ADEC 2000	0.04
GRO aliphatics	5.00	Neurotoxicity	NA	NA	ADEC 2000	5.00
GRO aromatics	0.2	Hepatotoxicity and nephrotoxicity	NA	NA	ADEC 2000	0.2
RRO aliphatics	2	Hepatotoxicity	NA	NA	ADEC 2000	2
RRO aromatics	0.3	Hepatotoxicity and nephrotoxicity	NA	NA	ADEC 2000	0.3

[a] The chemical was adminstered by gavage in the critical study upon which the oral RfD is based. Because of the "low" confidence rating of the oral RfD, no chronic inhalation value, based on route-to-route extrapolation, is proposed.

[b] No inhalation criteria are available for this chemical and NCEA specifically states the route-to-route extrapolation from oral to inhalation is not recommended for this chemical (NCEA-S-1400, April 2003).

Notes:
IRIS - EPA's Integrated Risk Information System (on-line data base)
LOAEL - lowest-observed-adverse-effect-level
NCEA - EPA's National Center for Environmental Assessment
NOAEL - no-observed-adverse-effect-level
RfD - Reference Dose
UF - Uncertainty factor

Table 5-8
Summary of Ecological Hazards, Free-Product Recovery Petroleum Sites
Former Adak Naval Complex, Adak Island, Alaska

Site Name	Complete and Significant Exposure Scenario		Medium Evaluated			Soil Hazard Index	Surface Water Hazard Index	Sediment Hazard Index
	Terrestrial Biota[a]	Aquatic Biota[b]	Surface Soil[c]	Surface Water[c]	Sediment[c]			
GCI Compound (UST GCI-1)	•		•			1.5[d]	N.P.	N.P.
SA 80, Steam Plant No. 4 (USTs 27089 and 27090)						N.P.	N.P.	N.P.
Tanker Shed (UST 42494)						N.P.	N.P.	N.P.
SA 78, Old Transportation Building (USTs 10583, 10584, and ASTs)						N.P.	N.P.	N.P.
SA 82, P-80/P-81 Buildings (UST 10579, 10587, and AST 10333)						N.P.	N.P.	N.P.
SA 88, P-70 Energy Generator (UST 10578)						N.P.	N.P.	N.P.
SWMU 58 and SA 73, Heating Plant No. 6		•		•	•	N.P.	>1[e]	>1[e]
Yakutat Hangar (UST T-2039A)						1	N.P.	N.P.
NORPAC Hill Seep Area	•	•	•	•	•	<0.01	N.C.	0.21

[a]Terrestrial biota include plants, invertebrates, birds, and mammals.
[b]Aquatic biota include macrophytes, phytoplankton/zooplankton, benthic and epibenthic invertebrates, fish, birds, and marine mammals.

Table 5-8 (Continued)
Summary of Ecological Hazards, Free-Product Recovery Petroleum Sites
Former Adak Naval Complex, Adak Island, Alaska

[c]Exposure pathways for surface soil, surface water, and sediment include incidental ingestion, dermal contact/root uptake, and food web. However, food web was not a significant exposure pathway for GCI Compound or SWMU 58/SA 73.
[d]Ecological HI in soil results from total lead concentration in one soil sample and represents a marginal ecological threat in soil to terrestrial plants and soil invertebrates with limited mobility. This threat was determined to be limited to a small portion of the site.
[e] Hazard quotients calculated for Heating Plant No. 6 were greater than 1 for 3 chemicals in sediment and 2 chemicals in surface water. However, data used to calculate these hazard quotients are no longer representative of current conditions, because these data were collected before remedial activities removed the sources of contamination. URS concludes that the potential for unacceptable risk to ecological receptors under current conditions is low.

Notes:
N.C. - Not calculated. Data not available permitting a hazard index calculation.
N.P. - No pathway. No significant ecological exposure pathway at this site.
AST - aboveground storage tank
SA - source area
SWMU - solid waste management unit
UST - underground storage tank

6.0 REMEDIAL ACTION OBJECTIVES AND CLEANUP LEVELS

This section describes the remedial action objectives established for the petroleum sites addressed in this DD and the associated cleanup levels.

6.1 REMEDIAL ACTION OBJECTIVES

Although there are currently no unacceptable risks at these 10 sites, there are potential future risks if exposure pathways become complete, such as use of the groundwater as a drinking water source. Therefore, the remedial action objectives (RAOs) to be achieved by the preferred cleanup alternatives for these sites are:

- Prevent future exposure to petroleum-related chemicals in soil and groundwater at the site
- Over the long term, reduce concentrations of petroleum-related chemicals in groundwater to levels below Alaska DEC groundwater cleanup levels

6.2 CLEANUP LEVELS

Chemical-specific cleanup criteria have been established for cleanup of petroleum-contaminated sites at the former Adak Naval Complex in accordance with Alaska DEC regulation 18 AAC 75. The Alaska regulations establish four methods for determining cleanup levels for soil [18 AAC 75.340] and three methods for determining cleanup levels for groundwater [18 AAC 75.345]. As discussed in Section 4, the Alaska DEC Method Two cleanup levels established to prevent migration of contaminants from soil to groundwater in the over 40 inches of rainfall zone (18 AAC 75.341, Tables B1 and B2) were used to estimate the potential extent of soil impacted by petroleum contamination at each site. The Alaska DEC Method Four cleanup levels [18 AAC 75.340(a)(4)], which are based on site-specific risk assessments, were used to evaluate what soil cleanup actions might be needed at each site. Groundwater cleanup levels established by Alaska Regulation 18 AAC 75.345(b) were used to estimate the potential extent of groundwater impacted by petroleum contamination at each site (see Section 4) and were used to determine whether groundwater cleanup actions are required at each site, as appropriate. Alaska regulations have not established numerical cleanup criteria for individual petroleum-related chemicals in surface water and sediment. Therefore, surface water and sediment monitoring

would be conducted to evaluate the impact of terrestrial cleanup activities on downgradient aquatic environments.

Under the Alaska DEC Method Four cleanup levels for soil, site-specific alternative cleanup levels (ACLs) may be proposed based upon results of the risk assessment conducted for an individual site. Proposed ACLs are submitted to the Alaska DEC for approval. These ACLs are designated for an individual site if the Alaska DEC agrees that they are protective of human health, safety, and welfare and of the environment [18 AAC 75.340(f)]. Because the risk assessments for these 10 sites established that the concentrations in soil do not pose a risk to humans or the environment above target health goals at their present contamination level, no separate ACLs were calculated and, by default, the existing contaminant levels at each site become the site-specific ACLs. The risk assessment findings of no unacceptable risk remain valid providing that the assumed land uses for the site, as per the Adak Reuse Plan, do not change.

Cleanup levels specified for groundwater at petroleum-contaminated sites on the former Adak Naval Complex are based on the use of groundwater as a drinking water source [18 AAC 75.345(b)(1), Table C], or 10 times these levels if the groundwater is not reasonably expected to be a potential future source of drinking water [18 AAC 75.345(b)(2)]. As discussed in Section 2.6, groundwater at the GCI Compound, SA 80, and Tanker Shed sites is considered to be a reasonably expected potential future source of drinking water. Groundwater cleanup levels for these sites are those specified in Table C of 18 AAC 75.345(b)(1). Groundwater at the seven remaining sites is not considered to be a reasonably expected potential future source of drinking water (see Table 2-4). Groundwater cleanup levels for these sites are 10 times the levels specified in Table C of the Alaska regulations. The groundwater cleanup levels are provided in Table 6-1. This table only provides groundwater cleanup levels for chemicals that exceeded the Alaska DEC cleanup levels at one or more sites.

Table 6-1
Alaska DEC Groundwater Cleanup Levels

Chemical	Groundwater Cleanup Levels	
	Drinking Water[a] (mg/L)	Not Drinking Water[b] (mg/L)
GRO	1.3	13
DRO	1.5	15
Benzene	0.005	0.05

[a]Table C values applicable to GCI Compound, SA 80, and Tanker Shed
[b]Ten times the Table C values applicable to SA 78, SA 82, SA 88, SWMU 58/SA 73, Yakutat Hangar, and NORPAC Hill

Notes:
DRO - diesel-range organics
GRO - gasoline-range organics
mg/L - milligram per liter

7.0 REMEDIAL ACTION ALTERNATIVES

A comprehensive array of remedial alternatives was previously identified, developed, and evaluated by the Navy for the 128 petroleum-release sites, including the 14 free-product petroleum sites, at the former Adak Naval Complex during the 1998 FFS (focused feasibility study), as amended in 1999 (URSG 1998b and 1999b). The 1998 FFS, as amended, provided the information required to select the preferred remedies for the 128 petroleum release sites in the OU A ROD, which was signed in 2002. For the 14 free-product petroleum sites, the OU A ROD selected an interim remedy, which consisted of free-product recovery. The OU A ROD also specified that these 14 sites were designated for future final remedy selection. Final remedy selection for 10 of the 14 free-product petroleum sites is described in this DD and the part 1 of the site characterization report (URS 2004a).

The list of cleanup alternatives developed for petroleum-release sites during the 1998 FFS, as amended (URSG 1998b and 1999b), was used as the starting point for identifying alternatives for the 10 free-product petroleum sites addressed in this DD. These alternatives are as follows:

Alternative 1, No Action. This alternative is included as a baseline to represent current conditions. No remedial actions are included with this alternative. It is used for comparison to the other alternatives.

Alternative 2, Limited Groundwater Monitoring. Groundwater monitoring would be conducted to confirm that petroleum-related chemicals in groundwater at concentrations less than cleanup levels are continuing to decline. This alternative applies to sites where there is some uncertainty as to whether the concentrations of chemicals in the groundwater are less than the cleanup levels. This approach to cleanup relies on naturally occurring processes to reduce petroleum concentrations in groundwater. During this process, microorganisms present in soil and groundwater break down petroleum compounds into harmless chemicals.

Alternative 3, Monitored Natural Attenuation and Institutional Controls. Groundwater monitoring would be conducted to evaluate whether petroleum-related chemicals in groundwater are attenuating to concentrations below applicable Alaska DEC groundwater cleanup levels. Petroleum-related chemicals that currently exceed applicable Alaska DEC cleanup levels would be monitored, as well as natural attenuation indicator compounds. This approach to cleanup relies on naturally occurring processes to reduce petroleum concentrations in groundwater. This alternative also includes institutional controls as an additional means of reducing potential

exposure to petroleum contamination. Institutional controls are currently in place and are described in Sections 2.1, 2.6, and 2.7.

Alternative 4, Product Recovery. Free product on the groundwater surface would be collected to the maximum extent practicable using skimmers.

Alternative 5, Limited Soil Removal/Source Removal and Thermal Desorption. Petroleum-contaminated soil would be excavated and then heated to drive off the petroleum compounds.

Alternative 6, *Ex Situ* Bioremediation of Soil. Petroleum-contaminated soil would be excavated and placed in a lined pile for treatment. Air, water, and nutrients would be added to the soil to encourage microorganisms to break down the petroleum compounds to harmless chemicals.

Alternative 7, *In Situ* Bioremediation of Soil, Monitored Natural Attenuation, and Institutional Controls. Petroleum-contaminated soil would be treated in the ground. This alternative relies on the same naturally occurring microorganisms as natural attenuation. However, the growth of the microorganisms is encouraged by increasing air flow in the ground by either blowing air into the ground or by pulling air through the soil. This alternative would also include institutional controls. Institutional controls are currently in place and are described in Sections 2.1, 2.6, and 2.7.

Alternative 8, Soil Cover, Monitored Natural Attenuation, and Institutional Controls. Contaminated surface soil would be covered with a layer of clean soil to prevent contact with petroleum. Institutional controls would be used to further limit contact with petroleum chemicals in soil and groundwater. Institutional controls are currently in place and are described in Sections 2.1, 2.6, and 2.7. Natural attenuation would cause the petroleum concentrations to decrease.

Alternative 9, Soil Vapor Extraction/Air Sparging, Monitored Natural Attenuation, and Institutional Controls. A vacuum system is used to cause light petroleum compounds to move to vapor extraction wells. It is only effective for lighter petroleum materials such as those present in gasoline. Institutional controls would be used to limit potential contact with petroleum. Institutional controls are currently in place and are described in Sections 2.1, 2.6, and 2.7.

Some of these alternatives are not applicable to any of 10 free-product petroleum sites. Specifically, Alternative 8 is not applicable because this alternative would apply to sites where

there are ecological risks, and Alternative 9 is not applicable because this alternative would apply to sites where only GRO is present.

8.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

The results of the 1998 FFS, as amended (URSG 1998b and 1999b), were applied to the selection of the final remedy for the 10 free-product petroleum sites addressed in part 1 of the site characterization report (URS 2004a) and this DD. The criteria used to complete the alternative evaluation in the 1998 FFS, as amended, were based on EPA guidance, which is very similar to ADEC guidance, and are summarized in Table 8-1. State acceptance and community acceptance were evaluated after public and state comments on the proposed cleanup actions were received. Therefore, these two criteria were not evaluated in the 1998 FFS, as amended.

An evaluation of alternatives using the EPA criteria was performed separately for each of the 128 petroleum-release sites at the Former Adak Naval Complex in the 1998 FFS, as amended (URSG 1998b and 1999b). In order to summarize the results of the evaluations for the 128 petroleum-release sites, the January 1998 *Proposed Plan for Cleanup Action at Petroleum Sites on Adak Island* (U.S. Navy et. al. 1998) presented the evaluations for nine categories of sites. Sites that had similar characteristics were grouped together into the nine categories and a single alternative evaluation was presented for each category. The nine categories of sites are as follows (note that the categories applicable to the 10 free-product petroleum sites presented in this DD are shown in bold type):

- **Category 1 – Free-product sites**
- Category 2 – Gasoline-only sites
- Category 3 – Diesel sites, soil concentrations below screening levels, near surface water, with buildings over the source area
- Category 4 – Diesel sites, soil concentrations below screening levels, near surface water, without buildings over the source area
- Category 5 – Diesel sites, soil concentrations above screening levels, with buildings over the source area
- **Category 6 – Diesel sites, soil concentrations above screening levels, without buildings over the source area, groundwater risk below acceptable risk**
- **Category 7 – Diesel sites, soil concentrations above screening levels, without buildings over the source area, groundwater risk above acceptable risk**

- Category 8 – Diesel sites, soil concentrations above screening levels, without buildings over the source area, predicted ecological risk above acceptable risk

- Category 9 – Diesel sites, soil concentrations above screening levels, with buildings over the source area, predicted ecological risk above acceptable risk

Soil screening levels referenced in the category descriptions above are the Alaska DEC Method Two Cleanup Levels and groundwater risk was assessed by comparing groundwater concentrations to the Alaska DEC Cleanup Levels. In the absence of institutional controls, groundwater risk is acceptable if concentrations are less than the Alaska DEC Cleanup Levels and unacceptable if concentrations are greater than the Alaska DEC Cleanup Levels.

The alternative evaluation that was performed for the Category 6 Sites in the January 1998 *Proposed Plan for Cleanup Action at Petroleum Sites on Adak Island* (U.S. Navy et. al. 1998) is applicable to SA 82, SA 88, Yakutat Hangar, and NORPAC Hill, because the petroleum concentrations in soil at these sites are above the Alaska DEC Method Two cleanup levels and the petroleum concentrations in groundwater are less than the Alaska DEC cleanup levels. The alternative evaluation that was performed for the Category 7 Sites in that same document is applicable to GCI Compound, SA 80, SA 78, and SWMU 58/SA 73 because the petroleum concentrations in both soil and groundwater are above the Alaska DEC cleanup levels. Finally, a combination of the alternative evaluations that were performed for the Category 1 Sites and the Category 7 Sites in the January 1998 proposed plan is applicable to Tanker Shed because free product has not been recovered to the maximum extent practicable at this site and the petroleum concentrations in both soil and groundwater are above the Alaska DEC cleanup levels.

The alternative evaluations that were performed for the Category 2, 3, 4, 5, 8, and 9 sites are not applicable to any of the 10 free-product petroleum sites addressed in this DD. Category 2 is not applicable to any of the sites because DRO is present at all of the sites addressed in this DD. Category 3, 4, and 5 are not applicable to any of the sites because groundwater issues are not addressed with these categories. Finally, Category 8 and 9 are not applicable to any of the sites because predicted ecological risks are acceptable.

The alternative evaluations presented in the January 1998 proposed plan (U.S. Navy et al. 1998) were modified slightly. First, Alternative 2, Limited Groundwater Monitoring, was not evaluated in the January 1998 proposed plan. It was added in the 1999 FFS addendum (URSG 1999b), and an evaluation was never performed for this alternative. Therefore, an evaluation of this alternative was added during preparation of the site characterization report (URS 2004a). Furthermore, the site-specific costs presented in the January 1998 proposed plan are not directly

applicable to the sites addressed in this DD. Therefore, the cost evaluation was also modified to provide relative costs. Finally, an evaluation using the two criteria, state acceptance and community acceptance, was added based on state and community input received during the public comment period. The resulting modified figures are included as Figures 8-1, 8-2, and 8-3.

In order to maintain consistency with cleanup decisions made in the OU A ROD, the 1998 FFS (as amended), the January 1998 proposed plan, and the OU A ROD were reviewed to determine what factors or criteria were used to select the preferred remedy for the 128 sites addressed in these documents. These factors or criteria are the suitability criteria listed in Table 8-2. Because site conditions do not pose a risk to human health or the environment at any of these 10 sites, remedial alternatives developed for sites that do pose a risk above target health goals (Alternatives 5, 6, and 7) were eliminated as potential preferred remedial alternatives. Therefore, the list of preferred remedial alternatives that may be selected for each of these 10 sites is limited to Alternatives 1, 2, 3, or 4. Product recovery has already been completed to the maximum extent practicable at all sites except Tanker Shed. Therefore, Alternative 4 is potentially applicable only to Tanker Shed.

The preferred cleanup alternative(s) for each of these sites was selected based on a comparison of site-specific conditions to the criteria used to determine the suitability of an alternative, as presented in Table 8-2. A solid bullet in this table adjacent to a suitability criterion indicates that site-specific conditions match the alternative's suitability criterion. An alternative is identified as the preferred remedy when site-specific conditions most closely match the alternative's suitability criteria.

Based on these comparisons, Alternative 2, Limited Groundwater Monitoring; Alternative 3, Monitored Natural Attenuation and Institutional Controls; and Alternative 4, Product Recovery are the selected preferred remedial alternatives for the 10 petroleum-contaminated sites addressed in this DD. These alternatives will provide appropriate, cost-effective remedies that protect human health and the environment and that can be implemented at the earliest possible time.

Alternative 2, Limited Groundwater Monitoring, is selected as the preferred remedial alternative for the SA 82, SA 88, Yakutat Hangar, and NORPAC Hill sites. Alternative 2 is selected for these sites because groundwater concentrations are not above the Alaska DEC cleanup levels (10 times the Alaska DEC Table C values) and monitored natural attenuation is therefore not required to reduce groundwater concentrations to below cleanup levels. Limited groundwater monitoring will ensure that conditions at these sites do not change, and concentrations of petroleum compounds continue to decrease. Therefore, Alternative 2 is protective of human health and the environment and complies with Alaska regulations. It provides excellent long-

term and short-term effectiveness at a low cost. In addition, the state concurs with the selection of this alternative and it is acceptable to the public. Finally, Alternative 2 is readily implementable.

Alternative 3, Monitored Natural Attenuation and Institutional Controls, is selected as the preferred remedial alternative for the GCI Compound, SA 80, Tanker Shed, SA 78, and SWMU 58/SA 73 sites. Alternative 3 is selected for these sites because groundwater concentrations are above the Alaska DEC cleanup levels. Monitored natural attenuation is needed to reduce concentrations to below the Alaska DEC cleanup levels and institutional controls are needed as long as concentrations are above Alaska DEC cleanup levels. Therefore, Alternative 3 is protective of human health and the environment and complies with Alaska regulations. It provides excellent long-term and short-term effectiveness at a low cost. In addition, the state concurs with the selection of this alternative and it is acceptable to the public. Finally, Alternative 3 is readily implementable. Alternative 4, Product Recovery, is also selected as a preferred remedial alternative at the Tanker Shed site. Alternative 4, Product Recovery, will be performed concurrently with Alternative 3, Monitored Natural Attenuation. Further product recovery will comply with the Alaska regulations and will reduce the source of petroleum dissolving into groundwater.

337555539-101a

EPA CRITERIA	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
Overall protectiveness of human health and the environment	◔	◕	◕		◕				
Compliance with ARARs	◔	◕	◕		◕				
Long-term effectiveness and permanence	◔	◕	◕		●				
Reduction of toxicity, mobility, or volume through active treatment	○	○	○		◕				
Short-term effectiveness	◔	◕	◕		◒				
Implementability	●	◕	◒		◔				
Cost	●	●	◕		◔				
State acceptance	○	◕	◕		●				
Community acceptance	○	◕	◕		◕				

ALTERNATIVES	
Alternative 1	No Action
Alternative 2	Limited Groundwater Monitoring
Alternative 3	Monitored Natural Attenuation and Institutional Controls
Alternative 4	Product Recovery
Alternative 5	Limited Soil Removal/Source Removal and Thermal Desorption
Alternative 6	Ex Situ Bioremediation of Soil
Alternative 7	In Situ Bioremediation of Soil, Monitored Natural Attenuation, and Institutional Controls
Alternative 8	Soil Cover, Monitored Natural Attenuation and Institutional Controls
Alternative 9	Soil Vapor Extraction/Air Sparging, Monitored Natural Attenuation, and Institutional Controls

LEGEND

- ● Superior
- ◕ Excellent
- ◒ Good
- ◔ Fair
- ○ Poor
- Technology and/or alternative not applicable for site

U.S.NAVY

Figure 8-1
Evaluation of Alternatives for SA 82, SA 88, Yakutat Hangar and NORPAC Hill

Delivery Order 0037
Adak Island, AK
DECISION DOCUMENT

337555539-101b

EPA CRITERIA	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
Overall protectiveness of human health and the environment	○	◔	◒		◕	◒	◒		
Compliance with ARARs	○	◔	◒		◕	◒	◒		
Long-term effectiveness and permanence	○	◔	◒		●	◕	◒		
Reduction of toxicity, mobility, or volume through active treatment	○	○	○		◕	◒	◒		
Short-term effectiveness	◔	◒	◒		◒	◒	◒		
Implementability	●	◕	◕		◔	◒	◔		
Cost	●	●	◕		○	◔	◒		
State acceptance	○	◔	◕		◕	◕	◕		
Community acceptance	○	◔	◕		◕	◕	◕		

ALTERNATIVES	
Alternative 1	No Action
Alternative 2	Limited Groundwater Monitoring
Alternative 3	Monitored Natural Attenuation and Institutional Controls
Alternative 4	Product Recovery
Alternative 5	Limited Soil Removal/Source Removal and Thermal Desorption
Alternative 6	Ex Situ Bioremediation of Soil
Alternative 7	In Situ Bioremediation of Soil, Monitored Natural Attenuation, and Institutional Controls
Alternative 8	Soil Cover, Monitored Natural Attenuation and Institutional Controls
Alternative 9	Soil Vapor Extraction/Air Sparging, Monitored Natural Attenuation, and Institutional Controls

LEGEND

- ● Superior
- ◕ Excellent
- ◒ Good
- ◔ Fair
- ○ Poor
- Technology and/or alternative not applicable for site

U.S.NAVY

Figure 8-2
Evaluation of Alternatives for GCI Compound, SA 80, SA 78, and SWMU 58/SA 73

Delivery Order 0037
Adak Island, AK
DECISION DOCUMENT

337555539-101c

EPA CRITERIA	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
Overall protectiveness of human health and the environment	○	◔	◒	◒	◔	◒	◒		
Compliance with ARARs	○	◔	◒	◒	◔	◒	◒		
Long-term effectiveness and permanence	○	◔	◒	○	●	◔	◒		
Reduction of toxicity, mobility, or volume through active treatment	○	○	○	◒	◔	◒	◒		
Short-term effectiveness	◔	◒	◒	◔	◒	◒	◒		
Implementability	●	◔	◔	◒	◔	◒	◔		
Cost	●	●	◔	◔	○	◔	◒		
State acceptance	○	◔	◔	◔	◔	◔	◔		
Community acceptance	○	◔	◔	◔	◔	◔	◔		

ALTERNATIVES

Alternative 1	No Action
Alternative 2	Limited Groundwater Monitoring
Alternative 3	Monitored Natural Attenuation and Institutional Controls
Alternative 4	Product Recovery
Alternative 5	Limited Soil Removal/Source Removal and Thermal Desorption
Alternative 6	Ex Situ Bioremediation of Soil
Alternative 7	In Situ Bioremediation of Soil, Monitored Natural Attenuation, and Institutional Controls
Alternative 8	Soil Cover, Monitored Natural Attenuation and Institutional Controls
Alternative 9	Soil Vapor Extraction/Air Sparging, Monitored Natural Attenuation, and Institutional Controls

LEGEND

- ● Superior
- ◔ Excellent
- ◒ Good
- ◔ Fair
- ○ Poor
- Technology and/or alternative not applicable for site

U.S.NAVY

Figure 8-3
Evaluation of Alternatives for Tanker Shed

Delivery Order 0037
Adak Island, AK
DECISION DOCUMENT

Table 8-1
EPA Criteria

EPA Criteria	Comparable Alaska DEC Criteria	Description
Overall protection of human health and the environment	Protectiveness	Whether a cleanup action provides adequate protection and how potential risks are eliminated, reduced, or controlled through treatment or control
Compliance with regulations	Regulations	Whether a cleanup action will meet all potential cleanup levels
Long-term effectiveness and permanence	Short- and long-term effectiveness	The ability of a cleanup action to reliably protect human health and the environment over time
Reduction of toxicity, mobility, or volume through active treatment	None	How well treatment technologies that may be used in a cleanup action work; how well the cleanup treatment may work to make the chemicals less harmful, make them less likely to spread, or reduce the amount of contaminated material
Short-term effectiveness	Short- and long-term effectiveness	How quickly the cleanup action is able to protect human health and the environment and what is its potential to create adverse effects during construction and implementation
Implementability, suitability	Practicable	How readily the cleanup can be accomplished: Are needed materials and services available? How appropriate is the solution to the problem?
Cost	Practicable	Costs to build, operate, and maintain the cleanup remedy
State acceptance	None	Whether, based on its review of the project documents and proposed plan, the state agrees with, opposes, or has no comment on the preferred alternative
Community acceptance	Public input	Whether the public agrees with, opposes, or has no comment on the preferred alternative (determined after reviewing the public comments received on this proposed plan)

Table 8-2
Evaluation of Cleanup Alternatives

Criteria to Determine the Suitability of Alternative	GCI Compound	SA 80	Tanker Shed	SA 78	SA 82	SA 88	SWMU 58/ SA 73	Yakutat Hangar	NORPAC Hill
Alternative 1: No Action									
• Petroleum-related chemicals do not pose an imminent threat to human health or the environment	●	●	●	●	●	●	●	●	●
• Petroleum-related chemicals on site do not exceed ADEC soil or groundwater cleanup levels	○	○	○	○	○	○	○	○	○
Selected as Preferred Alternative	NO	NO	NO	NO	NO	NO	NO	NO	NO
Alternative 2: Limited Groundwater Monitoring									
• Petroleum-related chemicals do not pose an imminent threat to human health or the environment (exclusive of the human health groundwater ingestion pathway)	●	●	●	●	●	●	●	●	●
• Groundwater at the site is not a reasonably expected potential future source of drinking water based on 18 AAC 75.350(2)	○	○	○	●	●	●	●	●	●
• Groundwater that is closely connected hydrologically to nearby surface water does not cause a violation of the Alaska Water Quality Standards, 18 AAC 70	NA	NA	NA	NA	NA	NA	NA	●	○
• Soil contains petroleum-related chemicals at concentrations above ADEC soil cleanup levels	●	●	●	●	●	●	●	●	●
• Groundwater monitoring indicates the presence of petroleum-related chemicals at concentrations below ADEC groundwater cleanup levels	○	○	○	○	●	●	○	●	●
Selected as Preferred Alternative	NO	NO	NO	NO	**YES**	**YES**	NO	**YES**	**YES**
Alternative 3: Monitored Natural Attenuation and Institutional Controls									
• Petroleum-related chemicals do not pose an imminent threat to human health or the environment (exclusive of the human health groundwater ingestion pathway)	●	●	●	●	●	●	●	●	●
• Groundwater at the site is a reasonably expected potential future source of drinking water based on 18 AAC 75.350(2)	●	●	●	○	○	○	○	○	○

Table 8-2 (Continued)
Evaluation of Cleanup Alternatives

Criteria to Determine the Suitability of Alternative	GCI Compound	SA 80	Tanker Shed	SA 78	SA 82	SA 88	SWMU 58/ SA 73	Yakutat Hangar	NORPAC Hill
• Groundwater that is closely connected hydrologically to nearby surface water does not cause a violation of the Alaska Water Quality Standards, 18 AAC 70	NA	NA	NA	NA	NA	NA	NA	●	○
• Soil contains petroleum-related chemicals at concentrations above ADEC soil cleanup levels	●	●	●	●	●	●	●	●	●
• Groundwater monitoring indicates the presence of petroleum-related chemicals at concentrations above ADEC groundwater cleanup levels	●	●	●	●	○	○	●	○	○
Selected as Preferred Alternative	**YES**	**YES**	**YES**	**YES**	NO	NO	**YES**	NO	NO
Alternative 4: Product Recovery									
• Site has quantities of residual free product on the groundwater surface that are considered practicable to recover	○	○	●	○	○	○	○	○	○
Selected as Preferred Alternative	NO	NO	**YES**	NO	NO	NO	NO	NO	NO

● true ○ false

Notes:
AAC - Alaska Administrative Code
ADEC - Alaska Department of Environmental Conservation
NA - not applicable
SA - source area
SWMU - solid waste management unit

9.0 DESCRIPTION OF SELECTED CLEANUP ACTION

Cleanup alternatives were selected for each of the 10 petroleum-contaminated sites based on their ability to meet the two remedial action objectives: (1) prevent future exposure to petroleum-related chemicals in soil and groundwater at the site and (2) reduce concentrations of petroleum-related chemicals in groundwater to levels below Alaska DEC groundwater cleanup levels over the long term. The selected cleanup alternatives for the 10 petroleum-contaminated sites that do not pose a risk above target health goals are identified in Table 9-1 and described below. Alternative 2, Limited Groundwater Monitoring, is selected as the remedial alternative for the SA 82, SA 88, Yakutat Hangar, and NORPAC Hill sites. Alternative 3, Monitored Natural Attenuation and Institutional Controls, is selected as the remedial alternative for the GCI Compound, SA 80, Tanker Shed, SA 78, and SWMU 58/SA 73 sites. Alternative 4, Product Recovery, is also selected as a remedial alternative at the Tanker Shed site. Alternative 4, Product Recovery, will be performed concurrently with Alternative 3, Monitored Natural Attenuation.

Groundwater monitoring will be conducted at sites where Alternative 2 (Limited Groundwater Monitoring) or Alternative 3 (Monitored Natural Attenuation and Institutional Controls) was selected. Details of the monitoring program resulting from implementation of Alternative 2 or Alternative 3 will be incorporated into subsequent versions of the *Comprehensive Monitoring Plan Revision 1, OU A, Former Adak Naval Complex* (URS 2004b). The Navy proposes to initiate remedy-based groundwater monitoring at these ten sites in conjunction with annual monitoring activities planned for 2005. A summary of the monitoring program to be performed at the 10 petroleum-contaminated sites addressed in this DD is provided in subsequent paragraphs. In addition, the existing excavation notification system would be extended to SA 78, SA 82, SA 88, and SWMU 58/SA 73 and visual inspections will be conducted to ensure that institutional controls are being implemented as prescribed at the GCI Compound, SA 80, Tanker Shed, SA 78, and SWMU 58/SA 73 sites. Finally, a work plan for free-product recovery will be developed for Tanker Shed.

The groundwater monitoring timeframes for the 10 sites cannot be predicted at this time. However, timeframes needed to achieve the Alaska DEC groundwater cleanup levels will be estimated after 5 years of groundwater monitoring has been completed. Given the small amounts of free product measured in the groundwater wells at Tanker Shed in 2001, it is anticipated that free-product recovery will be completed within 1 year of the restart of recovery operations. Short-term risks associated with groundwater monitoring and product recovery will be minimal and will be controlled through the use of personal protective equipment. Once groundwater

concentrations have been reduced to levels less than the Alaska DEC Cleanup Levels and free product has been removed to the extent practicable, residual risks at the site will be acceptable. Pockets of free product may remain at the site, even if none is detected in on-site wells. Therefore, some residual risk may remain at a site once cleanup actions have been completed.

Groundwater monitoring will be conducted at a frequency to be established by the Navy and Alaska DEC. At sites where Alternative 2 is the selected remedy, groundwater monitoring will be conducted to evaluate whether concentrations of petroleum-related compounds are continuing to decrease at locations to be specified in the monitoring plan. At sites where Alternative 3 is the selected remedy, groundwater monitoring will be conducted to evaluate whether petroleum-related chemicals in groundwater are attenuating to concentrations below Alaska DEC groundwater cleanup levels at locations to be specified in the monitoring plan. Natural attenuation indicator compounds will also be monitored at sites where Alternative 3 (Monitored Natural Attenuation and Institutional Controls) is the selected remedy. Groundwater sampling will be conducted following procedures specified in the appropriate Navy Standard Operating Procedures (SOPs) as specified in subsequent versions of the comprehensive monitoring plan for the Former Adak Naval Complex. Groundwater samples will only be collected for chemical analyses from individual wells if the measured product thickness in the well is less than 0.02 foot.

All available site-specific data will be evaluated after each year of monitoring is completed. These data evaluations will be performed to determine whether specified institutional controls are being successfully implemented at the sites, concentrations of petroleum-related chemicals in groundwater are decreasing, and/or free product is being recovered to the extent practicable. These analyses will incorporate historical, site-specific data where appropriate. Once the annual data evaluation is completed, the Navy will make recommendations for modifications to the monitoring program, as appropriate.

As part of the 5-year review established by the OU A ROD, the results of monitoring will be prepared by the Navy and submitted for review by the Alaska DEC. The 5-year review will evaluate the effectiveness of the selected remedies for petroleum-release sites at the former Adak Naval Complex. Based on this review, the Navy and the Alaska DEC will decide whether continued monitoring, or additional actions, are necessary at these former free-product recovery petroleum sites.

Table 9-1
Selected Cleanup Alternative(s) for Each Site

Site	Limited Groundwater Monitoring	Monitored Natural Attenuation and Institutional Controls	Product Recovery
GCI Compound		•	
SA 80		•	
Tanker Shed		•	•
SA 78		•	
SA 82	•		
SA 88	•		
SWMU 58/SA 73		•	
Yakutat Hangar	•		
NORPAC Hill	•		

10.0 ADDITIONAL ACTIVITIES

Additional removal or assessment activities will be performed at SA 80, SA 82, SA 88, SWMU 58/SA 73, Tanker Shed, and Yakutat Hangar to support the selection of the remedial alternatives. A description of the additional activities is provided below on a site-specific basis. A description of these activities is also provided in part 1 of the site characterization report (URS 2004a). The additional assessment activities to be performed are summarized in Table 10-1.

10.1 SA 80, STEAM PLANT NO. 4

The Navy will collect two additional soil samples in the vicinity of existing location 9. The goal of this sampling will be to evaluate the natural attenuation process within vadose zone soil by comparing the concentrations of petroleum-related chemicals in the soil samples to concentrations reported in soil samples collected during 1997. The soil samples will be collected at depths of 6 to 8 and 12 to 14 feet bgs. The samples will be chemically analyzed for DRO only. Figure 10-1 shows the location where these additional samples will be collected.

Because the risk assessment determined that petroleum-related chemicals in soil at this site pose no unacceptable risk to human health or the environment, no further action was determined for soil at SA 80. However, if new concentration data indicates unacceptable risk/hazard to human trespassers or ecological receptors, additional activities would be proposed to mitigate the risk. Potential risks/hazards posed to construction workers from exposure to these soils will be managed through existing institutional controls.

The Navy will collect one additional groundwater sample from groundwater monitoring well 04-173 (see Figure 10-1). If detected, free product will be removed from the well prior to sampling. The goal of this sampling will be to evaluate petroleum concentrations in the area where free product has been historically detected at SA 80. The sample will be chemically analyzed for DRO, GRO, and BTEX compounds.

Although free-product recovery endpoints have been met at this site, additional product recovery will be performed, as needed, as part of scheduled groundwater monitoring activities under the Comprehensive Monitoring Program. The Navy will perform annual free product monitoring as part of scheduled groundwater monitoring activities. Each of the existing wells at the site will be monitored for the presence of free-product. The Navy will remove free-product from on-site

wells, if the measured thickness is greater than 0.5 feet in a 2-inch well and greater than 0.1 feet in a 4- or 6-inch well.

10.2 SA 82, P-80/P-81 BUILDINGS

Although the risk assessment conducted for this site determined that risks posed to human and ecological receptors are within target health goals, an additional limited soil removal will be conducted at the SA 82, P-80/P-81 Buildings site. The goal of this limited soil removal is to remove shallow soils surrounding location 182 potentially containing elevated concentrations of DRO in order to eliminate potential exposure of these soils to ecological receptors. The area of the limited soil removal is identified on Figure 10-2. This soil removal will extend to a maximum depth of 6 feet bgs and will be limited to an area 10 feet square centered on location 182. The anticipated volume of soil to be removed at this location will be approximately 22 cubic yards. One soil sample will be collected from the bottom of the excavation for chemical analyses to demonstrate the effectiveness of the removal activity. The sample will be analyzed for DRO only. The excavation will be performed in conjunction with larger soil removal actions scheduled at other sites on Adak Island.

10.3 SA 88, P-70 ENERGY GENERATOR

The Navy will collect four additional groundwater samples from groundwater monitoring wells 12-252, 12-162, 12-163, and 12-198. Figure 10-3 shows the locations where the additional groundwater samples will be collected. If detected in any of the wells, free product will be removed prior to sampling. The goal of this sampling is to provide updated petroleum concentration data for these four locations. These locations have not been sampled since 1997. The samples will be chemically analyzed for DRO, GRO, and BTEX compounds.

Although free-product recovery endpoints have been met at this site, additional product recovery will be performed, as needed, as part of scheduled groundwater monitoring activities under the Comprehensive Monitoring Program. The Navy will perform annual free product monitoring as part of scheduled groundwater monitoring activities. Each of the existing wells at the site will be monitored for the presence of free-product. The Navy will remove free-product from on-site wells, if the measured thickness is greater than 0.5 feet in a 2-inch well and greater than 0.1 feet in a 4- or 6-inch well.

10.4 SWMU 58 AND SA 73, HEATING PLANT NO. 6

The Navy will collect one additional soil sample during replacement of well 12-203. The goal of this sampling will be to evaluate the natural attenuation process within vadose zone soil by comparing the concentrations of petroleum-related chemicals in the soil sample to concentrations reported in soil samples collected during 1997. The soil sample will be collected at a depth of 9 to 11 feet bgs during well installation activities. The soil sample will be chemically analyzed for DRO only. In addition, the existing 0.5-inch diameter well (12-203) will be replaced with a 2-inch diameter well to better facilitate groundwater monitoring in this portion of the site. Figure 10-4 shows the location for this replacement well.

Because the risk assessment determined that petroleum-related chemicals in soil at this site pose no unacceptable risk to human health or the environment, no further action was determined for soil at SWMU 58/SA 73. However, if new concentration data indicates unacceptable risk/hazard to human trespassers or ecological receptors, additional activities would be proposed to mitigate the risk. Potential risks/hazards posed to construction workers from exposure to these soils will be managed through existing institutional controls.

The Navy will collect two additional groundwater samples from groundwater monitoring wells 12-203 and 12-110 (see Figure 10-4). If detected in any of the wells, free product will be removed prior to sampling. The goal of this sampling is to provide updated petroleum concentration data for these two locations. These locations have not been sampled since 1997. The samples will be chemically analyzed for DRO, GRO, and BTEX compounds.

In addition, the Navy will collect one surface water sample from the downstream end of the two on-site drainage ditches prior to their discharge into CDAA (circular disposed antenna array) Creek. The goal of this sampling is to evaluate contaminant loading from groundwater into surface water within the drainage ditches prior to their discharge into CDAA Creek. Figure 10-3 shows the trace of these ditches, identifies the sections of the ditches that are contained within underground piping, and presents the surface water sampling location. The water sample will be chemically analyzed for DRO, GRO, and BTEX compounds. Results of the chemical analyses will be compared to the applicable Alaska Water Quality Standards in 18 AAC 70. If concentrations are below the applicable Water Quality Standards the Navy will discontinue surface water monitoring in the ditches. If concentrations exceed the applicable Water Quality Standards, the Navy proposes to repeat the surface water monitoring on an annual basis as part of the Monitored Natural Attenuation remedy selected for the site.

Although free-product recovery endpoints have been met at this site, additional product recovery will be performed, as needed, as part of scheduled groundwater monitoring activities under the Comprehensive Monitoring Program. The Navy will perform annual free product monitoring as part of scheduled groundwater monitoring activities. Each of the existing wells at the site will be monitored for the presence of free-product. The Navy will remove free-product from on-site wells, if the measured thickness is greater than 0.5 feet in a 2-inch well and greater than 0.1 feet in a 4- or 6-inch well.

10.5 TANKER SHED

The Navy will collect one additional soil sample from a location half way between locations TSSB9 and TSSB10 at a depth of 5 to 7 feet bgs. This sample will be chemically analyzed for DRO, GRO, and BTEX compounds. Figure 10-5 shows the location where this additional sample will be collected. The goal of this sampling is to evaluate the lateral extent of petroleum-related chemicals identified in this area.

Because the risk assessment determined that petroleum-related chemicals in soil at this site pose no unacceptable risk to human health or the environment, no further action was determined for soil at the Tanker Shed. However, if the new concentration data indicates an unacceptable risk/hazard to human trespassers or ecological receptors, additional activities would be proposed to mitigate the risk. Risks/hazards posed to construction workers from exposure to these soils would be managed through existing institutional controls.

The Navy will also install one additional groundwater monitoring well downgradient from existing well 04-601, upgradient from the East Canal, and south of the paved area. A well installed in this area would provide an additional downgradient monitoring point that would be used to evaluate the effectiveness of the selected remedy. Figure 10-5 shows the location for this well. Groundwater samples collected from this location will be tested for GRO, DRO, BTEX compounds, and MNA parameters.

10.6 YAKUTAT HANGAR

The Navy will sample surface water within the drainage ditch located north-northwest from the product recovery trench, prior to the surface water discharge into South Sweeper Creek. Figure 10-6 identifies the proposed sampling locations. The goal of this sampling is to evaluate contaminant loading from groundwater into surface water within the drainage ditch prior to its

discharge into South Sweeper Creek and confirm the results of the modeling conducted in part 2 of the site characterization report (URS 2004a).

A surface water sample will be collected from within the drainage ditch near well 05-222 (proposed Location No. 1) if sufficient flow is found. If flow is not sufficient to obtain a surface water sample within this section of the ditch, a sample will be collected near well 05-801 (proposed Location No. 2). However, because the ecological risk assessment has determined South Sweeper Creek to be the closest ecologically sensitive environment to the Yakutat Hangar site, the Navy will also collect one surface water sample where the ditch discharges into South Sweeper Creek, which is the regulatory point of compliance (Figure 10-6). The surface water samples will be analyzed for DRO, GRO, and BTEX compounds. Results of the chemical analyses will be compared to the applicable Alaska Water Quality Standards in 18 AAC 70. If concentrations are below the applicable Water Quality Standards, the Navy will discontinue surface water monitoring in this ditch. If concentrations exceed the applicable Water Quality Standards, the Navy proposes to repeat the surface water monitoring on an annual basis as part of the Limited Groundwater Monitoring remedy selected for the site.

U.S. NAVY

Figure 10-1
Soil and Groundwater Sampling Locations
SA 80, Steam Plant 4
USTs 27089 and 27090

Delivery Order 0037
Adak Island, AK
DECISION DOCUMENT

FILENAME: T:\ADAK\IDIQ\Sub-Tasks\DO 37\DD\Figure 10-1.dwg
EDIT DATE: 01/21/05 AT: 13:24

LEGEND

- 25 — Elevation Contour (ft Above MLLW)
- Road
- Fence
- Monitoring Well
- Abandonded Monitoring Well
- Geoprobe Well
- Soil Boring
- Geoprobe

Chemical Concentrations in Soil (mg/kg)

04-211	10/10/96	Sample Date
	15 to 17	Sample Depth Interval (ft bgs)
	12	DRO
	12	GRO
	0.06	Benzene
	0.08	Toluene
	0.38	Ethylbenzene
	1.4	Total Xylenes

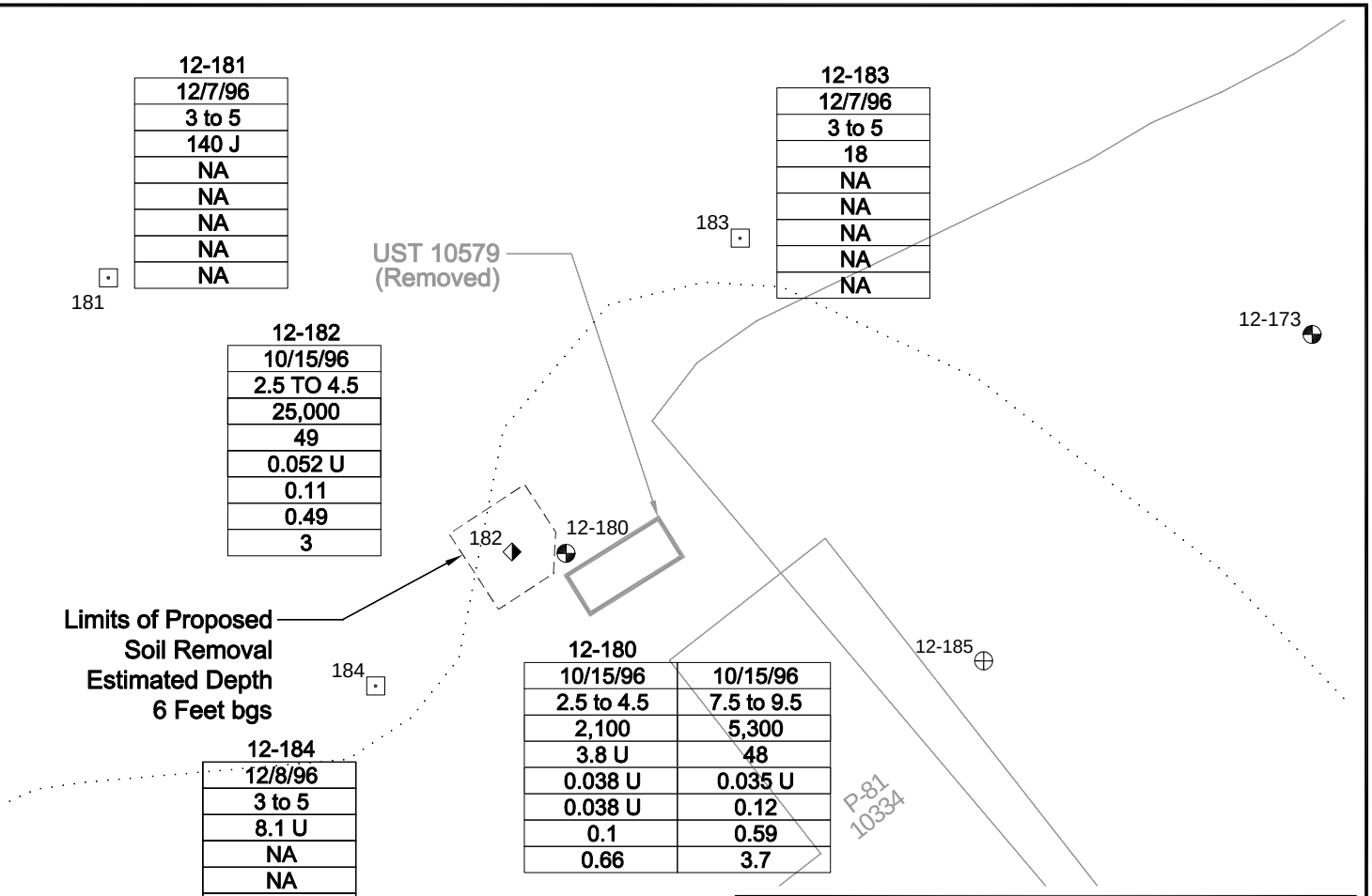
U Chemical Not Detected at Concentration Shown

J Estimated Concentration

bgs Below Ground Surface

NA Not Analyzed

Note:
Estimated volume of soil to be removed is 22 cubic yards.



Alaska DEC Method 2 Soil Criteria Over 40-Inch Rainfall Zone

	Ingestion	Inhalation	Migration to Groundwater
DRO	8,250 mg/kg	12,500 mg/kg	230 mg/kg
GRO	1,400 mg/kg	1,400 mg/kg	260 mg/kg
Benzene	230 mg/kg	6.4 mg/kg	0.02 mg/kg
Toluene	17,000 mg/kg	180 mg/kg	4.8 mg/kg
Ethylbenzene	8,300 mg/kg	89 mg/kg	5 mg/kg
Total xylenes	166,000 mg/kg	81 mg/kg	69 mg/kg

Note: These criteria levels are specified for petroleum release sites at Adak in the Record of Decision for Operable Unit A.

U.S. NAVY

N

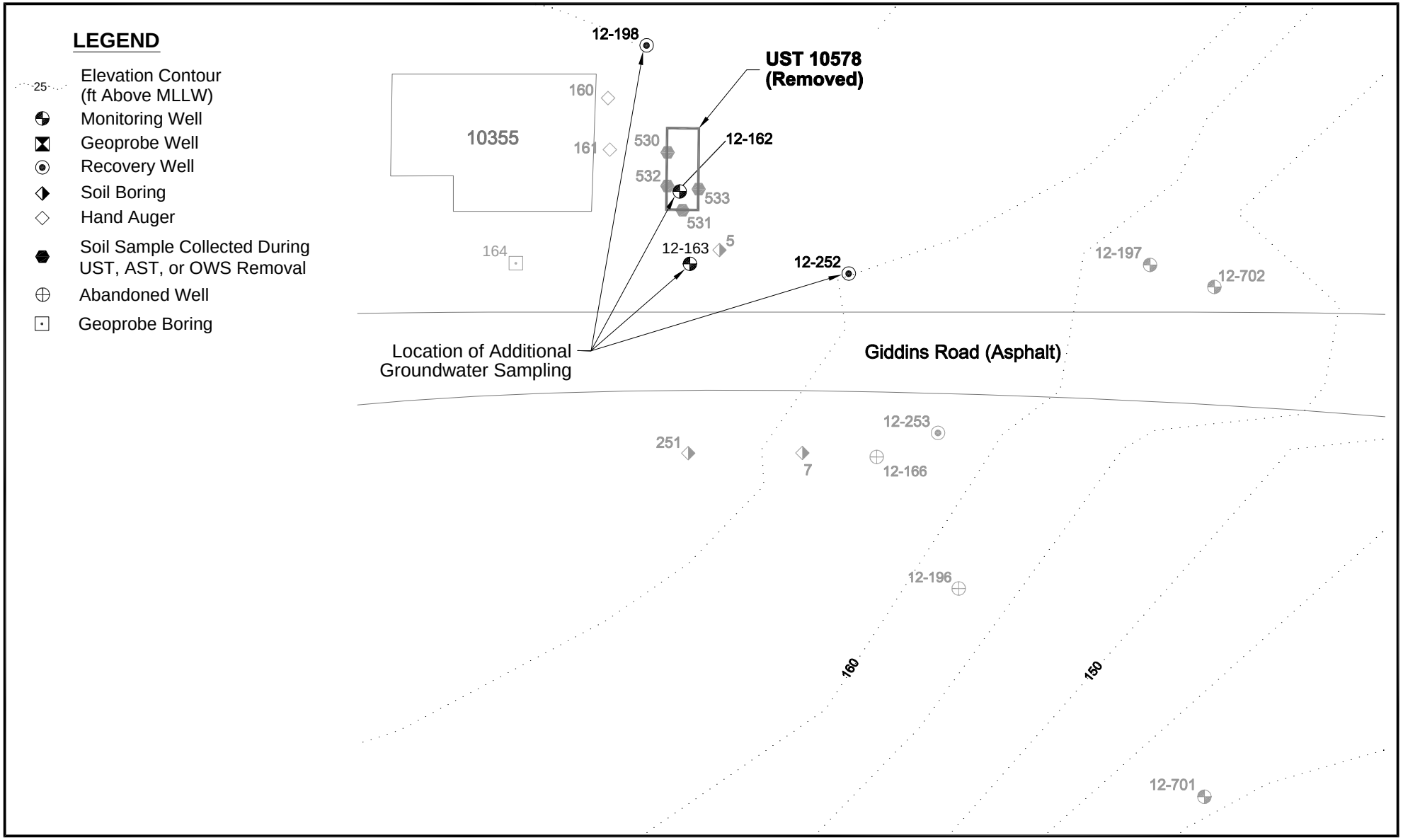
0 10 20

SCALE IN FEET

Figure 10-2
Extent of Limited Soil Removal
SA 82, P-80/P-81 Buildings

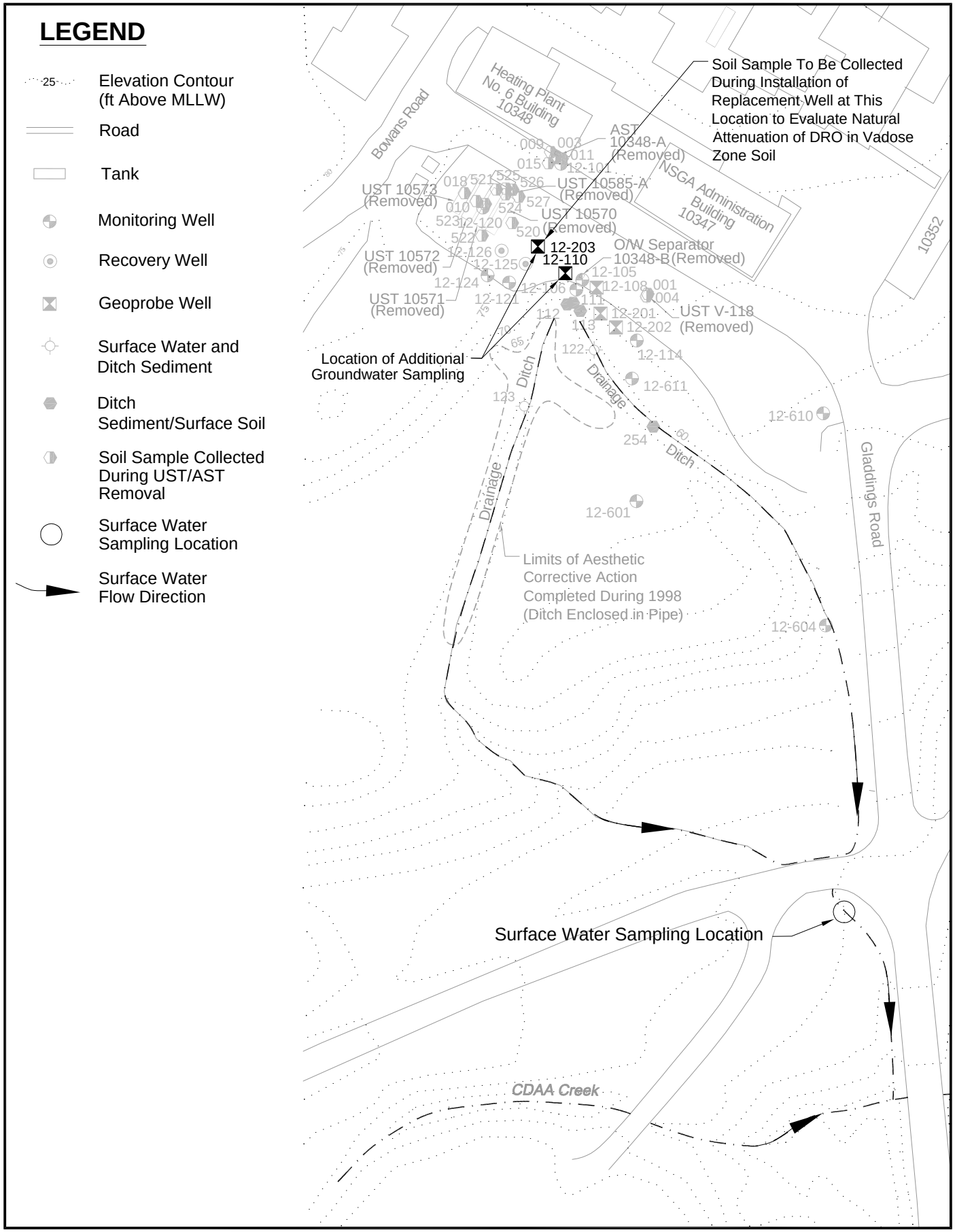
Delivery Order 0037
Adak Island, AK
DECISION DOCUMENT

FILENAME: T:\ADAK\IDIQ\Sub-Tasks\DO 37\DD\Figure 10-2.dwg
EDIT DATE: 03/17/05 AT: 15:36



U.S. NAVY	N; 0 15 30 SCALE IN FEET	**Figure 10-3** **Groundwater Sampling Locations** **SA 88, P-70 Energy Generator, UST 10578**	Delivery Order 0037 Adak Island, AK DECISION DOCUMENT

FILENAME: T:\ADAK\IDIQ\Sub-Tasks\DO 37\DD\Figure 10-3.dwg
EDIT DATE: 03/17/05 AT: 15:43



FILENAME: T:\ADAK\DIQ\Sub-Tasks\DO 37\DD\Figure 10-4.dwg
EDIT DATE: 03/17/05 AT: 15:51

U.S. NAVY

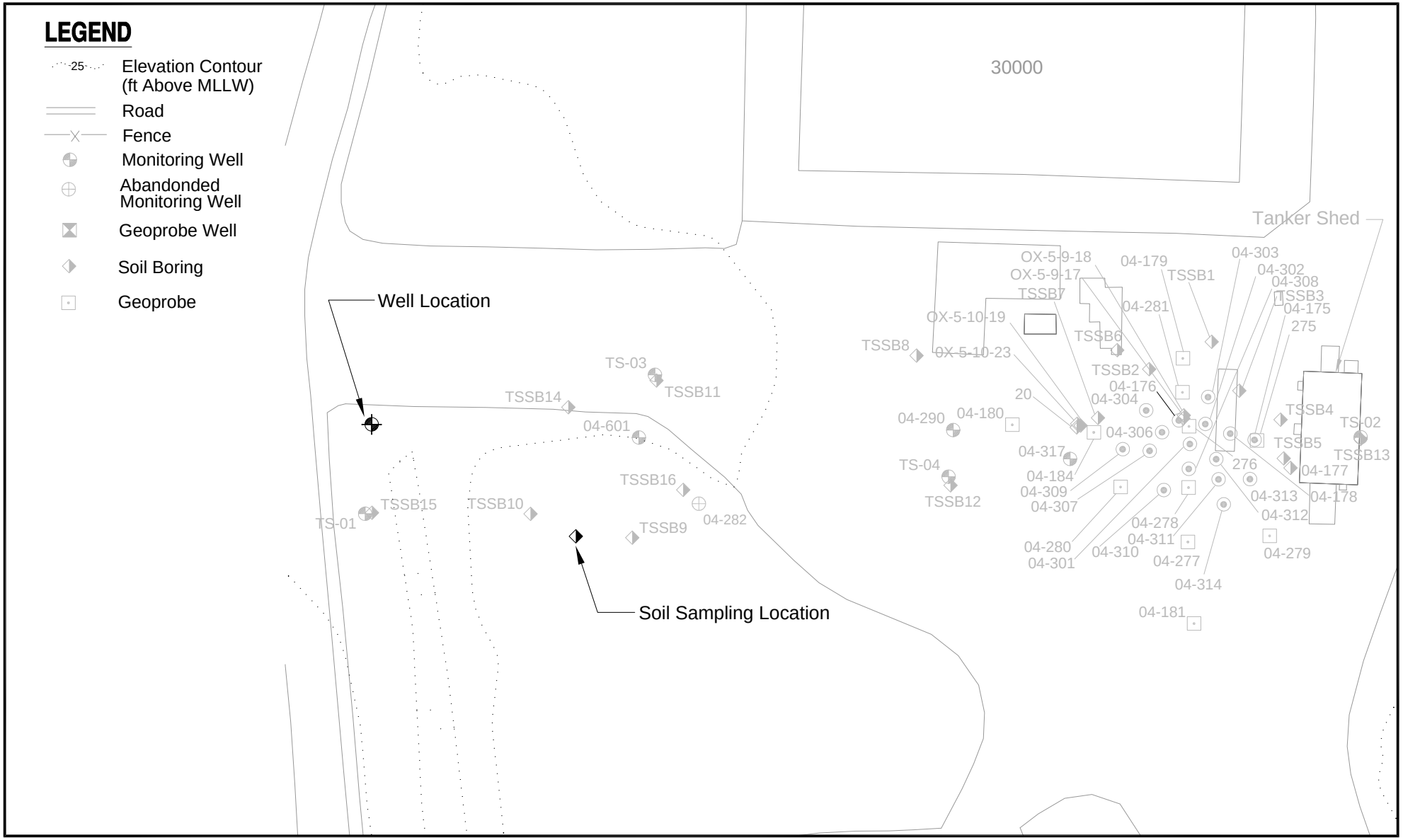
N

0 60 120

SCALE IN FEET

Figure 10-4
Soil, Groundwater, and Surface Water Sampling Locations, SWMU 58 and SA 73, Heating Plant No. 6

Delivery Order 0037
Adak Island, AK
DECISION DOCUMENT

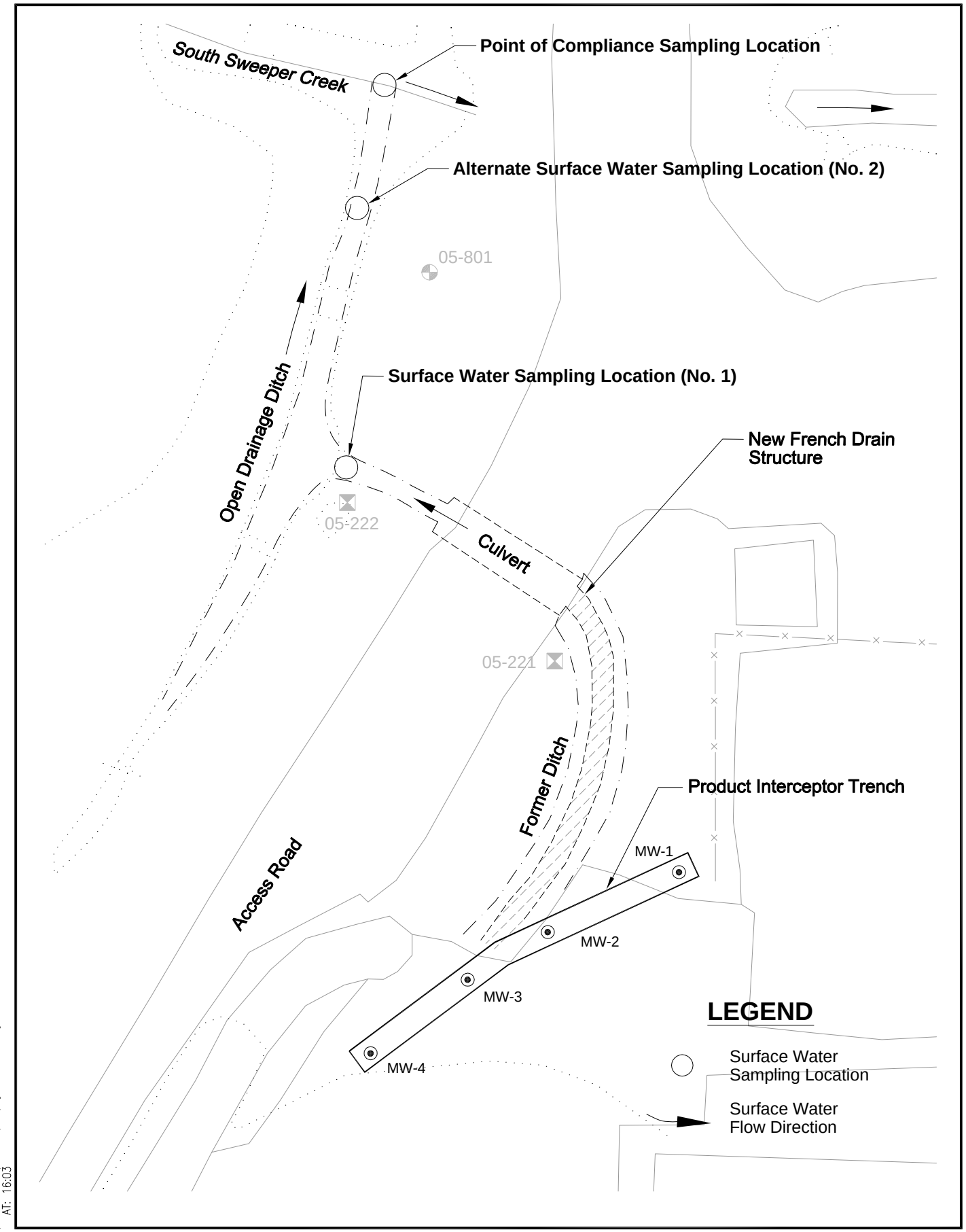


U.S. NAVY

Figure 10-5
Soil and Groundwater Sampling Locations
Tanker Shed, UST 42494

Delivery Order 0037
Adak Island, AK
DECISION DOCUMENT

FILENAME: T:\ADAK\IDIQ\Sub-Tasks\DO 37\DD\Figure 10-5.dwg
EDIT DATE: 03/17/05 AT: 15:58



FILENAME: T:\ADAK\IDIQ\Sub-Tasks\DO 37\DD\Figure 10-6.dwg
EDIT DATE: 03/17/05 AT: 16:03

U.S. NAVY	N 0 25 50 SCALE IN FEET	**Figure 10-6** **Surface Water Sampling Locations** **Yakutat Hangar**	Delivery Order 0037 Adak Island, AK DECISION DOCUMENT

Table 10-1
Additional Assessment Activities

Site	Samples	Analyses	Goals	Potential Impacts
SA 80	1 GW	DRO, GRO, BTEX	Provide petroleum concentration data for one location	Better evaluate effectiveness of selected remedy.
	2 soil	DRO	Evaluate natural attenuation in vadose zone soil	If recalculation of risk including new data shows potential unacceptable risk, then additional remedial activities will be evaluated
Tanker Shed	2 soil[a]	DRO, GRO, BTEX	Evaluate lateral extent of petroleum-related chemicals	
	1 GW	DRO, GRO, BTEX, MNA Parameters	Provide additional downgradient monitoring point for MNA	Better evaluate effectiveness of selected remedy.
SA 88	4 GW	DRO, GRO, BTEX	Provide updated petroleum concentration data for four locations	Better evaluate effectiveness of selected remedy.
SWMU 58/SA 73	1 soil	DRO	Evaluate natural attenuation in vadose zone soil	If recalculation of risk including new data shows potential unacceptable risk, then additional remedial activities will be evaluated
	2 GW	DRO, GRO, BTEX	Provide updated petroleum concentration data for two locations	Better evaluate effectiveness of selected remedy.
	1 SW	DRO, GRO, BTEX	Evaluate contaminant loading from GW into surface water in drainage ditches prior to discharge into creek	If concentrations in surface water are above Alaska Water Quality Standards in 18 AAC 70, the Navy will include annual surface water monitoring in the monitoring program
Yakutat Hanger	2 SW	DRO, GRO, BTEX		

[a]Samples collected from two locations. More than one sample may be collected from one of the sampling locations planned at Tanker Shed.

Notes:
BTEX - benzene, toluene, ethylbenzene, and total xylenes
DRO - diesel-range organics
GRO - gasoline-range organics
GW - groundwater
MNA - monitored natural attenuation
SW - surface water

11.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

As discussed in Section 6, Alaska DEC regulation 18 AAC 75 specifies soil and groundwater cleanup criteria established for petroleum-release sites located within the State of Alaska. Cleanup levels specified for soil at free-product recovery petroleum sites on the Former Adak Naval Complex are based on Alaska DEC Method Four criteria [18 AAC 75.340(a)(4)]. Cleanup levels specified for groundwater at free-product recovery petroleum sites on the former Adak Naval Complex are based on the use of groundwater as a drinking water source [18 AAC 75.345(b)(1)], or 10 times these levels if the groundwater is not a current source of drinking water, or is not reasonably expected to be used as a future drinking water source [18 AAC 75.345(b)(2)].

In addition, Alaska regulations [18 AAC 75.345(f)] specify that groundwater hydrologically connected to nearby surface water may not cause a violation of the water quality standards in 18 AAC 70 for surface water. Free-product recovery petroleum sites at the former Adak Naval Complex that pose no risk to human health or the environment above target health goals and where groundwater has been determined to be closely connected to surface water include the following:

- NORPAC Hill Seep Area
- Yakutat Hangar (UST T-2039A)

Sampling results for the NORPAC Hill Seep Area indicated that petroleum-related compounds have not been detected in surface water at the site (see Section 4.9). Therefore, water quality criteria for surface water have been met at the NORPAC Hill Seep Area site. Surface water samples have not been collected from the drainage ditch at Yakutat Hangar which discharges into South Sweeper Creek. However, contaminant-loading modeling was performed and model results predicted that surface water quality criteria would be met at the site (see Section 4.8). In addition, surface water sampling is planned for the Yakutat Hangar site to confirm the predictions of the model (see Section 10.6).

12.0 PUBLIC INVOLVEMENT

12.1 PUBLIC INVOLVEMENT ACTIVITIES

The Navy established a community involvement program in 1994 to provide interested Alaska citizens and Adak residents with timely and updated information on the environmental cleanup and the transfer and reuse of Navy land and facilities. The community involvement program also provides a mechanism for public input on environment cleanup decisions. Information is conveyed to the public via fact sheets and newsletters, Restoration Advisory Board (RAB) meetings and other formal public meetings, web site announcements (www.adakupdate.com), information repositories on Adak Island (Bob Reeve High School building, second floor) and in Anchorage (University of Alaska library, reserve room), and the administrative record file located at Naval Facilities Engineering Command, Engineering Field Activity, Northwest, Poulsbo, Washington. In addition, a mailing list is maintained and updated to inform concerned citizens of upcoming meetings and significant activities, such as public comment periods. Public input is obtained through RAB meetings and other formal public meetings, community interviews, requests for public comments, and a telephone hotline.

The Navy and the Alaska DEC held a public meeting on September 20, 2004 to present the proposed plan (U.S. Navy and Alaska DEC 2004) for the 10 petroleum-contaminated sites. The proposed plan was then provided to the public for review during the 30-day public comment period beginning on October 1, 2004. In addition, the Alaska DOT and TAC (both current landowners) were provided copies of the site characterization report (URS 2004a) and the proposed plan (U.S. Navy and Alaska DEC 2004) and were invited to comment on these documents. Only one comment was received. This comment was received via e-mail from the Alaska Department of Transportation. This comment and the Navy's response to the comment is provided in the Responsiveness Summary section.

12.2 FUTURE CONTACTS

Adak community members are encouraged to contact Navy and Alaska DEC site managers with questions or comments. The Navy and Alaska DEC site managers are:

Mark Wicklein, P.E.
Engineering Field Activity, Northwest
Naval Facilities Engineering Command
19917 Seventh Avenue NE
Poulsbo, WA 98370-7570
Phone: (360) 396-0226
Fax: (360) 396-0857
Email: mark.wicklein@navy.mil

Jason Weigle
Alaska Department of Environmental Conservation
555 Cordova St.
Anchorage, AK 99502
Phone: (907) 269-7528
Fax: (907) 269-7649
Email: jason_weigle@dec.state.ak.us

13.0 RESPONSIVENESS SUMMARY

Comment Received from Ron Stroman of the Alaska Department of Transportation via E-Mail on November 30, 2002:

First off, the department's effort isn't to obstruct the Navy's clean up effort or even to obtain an ACL (Alternative Cleanup Level) for the tanker shed site. Our intent is for the Navy to continue to recover free product from this site until the product thickness measurement is NP (no measurable product in well) on average for a 12 to 18 month period. I understand that an agreement (ROD-Record of Decision) has been made with ADEC (and EPA ?) albeit before ADOT was in the picture, that if the annual average of recovered product in a given well is below 5 gallons (how did this figure come into being?) then no further efforts will be advanced.

I fully understand that the level of contamination remaining in the ground will not likely cause any human health risks unless there is a considerably long exposure period. I also understand that during any intrusion into the contamination through any project the department may have for this site will create minimal risk, albeit at a higher cost, for the construction crew as long as they wear protective clothing.

Our main concern Mark is what this contamination, in the level that is there, will have on any proposed future airport improvement projects. The August and September Monthly Technical Reports indicate that in excess of 10 gallons of free product has been extracted from this site. While this figure probably isn't representative or indicative of the actual saturation level of the site, it does indicate that there is enough free product within the soil that any project within this area will likely encounter this saturated material, to what extend isn't known at this time but is likely to be enough to cause a considerable increase in project costs.

It is this that requires the State to seek agreement with the Navy and the ADEC for the Navy's continuing efforts, at regularly scheduled times, to continue to monitor and extract product from the tanker shed site until there is insufficient detect levels over a period of time, say 12 to 18 months. I look forward to meeting with you on December 6 to discuss the particulars of my request.

Response:

Alternative 4, Product Recovery, has been selected for the Tanker Shed site. Additionally, free-product recovery has already been implemented at Tanker Shed. Because endpoint criteria for free product have not yet been achieved, free product recovery activities were restarted at Tanker

Shed in August of 2004. Although data from this recovery effort could not be in incorporated into this document since the recovery effort is not complete and the entirety of the data was not available in time for inclusion, a review of the data indicates the extent of free product is decreasing. The area of free-product at Tanker Shed has reduced, via natural attenuation and recovery, to the proximity of Well 4-309, only. Currently, there is only 0.01 inches of product in this well, and no product is observed in any other well.

As specified in the OU A ROD, the Navy will be removing free-product from Tanker Shed to the endpoint criterion of 5 gallons per month (rolling average) during the current recovery effort. Removing all of the free product from the soil could not occur without a removal of all buildings, pavement, and soil from the area. This is unreasonable given that future site development construction costs would not be significantly reduced if the Navy were to remove all measurable free product when compared to removing free product to the OU A ROD-specified endpoint criterion. Even with no measurable product, residual product will still exist and most likely will be encountered during construction.

Any construction contract can and should describe the contamination present, including the residual free-product a contractor may encounter during work. The value of construction contracts let for work in this area will be higher than if the area was not contaminated. Construction contracts for work performed at any industrial site where contamination is known to be present typically present a potential risk of increased costs to property owners. However, no site can be practicably investigated to the point where all subsurface conditions are known and no risk exists. The proposed removal of free-product beyond what is specified in the OU A ROD is not necessary to protect human health and the environment, nor to reduce construction costs.

However, once free-product endpoints have been met, additional free product will be performed, as needed, as part of scheduled groundwater monitoring activities under the Comprehensive Monitoring Program. The Navy will perform annual free product monitoring as part of scheduled groundwater monitoring activities. Each of the existing wells at the site will be monitored for the presence of free-product. The Navy will remove free-product from on-site wells, if the measured thickness is greater than 0.5 feet in a 2-inch well and greater than 0.1 feet in a 4- or 6-inch well.

14.0 REFERENCES

Adak Reuse Corporation (ARC). 2000. Economic Reuse Study Phase II: Engineering Analyses, Adak Naval Air Facility. Prepared by ASCG Incorporated. September 14, 2000.

Alaska Department of Environmental Conservation (ADEC). 2000. *Guidance for Cleanup of Petroleum Contaminated Sites.* September 2000.

Bristol Environmental & Engineering Services Corporation (BEESC). 1998. Final Closure Report, Petroleum Aesthetic Corrective Action, East Airport Ditch, NSGA Heating Plant #6, South Runway Area, Naval Facility Adak, Alaska, Adak Island, Alaska. Prepared for Engineering Field Activity, Northwest, under Contract No. N44255-98-D-9951/DO #0004. Anchorage, Alaska. October 29, 1998.

Dames & Moore. 1991. *Basis of Design, Outline Specifications, and Cost Estimates, 35% Submittal – UST Removal, Naval Security Group Activity, Adak, Alaska.* (Includes tanks number 10578, 10518A, 10582, 10588, 10517A, and 10592). Prepared for U.S. Navy by Dames & Moore, Seattle, Washington. August 16, 1991.

EMCON. 1996a. *Final Addendum to the Release Investigation Work Plan, Naval Air Facility (NAF) Sites, Adak, Alaska.* Prepared for U.S. Navy by EMCON, Bothell, Washington. June 25, 1996.

———. 1996b. *Final Release Investigation Work Plan: Naval Air Facility (NAF) Sites, Adak, Alaska.* Bothell, Washington. March 8, 1996.

Foster Wheeler. 2002. *Final Report of Findings, Monitored Natural Attenuation Sampling, Adak, Alaska.* Prepared for Engineering Field Activity, Northwest, under Contract No. N44255-01-D-2000. Poulsbo, Washington. October 18, 2002.

———. 1997. *Source Investigation and Recovery Trench Installation Report, Investigation and Response Action, Yakutat Hobby Complex, Naval Air Facility, Adak, Alaska.* Delivery Order 0073. Prepared for U.S. Navy Contract No. N44255-93-D-4050. May 2, 1997.

Johnson, P.C., M.W. Kemblowski, and R.L. Johnson. 1999. Assessing the Significance of Subsurface Contaminant Vapor Migration to Enclosed Spaces: Site-Specific Alternatives to Generic Estimates. J. of Soil Contamination, Vol. 8, No. 3, pp389-421, 1999.

Johnson, P.C. and R. Ettinger. 2000. The Johnson-Ettinger Model Revealed and the Cutting Edge of Vapor Intrusion Science. RCRA Corrective Action EI Forum, August 15, 2000. Audio available at: http://www.clu-in.org/eiforum2000/agenda.cfm.

Quest. 1993a. *Project Report, Tank #10583 Removal at NSGA, Adak NAS, AK.* Prepared for U.S. Navy by Quest Environmental, Anchorage, Alaska. September 9, 1993.

———. 1993b. *Project Report, Tank #10578 Removal at NSGA, Adak NAS, AK.* Prepared for U.S. Navy, Anchorage, Alaska. September 9, 1993.

———. 1993c. *Project Report, Tank #10585A Removal at NSGA, Adak NAS, AK.* Prepared for U.S. Navy by Quest Environmental, Anchorage, Alaska. September 9, 1993.

Shannon & Wilson, Inc. 1996a. *UST 10570 Site Assessment, Heating Plant No. 6, Adak Naval Air Facility, Adak, Alaska.* Anchorage, Alaska. June 1996.

———. 1996b. *UST 10571 Site Assessment, Heating Plant No. 6, Adak Naval Air Facility, Adak, Alaska.* Anchorage, Alaska. June 1996.

———. 1993a. *Tank T27090 Closure Assessment, Adak Naval Air Station, Adak, Alaska.* Prepared for Linder Construction under U.S. Navy CLEAN. Anchorage, Alaska. November 1993.

———. 1993b. *Tank T-2039A Closure Assessment, Adak Naval Air Station, Adak, Alaska.* Prepared for Engineering Field Activity, Northwest. Anchorage, Alaska. October 1993.

———. 1992. *Additional Site Assessment Sampling, Construct Bachelors Enlisted Quarters, Naval Security Group Activity, Adak, Alaska.* Anchorage, Alaska. February 1992.

———. 1991. *Environmental Site Assessment Report for FY-92, P-069, Construct Bachelors Enlisted Quarters, Naval Security Group Activity, Adak, Alaska.* Anchorage, Alaska. June 1991.

URS Consultants, Inc. (URS). 1996a. *Site Assessment Report: Underground Storage Tank 42492, Tanker Shed (Building 42494), Naval Air Facility Adak, Adak, Alaska.* Prepared for Engineering Field Activity, Northwest, under CLEAN Contract No. N62474-89-D-9295. Seattle, Washington. January 1996.

———. 1996b. *Site Assessment Report: Underground Storage Tanks T-2039-B and -C, Yakutat Hangar Building T-2039, Naval Air Facility Adak, Adak, Alaska*. Prepared for

Engineering Field Activity, Northwest, under CLEAN Contract No. N62474-89-D-9295. Seattle, Washington. January 1996.

———. 1996c. Final Preliminary Source Evaluation 2 (PSE-2) Guidance Document, Operable Unit A, Naval Air Facility (NAF) Adak, Adak Island, Alaska. CTO-165. Prepared for Engineering Field Activity, Northwest, Southwest Division, Naval Facilities Engineering Command, Poulsbo, WA by URS Consultants, Seattle, WA.

———. 1996d. Final Remedial Investigation/Feasibility Study Management Plan, Adak Naval Complex, Adak Island, Alaska. CTO-203. Prepared for Engineering Field Activity, Northwest, Southwest Division, Naval Facilities Engineering Command, Poulsbo, WA by URS Consultants, Seattle, WA.

———. 1996e. Draft Methodology Report: Tiered Approach to Risk Assessment for Petroleum Site Cleanup. Naval Air Facility Adak, Adak Island, Alaska. CTO-213. Prepared for Engineering Field Activity, Northwest, Southwest Division, Naval Facilities Engineering Command, Poulsbo, WA by URS Consultants, Seattle, WA.

———. 1995a. *Final Groundwater Study Report, Operable Unit A, Naval Air Facility (NAF) Adak, Adak Island, Alaska*. Prepared for Engineering Field Activity, Northwest, under CLEAN Contract N62474-89-D-9295. Seattle, Washington. March 31, 1995.

———. 1995b. *Site Assessment Report: Underground Storage Tank GCI 1, GCI Compound, Naval Air Facility Adak, Adak, Alaska.* Prepared for Engineering Field Activity, Northwest, under CLEAN Contract No. N62474-89-D-9295. Seattle, Washington. October 1995.

———. 1995c. *Final Background Study Report for the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract, Northwest Area, Naval Air Facility (NAF) Adak, Adak Island, Alaska.* Prepared for Engineering Field Activity, Northwest, under Contract No. N62474-89-D-9295. Seattle, Washington. July 31, 1995.

———. 1995d. *Site Assessment Report, Underground Storage Tank (UST) 27089, Steam Plant #4, Naval Air Facility Adak, Adak, Alaska, CTO 0142*. Prepared for U.S. Navy CLEAN Contract No. N62474-89-D-9295. Seattle, Washington. May 1995.

———. 1995e. *Site Assessment Report, Underground Storage Tank 27089 (Source Area 80), Steam Plant No. 4, Naval Air Facility Adak, Adak, Alaska, CTO 0142*. Prepared for U.S. Navy CLEAN Contract No. N62474-89-D-9295. Seattle, Washington. November 1995.

———. 1995f. *Final Preliminary Source Evaluation 2 (PSE-2) Report for Batch 1 Sites, Operable Unit A, Adak Naval Complex, Adak, Alaska.* Prepared for Engineering Field Activity, Northwest, under CLEAN Contract N62474-89-D-9295. Seattle, Washington. June 1995.

———. 1995g. *Exploratory Excavation at NSGA Old Transportation Building 10354 for UST 10584.* Prepared for Engineering Field Activity, Northwest, under CLEAN Contract N62474-89-D-9295. Seattle, Washington. November 10, 1995.

———. 1995h. *Site Assessment Report: Aboveground Storage Tank (AST) 10333, NSGA Building P-80, Naval Air Facility Adak, Adak, Alaska.* Prepared for U.S. Navy CLEAN Contract No. N62474-89-D-9295. Seattle, Washington. May 1995.

———. 1995i. *Site Assessment Report, Underground Storage Tanks (USTs) 10572 and 10573, NSGA Power Plant #6, Naval Air Facility Adak, Adak, Alaska.* Prepared for Engineering Field Activity, Northwest, under CLEAN Contract N62474-89-D-9295. Seattle, Washington. May 31, 1995.

———. 1995j. *Site Assessment Report, Underground Storage Tank (UST) V-118, NSGA Parking Lot, Naval Air Facility Adak, Adak, Alaska.* Prepared for Engineering Field Activity, Northwest, under CLEAN Contract N62474-89-D-9295. Seattle, Washington. May 31, 1995.

———. 1995k. *Site Assessment Report, Aboveground Storage Tank (AST) 10348A, NSGA Power Plant #6, Naval Air Facility Adak, Adak, Alaska.* Prepared for Engineering Field Activity, Northwest, under CLEAN Contract N62474-89-D-9295. Seattle, Washington. May 31, 1995.

———. 1995l. *Site Assessment Report, Oil/Water Separator (O/W) 10348B, NSGA Parking Lot, Naval Air Facility Adak, Adak, Alaska.* Prepared for Engineering Field Activity, Northwest, under CLEAN Contract N62474-89-D-9295. Seattle, Washington. May 31, 1995.

———. 1994. *Final Release Investigation Report: Tank Farm B, Tank Farm D, Main Road Pipeline, and Steam Plant No. 4 USTs, Naval Air Station (NAS), Adak, Alaska.* Prepared for Engineering Field Activity, Northwest, under CLEAN Contract No. N62474-89-D-9295. Seattle, Washington. February 10, 1994.

URS Greiner, Inc. (URSG). 2000a. *Draft Free-Product Recovery Closure Report, Adak Naval Complex, Adak Island, Alaska.* Prepared for Engineering Field Activity, Northwest, under CLEAN Contract No. N62474-89-D-9295. Seattle, Washington. August 30, 2000.

———. 2000b. *Final Limited Soil Removal Report, Adak Naval Complex, Adak Island, Alaska.* Prepared for Engineering Field Activity, Northwest, under CLEAN Contract No. N62474-89-D-9295. Seattle, Washington. June 2000.

———. 1999a. *Final Site Summary Report for Free-Product Petroleum Sites, Adak Naval Complex, Adak Island, Alaska.* 2 vols. Prepared for Engineering Field Activity, Northwest, under CLEAN Contract No. N62474-89-D-9295. Seattle, Washington. March 1999.

———. 1999b. *Final Addendum, Final Focused Feasibility Study for Petroleum Sites, Adak Naval Complex, Adak Island, Alaska.* Prepared for Engineering Field Activity, Northwest, under CLEAN Contract No. N62474-89-D-9295. Seattle, Washington. June 3, 1999.

———. 1999c. *Letter Report of a Limited Subsurface Investigation, NORPAC Hill Seep Area, Adak, Alaska.* Prepared for Engineering Field Activity, Northwest, under CLEAN Contract No. N62474-89-D-9295. Seattle, Washington. November 24, 1999.

———. 1998a. *Draft Site Investigation Report NORPAC Hill Seep Area, Adak Naval Complex, Adak Island, Alaska.* Prepared for Engineering Field Activity, Northwest, under CLEAN Contract No. N62474-89-D-9295. Seattle, Washington. November 25, 1998.

———. 1998b. *Final Focused Feasibility Study for Petroleum Sites, Adak Naval Complex, Adak Island, Alaska.* Prepared for Engineering Field Activity, Northwest, under CLEAN Contract No. N62474-89-D-9295. Seattle, Washington. January 16, 1998.

URS Group, Inc. (URS). 2004a. *Final Site Characterization Report, Parts 1 and 2, Free-Product Recovery Petroleum Sites with Risks Below Target Health Goals, Former Adak Naval Complex, Adak Island, Alaska*. Prepared for Engineering Field Activity, Northwest, Naval Facilities Engineering Command under U.S. Navy Contract No. N44255-02-D-2008. Poulsbo, Washington. September 2004.

———. 2004b. *Comprehensive Monitoring Plan, Revision 1, Operable Unit A, Volumes 1 and 2, Former Adak Naval Complex, Adak Island, Alaska.* Prepared for Engineering Field

Activity, Northwest, under Contract No. N44255-02-D-2008. Seattle, Washington. March 2004.

———. 2004c. Draft Addendum to Site Characterization Report, Tanker Shed, UST 42494, Former Adak Naval Complex, Adak Island, Alaska. Prepared for Engineering Field Activity, Northwest, under Contract No. N44255-02-D-2008. Seattle, Washington.

———. 2001. *Saltwater Intrusion Investigation Report, Downtown Groundwater Body, Former Adak Naval Complex, Adak Island, Alaska.* Prepared for Engineering Field Activity, Northwest, under Contract No. N44255-00-D-2476. Seattle, Washington. December 10, 2001.

U.S. Environmental Protection Agency (USEPA). 2003. Integrated Risk Information System (IRIS) Online Database (http://www.epa.gov/iris/index.html). May 2003.

———. 2002a. *U.S. EPA Region 9 Preliminary Remedial Goal (PRG) Table and Supplemental Information*. October 2002.

U.S. Navy and Alaska Department of Environmental Conservation (ADEC). 2004. Proposed Plan for Petroleum Sites with No Unacceptable Risk, Former Adak Naval Complex, Adak Island, Alaska. September 2004.

U.S. Navy, U.S. Environmental Protection Agency (USEPA), and Alaska Department of Environmental Conservation (ADEC). 2000. *Draft Final Record of Decision for Operable Unit A, Former Adak Naval Complex, Adak Island, Alaska.* Final. Prepared by URS Greiner, Inc., for Engineering Field Activity, Northwest, under CLEAN Contract No. N62474-89-D-9295. Poulsbo, Washington. Accepted as final, April 2000.

———. 1998. Proposed Plan for Cleanup Action at Petroleum Sites on Adak Island. January 1998.