9. TNT/RDX CONTAMINATED SITES

Remedial action is required for five sites contaminated with TNT and RDX: TNT at the Fire Station II Zone and Range Fire Burn Area, the Experimental Field Station, Land Mine Fuze Burn Area, and NOAA soil sites, and RDX at the NODA Area 2 soil site. These five sites are also located within the ordnance areas (discussed in section 8) and are subjected to the selected remedial action for those areas as well. Figure 17 shows the location of the five TNT/RDX contaminated sites within the NPG. Although risks for the five contaminated soil sites were analyzed individually, they were considered collectively for the analysis of remedial alternatives. Therefore, Sections 9.1 through 9.5 each addresses a single site, including a summary of the site investigations, nature and extent of contamination, and baseline risk estimates. Ingestion of homegrown produce, dermal absorption of soil, and ingestion of groundwater are the only human health exposure routes with unacceptable estimated risk for the TNT/RDX contaminated soil sites. Subsequent sections present the analysis of alternatives for the entire group. Remedial action objectives, remedial alternatives, and the selected remedy are presented. More detailed information about the contaminated soil sites can be found in the OU 10-04 Comprehensive RI/FS report (DOE-ID 2001). Figure 18 presents photographs of soil contaminated with TNT and RDX fragments present in the TNT/RDX contaminated areas.

9.1 Site: Fire Station II Zone and Range Fire Burn Area

The Fire Station II Zone and Range Fire Burn Area will be remediated to address the risk to human and ecological receptors posed by contaminated soil. Site investigations, the nature and extent of contamination, and a summary of site risks are presented below.

The Fire Station II Zone and Range Fire Burn Area is located adjacent to the Fire Station II training site for the INEEL Fire Department (see Figure 17). It is located just east of Lincoln Boulevard at Mile Marker 5 and includes an area of contamination approximately 13 ha (33 acres) in size. Earlier NPG activities at the site included some low-order bomb detonations that scattered UXO and pieces of explosives over several areas of the site. In the early 1970s, the entire 800-acre area was engulfed by a range fire that reportedly burned some UXO. More detailed information about the Fire Station II Zone and Range Fire Burn Area can be found in the OU 10-04 Comprehensive RI/FS report (DOE-ID 2001).

9.1.1 Site Investigation

A 4-ha (10-acre) area was cleared to a depth of 0.61 m (2 ft) of UXO and pieces of explosives during the 1993 interim action, and only a few areas of explosive contaminated soils were found. A total of 20 samples were collected and analyzed from the area. The results ranged from 0.0 to 2,141 ppm for TNT and 0.0 to 4.7 ppm for RDX. Areas above the TNT action levels were excavated by hand until the verification sample results met the cleanup levels of 44 ppm.

During the 1996 field assessment, the entire site was assessed, including the area outside the 4-ha (10-acre) site that was cleared of ordnance during the 1993 interim action. The assessment included a visual examination for signs of craters, detonation tests, surface UXO, pieces of explosives, and soil contamination. The boundary of soil contamination was extended and mapped. The burn area was covered during the sweep of the downrange area. The area outside of the 4-ha (10-acre) site was walked at 10-m (33-ft) intervals. The area searched extended out to the last identified piece of TNT, which became the tentative outer boundary of the site. From this piece, the search moved laterally, until another piece of TNT could be located. The search then again extended out to confirm that no other pieces could be found and then retracted to the last peripheral piece, which was flagged as the boundary. This search process was repeated until the entire boundary was established. In addition to the Fire Station II Area, the Range Fire Burn Area also was assessed. The search team fanned out in approximately 10-m (33-ft) intervals from the Fire Station II training area and walked east and northeast toward the Experimental Field Station (DOE-ID 1998).

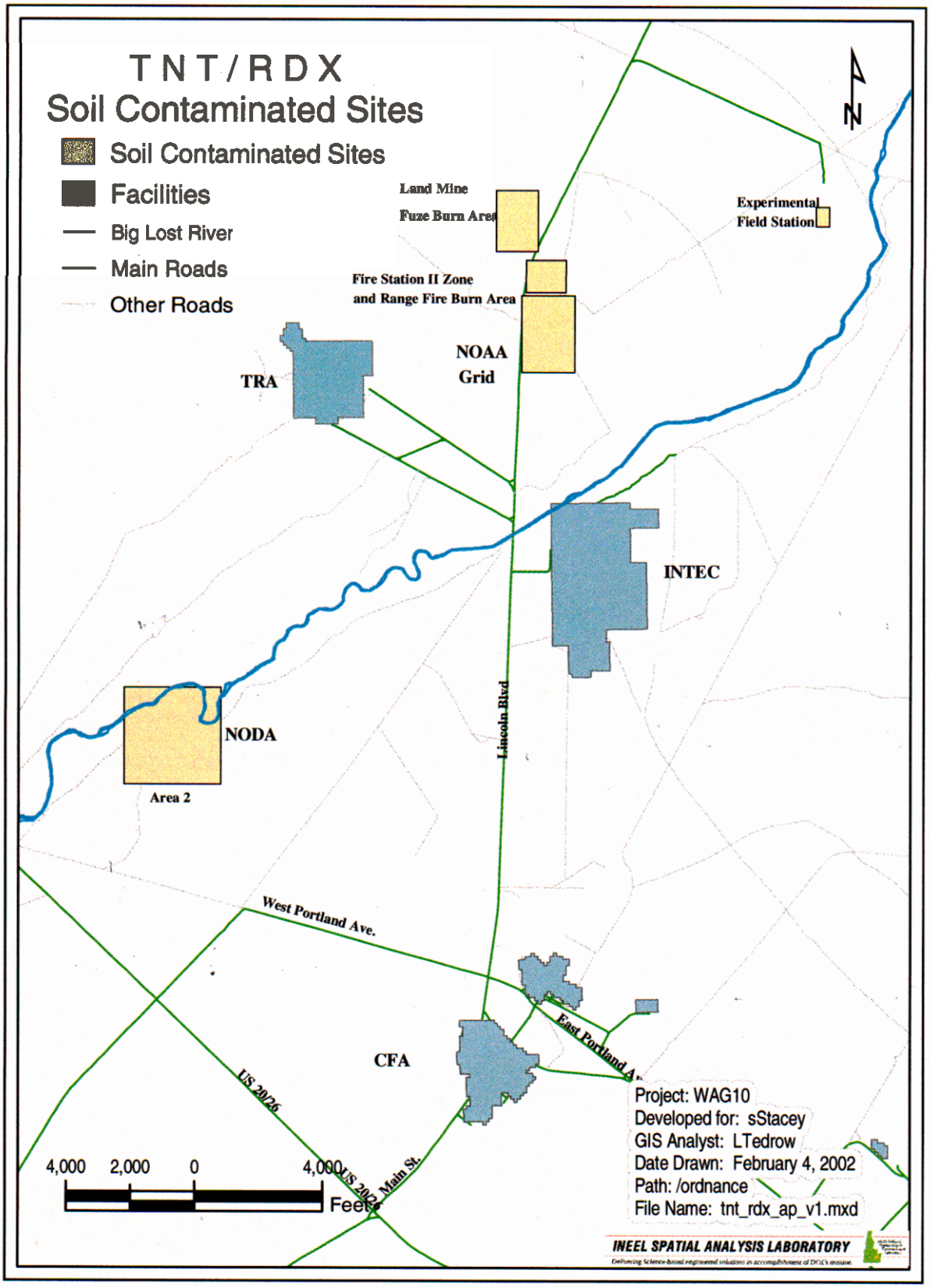

Figure 17. Location of the NODA, NOAA Experimental Field Station, Land Mine Fuze Burn Area and Fire Station II Zone and Range Fire Burn Area.

Figure 18. The top photograph shows a large metal fragment remaining from a bomb and chunks of TNT. The bottom photograph shows chunks of RDX.

In 1999, surface soil samples were collected as described in the *Field Sampling Plan (FSP) for Operable Unit (OU) 10-04 Explosive Compounds* (DOE-ID 1999c). The results of this sampling effort were evaluated in the OU 10-04 Comprehensive RI/FS report (DOE-ID 2001), and presented below in Section 9.1.3.

9.1.2 Nature and Extent of Contamination

The location of the Fire Station II Zone and Range Fire Burn Area is shown in Figure 17. In 1999 soil samples were taken from this area. Contaminants were detected between 0 to 0.61 m (0 to 2 ft) below the ground surface; however, the highest detected concentrations were mainly located in the top 15 cm (0.5 ft) of the surface soil. The maximum detected RDX concentration was 3.7 mg/kg. For TNT, the maximum detected concentration was 130 mg/kg. The volume of contaminated soil that must be remediated at this site is an estimated 150 yd^3.

Some of the unexploded ordnance was removed during the 1993 and 1997 removal activities. However, there is still some potential for UXO to remain in the area.

9.1.3 Summary of Site Risks

The 1999 samples yielded concentrations of benzo(a)pyrene, phenanthrene, and TNT in excess of contaminant screening levels for human health, and concentrations of 4-amino-2,6-dinitrotoluene, copper, HMX, lead, nitrate, nitrite, RDX, selenium, TPH-diesel, trichlorofluoromethane, and xylene above screening levels for the ecological risk assessment. There still remains a potential for UXO to be located within the site presenting a risk to human health. The results of the human health and ecological risk assessments are given below.

The Fire Station II Zone and Range Fire Burn Area was divided into four separate areas for the human health and ecological risk assessments (more detailed information about these four areas can be found in Section 12 of the OU 10-04 RI/FS [DOE-ID 2001]). In the human health assessment the inhalation and groundwater pathways were evaluated cumulatively across all four areas, whereas all other pathways were evaluated separately for each area. Area 4 posed the greatest risk in the human health risk assessment while areas 1 and 2 showed the greatest risk for ecological receptors. Therefore, the four areas were grouped in the remediation evaluation.

9.1.3.1 Human Health Risk Assessment Summary. TNT is identified as a COC based on human health risk estimates. The exposure pathways of concern are ingestion of homegrown produce and dermal absorption. Contribution of all other contaminants to total risk and hazard index is insignificant. A summary of the information about the human health COC in soil at the Fire Station II Zone and Range Fire Burn Area is given in Table 12.

Table 12. Soil concentrations for the human health contaminant of concern at the Fire Station II Zone and Range Fire Burn Area.

Contaminant of Concern	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Frequency of Detection	Background Concentration (mg/kg)	Exposure Point Concentration (mg/kg)	Statistical Measure[a]
TNT	0.20	130	24/37	NA	130	Maximum

a. The lower of either the maximum or the 95% UCL (95% upper confidence limit on the mean soil concentration) was used in the assessment.

The total risk for all pathways for the current occupational scenario is less than 1E-04, and the noncarcinogenic hazard index for the current occupational scenario is less than 1.0.

The total estimated risk for all pathways for the 100-year future residential scenario is 1E-04 (1 in 10,000) from TNT. The noncarcinogenic hazard index of 12 for the future residential scenario is from TNT.

The total estimated risk for all pathways for the 100-year future occupational scenario is less than 1E-04, and the noncarcinogenic hazard index for the future occupational scenario is less than 1.0.

9.1.3.2 Ecological Risk Assessment Summary. RDX and TNT were identified as COCs at the Fire Station II Zone and Range Fire Burn Area for ecological receptors. A summary of the information about the ecological COCs in soil at the Fire Station II Zone and Range Fire Burn Area is given in Table 13.

The HQs for exposure to RDX in the surface and subsurface soil at the Fire Station II Zone and Range Fire Burn Area (Area 2) ranged from 2 for the mule deer to a maximum of 40 for the pygmy rabbit. The deer mouse also has HQs exceeding 1.0.

The HQs for exposure to TNT in the surface and subsurface soil range from 9 for the deer mouse to a maximum of 20 for the pygmy rabbit. The pygmy rabbit is classified as a species of special concern by the State of Idaho.

Table 13. Soil concentrations for the ecological contaminants of concern at the Fire Station II Zone and Range Fire Burn Area.

Contaminant of Concern	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Frequency of Detection	Background Concentration (mg/kg)	Exposure Point Concentration (mg/kg)	Statistical Measure[a]
RDX	0.23	3.7	7/37	NA	3.7	Maximum
TNT	0.20	130	24/37	NA	130	Maximum

a. The lower of either the maximum or the 95% UCL (95% upper confidence limit on the mean soil concentration) was used in the assessment.

9.2 Site: Experimental Field Station

The Experimental Field Station will be remediated to address the risk to human and ecological receptors posed by contaminated soil. Site investigations, the nature and extent of contamination, and a summary of site risks are presented below.

This site is located within the Naval Proving Ground gunnery range approximately 9.7 km (6 mi) downrange and northeast of the CFA-633 Naval Proving Ground firing site, and approximately 0.4 km (0.25 mi) west of the Big Lost River channel (see Figure 17). The contaminated area of the site is an estimated 2 ha (5 acres) (DOE-ID 2001). This site includes multiple craters within which a variety of explosive tests were conducted. The site is known to contain UXO, pieces of explosives, structural debris, and soil contamination (DOE-ID 1999c). More detailed information about the Experimental Field Station can be found in the OU 10-04 Comprehensive RI/FS report (DOE-ID 2001).

9.2.1 Site Investigation

The 1996 field team encountered remnants of World War I and World War II vintage bombs and two areas of widespread heavy concentrations of explosive contaminated soils. One area was approximately 0.8 ha (2 acres) in size. The second area was approximately 0.3 ha (0.8 acres) (see map in

[DOE-ID 1998] Appendix H). The assessment included a visual examination for signs of craters, detonation tests, surface UXO, pieces of explosives, and soil contamination. The area was searched for UXO using 10-m (33-ft) sweeps. When the team encountered areas of TNT contamination, the region was examined in great detail, and the area was mapped. Several large craters were located in this area, however, no ordnance was found in any of the craters. The craters appear to have resulted from ordnance destruction or ordnance testing. Approximately 2.4 km (1.5 mi) away, the nose section of a World War I vintage bomb with TNT and an empty tail section of a World War I vintage bomb were found during the assessment and transported during the 1996 removal action to the MDA for disposal using detonation.

In 1999, surface soil samples were collected as described in the *Field Sampling Plan (FSP) for Operable Unit (OU) 10-04 Explosive Compounds* (DOE-ID 1999c). Nineteen samples were collected and analyzed from the TNT-contaminated soil areas (DOE-ID 1999a). The results of this sampling effort were evaluated in the OU 10-04 Comprehensive RI/FS report (DOE-ID 2001), and presented below in Section 9.2.3.

9.2.2 Nature and Extent of Contamination

The location of the Experimental Field Station is shown in Figure 17. In 1999, soil samples were taken at the Experimental Field Station. Contaminants were detected between 0 to 0.61 m (0 to 2 ft) below the ground surface; however, the highest detected concentrations were mainly located in the top 15 cm (0.5 ft) of the surface soil. The maximum detected 1,3 DNB concentration was 14 mg/kg. For TNT, the maximum detected concentration was 1,100 mg/kg. The volume of contaminated soil that must be remediated at this site is an estimated 10 yd^3. There is still some potential for UXO to remain at the Experimental Field Station.

9.2.3 Summary of Site Risks

The 1999 samples yielded concentrations of 4-amino 2,6 dinitrotoluene and TNT in excess of contaminant screening levels for human health, and concentrations of 1,3,5-trinitrobenzene, 1,3 DNB 4-amino-2,6-dinitrotoluene, nitrate, nitrite, and TNT above screening levels for the ecological risk assessment. There remains a potential for UXO to be located within the site presenting a risk to human health. The results of the human health and ecological risk assessments are given below.

The Experimental Field Station was divided into two separate areas for the human health and ecological risk assessments (more detailed information about both of these areas can be found in Section 12 of the OU 10-04 RI/FS). In the human health assessment the inhalation and groundwater pathways were evaluated cumulatively across both areas, whereas all other pathways were evaluated separately for each area. Area 1 posed the greatest risk in the human health and ecological receptors risk assessment. These areas were grouped in the remediation evaluation.

9.2.3.1 Human Health Risk Assessment Summary. TNT was identified as a COC based on human health risk estimates. The exposure pathway of concern is ingestion of homegrown produce. A summary of the information about the human health COC in soil at the Experimental Field Station is given in Table 14.

Table 14. Soil concentrations for the human health contaminant of concern at the Experimental Field Station.

Contaminant of Concern	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Frequency of Detection	Background Concentration (mg/kg)	Exposure Point Concentration (mg/kg)	Statistical Measure[a]
TNT	0.28	1,100	10/19	NA	1,100	Maximum

a. The lower of either the maximum or the 95% UCL (95% upper confidence limit on the mean soil concentration) was used in the assessment.

The total risk for all pathways for the current occupational scenario is less than 1E-04. The noncarcinogenic hazard index for the current occupational scenario is equal to 1.0 from TNT.

The total estimated risk for all pathways for the 100-year future residential scenario is slightly less than 1E-04, and the noncarcinogenic hazard index of 10 for the future residential scenario is primarily from TNT.

The total estimated risk for all pathways for the 100-year future occupational scenario is less than 1E-04. The noncarcinogenic hazard index for the future occupational scenario is equal to 1.0 from TNT.

9.2.3.2 Ecological Risk Assessment Summary. 1,3 DNB and TNT were identified as COCs at the Experimental Field Station for ecological receptors. A summary of the information about the ecological COCs in soil at the Experimental Field Station is given in Table 15.

The HQs for exposure to 1,3 DNB in the surface and subsurface soil at the Experimental Field Station (Area 1) ranged from 30 for the deer mouse to a maximum of 80 for the pygmy rabbit.

The HQs for exposure to TNT in the surface and subsurface soil range from 200 for the deer mouse to a maximum of 300 for the pygmy rabbit. The pygmy rabbit is classified as a species of special concern by the State of Idaho.

Table 15. Soil concentrations for the ecological contaminants of concern at the Experimental Field Station.

Contaminant of Concern	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Frequency of Detection	Background Concentration (mg/kg)	Exposure Point Concentration (mg/kg)	Statistical Measure[a]
1,3 DNB	0.22[b]	14	1/19	NA	14	Maximum
TNT	0.28	1,100	10/19	NA	1,100	Maximum

a. The lower of either the maximum or the 95% UCL (95% upper confidence limit on the mean soil concentration) was used in the assessment.
b. Although the minimum concentration was less than the detection limit, this value was used in determining the exposure point concentration for this site.

9.3 Site: Land Mine Fuze Burn Area

The Land Mine Fuze Burn Area will be remediated to address the risk to human and ecological receptors posed by contaminated soil. Site investigations, the nature and extent of contamination, and a summary of site risks are presented below.

The site is 0.8 km (0.5 mi) west of Lincoln Boulevard and approximately 0.8 km (0.5 mi) north of the Fire Station II training area (Mile Marker 5) (see Figure 17). The site consists of approximately five separate ordnance disposal locations in a 8.1-ha (20-acre) area between a meander of a former channel of the Big Lost River and an old abandoned irrigation canal that was hand dug in the early 1900s. The contaminated area of the site is an estimated 12 ha (30 acres) (DOE-ID 2001). The site was used by NPG personnel for disposal of land mine pressure plates and aerial bomb packaging materials and as an area to dispose of land mine fuses by burning (DOE-ID 1998). More detailed information about the Land Mine Fuze Burn Area can be found in the OU 10-04 Comprehensive RI/FS report (DOE-ID 2001).

9.3.1 Site Investigation

During the 1996 field assessment, the perimeter of the site was established, and the area for the 1996 removal action was defined. The subsurface was characterized using geophysical methods during a Technology Demonstration Project in June 1996. Approximately 0.6 ha (1.5 acres) were surveyed to a depth of 0.61 m (2 ft), and the area was mapped (DOE-ID 1998).

During the 1996 removal action, 8.1 ha (20 acres) were surface cleared, characterized using geophysical methods, and mapped. A subsurface clearance was not performed based on the removal action subcontractor's evaluation of the data. However, during the INEEL quality check of the results of the action in the subsurface at this site, several inert items were found and excavated (DOE-ID 1998).

In 1999, surface soil samples were collected as described in the *Field Sampling Plan (FSP) for Operable Unit (OU) 10-04 Explosive Compounds* (DOE-ID 1999c). The results of this sampling effort were evaluated in the OU 10-04 Comprehensive RI/FS report (DOE-ID 2001), and presented below in Section 9.3.3.

9.3.2 Nature and Extent of Contamination

The location of the Land Mine Fuze Burn Area is shown in Figure 17. In 1999, surface soil samples were collected at the Land Mine Fuze Burn Area. Contaminants were detected between 0 to 0.61 m (0 to 2 ft) below the ground surface; however, the highest detected concentrations were mainly located in the top 15 cm (0.5 ft) of the surface soil. The maximum detected TNT concentration was 79,000 mg/kg. The volume of contaminated soil that must be remediated at this site is an estimated 240 yd^3. Some UXO was removed from this site during the 1996 and 1997 removal activities. However, there is still some potential for UXO to remain in the area.

9.3.3 Summary of Site Risks

The 1999 samples yielded concentrations of TNT in excess of contaminant screening levels for human health, and concentrations of 2,4-DNT, 2,6-DNT, lead, nitrate, selenium, TNT, TPH-diesel, and zinc above screening levels for the ecological risk assessment. There still remains a potential for UXO to be located within the site also presenting potential risk to human health. The results of the human health and ecological risk assessments are given below.

The Land Mine Fuze Burn Area was divided into separate areas (areas 2 and 3) for the human health and ecological risk assessments (more detailed information about these areas can be found in Section 12 of the OU 10-04 RI/FS). In the human health assessment the inhalation and groundwater pathways were evaluated cumulatively across both areas, whereas all other pathways were evaluated separately for each area. Area 3 posed the greatest risk in both the human health and ecological risk assessments. These areas were grouped for the remediation evaluation.

9.3.3.1 Human Health Risk Assessment Summary. TNT was identified as a COC based on the human health risk estimates. The exposure pathways of concern are ingestion of soil, groundwater, and homegrown produce. A summary of the information about the human health COC in soil at the Land Mine Fuze Burn Area is given in Table 16.

Table 16. Soil concentrations for the human health contaminant of concern at the Land Mine Fuze Burn Area.

Contaminant of Concern	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Frequency of Detection	Background Concentration (mg/kg)	Exposure Point Concentration (mg/kg)	Statistical Measure[a]
TNT	0.26	79,000	7/13	NA	69,000[b]	Maximum

a. The lower of either the maximum or the 95% UCL (95% upper confidence limit on the mean soil concentration) was used in the assessment.

b. The soil sample containing the maximum detection for TNT was a duplicate sample, the average of the two maximum detects (79,000 and 59,000 mg/kg) was 69,000 mg/kg.

The total risk for all pathways for the current occupational scenario is 4E-03 from TNT. The noncarcinogenic hazard index for the current occupational scenario is 70 from exposure to TNT.

The total estimated risk for all pathways for the 100-year future residential scenario is 6E-03 from TNT. The noncarcinogenic hazard index of 700 for the future residential scenario is from TNT.

The total estimated risk for all pathways for the 100-year future occupational scenario is 4E-03 from TNT. The noncarcinogenic hazard index for the future occupational scenario is 70 from exposure to TNT.

9.3.3.2 Ecological Risk Assessment Summary. TNT was identified as a COC at the Land Mine Fuze Burn Area for ecological receptors. A summary of the information about the ecological COCs in soil at the Land Mine Fuze Burn Area is given in Table 17.

The HQs for exposure to TNT in the surface and subsurface soil range from 900 for the deer mouse to a maximum of 10,000 for the pygmy rabbit. The pygmy rabbit is classified as a species of special concern by the State of Idaho.

Table 17. Soil concentrations for the ecological contaminant of concern at the Land Mine Fuze Burn Area.

Contaminant of Concern	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Frequency of Detection	Background Concentration (mg/kg)	Exposure Point Concentration (mg/kg)	Statistical Measure[a]
TNT	0.26	79,000	7/13	NA	69,000[b]	Maximum

a. The lower of either the maximum or the 95% UCL (95% upper confidence limit on the mean soil concentration) was used in the assessment.

b. The soil sample containing the maximum detection for TNT was a duplicate sample, the average of the two maximum detects (79,000 and 59,000 mg/kg) was 69,000 mg/kg.

9.4 Site: National Oceanic and Atmospheric Administration (NOAA)

The NOAA site will be remediated to address the risk to human and ecological receptors posed by contaminated soil. Site investigations, the nature and extent of contamination, and a summary of site risks are presented below.

The NOAA site is located just east of Lincoln Boulevard, approximately midway between Mile Markers 4 and 5 (see Figure 17). The contaminated area of the site is an estimated 25 ha (63 acres) (DOE-ID 2001). The site was used for a variety of explosive tests or cleanup detonations or both following such tests. The area contains a number of small craters, low-ordered bomb casings and detonators, and some widely scattered pieces of explosives. The NOAA site has been and is currently used by NOAA and other governmental agencies for a variety of atmospheric, geodetic, and weather-related monitoring and research work (DOE-ID 1998). More detailed information about the NOAA site can be found in the OU 10-04 Comprehensive RI/FS report (DOE-ID 2001).

9.4.1 Site Investigation

During the 1993 interim action, a surface clearance and a geophysical survey were performed to a depth of 0.61 m (2 ft) on a large site consisting of 1.7 ha (4.13 acres) and a small site consisting of 0.88 ha (2.17 acres). No UXO was found below the surface. Pieces of TNT remain at the surface of this site (DOE-ID 1998).

During the 1996 field assessment, the major objectives of the field team were to determine whether ordnance or soil contamination existed outside of the previously identified area, to establish the boundary, to reestimate the volume of contaminated soil, and to look for any indications that detonation pits existed in the area. This area was searched on foot by field crews at approximately 10-m (33-ft) intervals. Scattered TNT was located, ranging from small flakes to baseball-size chunks. The area of contamination covers a large area of the site. Several craters were located on the south side of the site. It appears that they were sites of ordnance destruction. Several partial 100-lb bombs were found southeast of the NOAA site, which indicates they had been intentionally *low-ordered*. A low-order detonation is the result of a low-order procedure, intended to detonate an explosive item without causing the item to totally consume itself. A low-order procedure is performed in an area that could not withstand a high-order detonation, which would have totally consumed the item (DOE-ID 1998).

In 1999, surface soil samples were collected as described in the *Field Sampling Plan (FSP) for Operable Unit (OU) 10-04 Explosive Compounds* (DOE-ID 1999c). The results of this sampling effort were evaluated in the OU 10-04 Comprehensive RI/FS report (DOE-ID 2001), and presented below in Section 9.4.3.

9.4.2 Nature and Extent of Contamination

The location of NOAA is shown in Figure 17. In 1999, the soil was sampled at NOAA. Contaminants were detected between 0 to 0.61 m (0 to 2 ft) below the ground surface; however, the highest detected concentrations were mainly located in the top 15 cm (0.5 ft) of the surface soil. The maximum detected 1,3 DNB concentration was 27 mg/kg. For RDX, the maximum detected concentration was 53 mg/kg. The maximum detected TNT concentration was 17,014 mg/kg. The volume of contaminated soil that must be remediated at this site is an estimated 370 yd^3.

Unexploded ordnance was removed during the 1993 and 1997 removal activities. However, there is still potential for some UXO to remain in the area.

9.4.3 Summary of Site Risks

The 1999 samples yielded concentrations of RDX and TNT in excess of contaminant screening levels for human health, and concentrations of 1,3 DNB, 1,3,5-trinitrobenzene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, nitrate, nitrite, RDX, and TNT above screening levels for the ecological risk assessment. There still remains a potential for UXO to be located within the site presenting a risk to human health. The results of the human health and ecological risk assessments are given below.

NOAA was divided into five separate areas (areas 2, 2a, 3, 5, and 6) for the human health and ecological risk assessments (more detailed information about these five areas can be found in Section 12 of the OU 10-04 RI/FS). In the human health assessment the inhalation and groundwater pathways were evaluated cumulatively across all five areas, whereas all other pathways were evaluated separately for each area. All five areas pose risk in the human health risk assessment and areas 2a, 3, 5, and 6 showed the greatest risk for ecological receptors. These areas were grouped in the remediation evaluation.

9.4.3.1 Human Health Risk Assessment Summary. TNT was identified as a COC based on human health risk estimates. The exposure pathways of concern are ingestion of soil, groundwater, and homegrown produce. A summary of the information about the human health COC in soil at NOAA is given in Table 18. RDX is only a COC for ecological receptors as discussed in the next section.

Table 18. Soil concentrations for the human health contaminant of concern at NOAA.

Contaminant of Concern	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Frequency of Detection	Background Concentration (mg/kg)	Exposure Point Concentration (mg/kg)	Statistical Measure[a]
TNT	0.20	17,014	455/489	NA	1,900	UCL

a. The lower of either the maximum or the 95% UCL (95% upper confidence limit on the mean soil concentration) was used in the assessment.

The total risk for all pathways for the current occupational scenario is less than 1E-04, and the noncarcinogenic hazard index for the current occupational scenario is less than 1.0.

The total estimated risk for all pathways for the 100-year future residential scenario is 4E-04 (4 in 10,000) from TNT. The noncarcinogenic hazard index of 40 for the future residential scenario is from TNT.

The total estimated risk for all pathways for the 100-year future occupational scenario is less than 1E-04, and the noncarcinogenic hazard index for the future occupational scenario is less than 1.0.

9.4.3.2 Ecological Risk Assessment Summary. 1,3 DNB, RDX, and TNT were identified as COCs for NOAA for ecological receptors. A summary of the information about the ecological COCs in soil at NOAA is given in Table 19.

The HQs for exposure to 1,3 DNB in the surface and subsurface soil at NOAA (Area 6) ranged from 1 for the mule deer to a maximum of 200 for the pygmy rabbit. The deer mouse also has HQs exceeding 1.0.

The HQs for exposure to RDX in the surface and subsurface soil at NOAA (Area 3) ranged from 1 for the mule deer to a maximum of 20 for the pygmy rabbit. The deer mouse also has HQs exceeding 1.0.

The HQs for exposure to TNT in the surface and subsurface soil (Area 5) range from 4 for the mule deer to a maximum of 500 for the pygmy rabbit. The deer mouse also has HQs exceeding 1.0. The pygmy rabbit is classified as a species of special concern by the State of Idaho.

Table 19. Soil concentrations for the ecological contaminants of concern at NOAA.

Contaminant of Concern	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Frequency of Detection	Background Concentration (mg/kg)	Exposure Point Concentration (mg/kg)	Statistical Measure[a]
1,3 DNB	0.22	27	1/26	NA	27	Maximum
RDX	0.22	53	171/459	NA	1.78	UCL
TNT	0.20	17,014	455/489	NA	1,900	UCL

a. The lower of either the maximum or the 95% UCL (95% upper confidence limit on the mean soil concentration) was used in the assessment.

9.5 Site: Naval Ordnance Disposal Area (NODA) – Area 2

The NODA site will be remediated to address the risk to human and ecological receptors posed by contaminated soil. Site investigations, the nature and extent of contamination, and a summary of site risks are presented below.

The NODA site is located approximately 1.6 km (1 mi) northeast of U.S. Highway 20/26 between Mile Markers 266 and 267 and about 3.2 km (2 mi) halfway from the TRA, INTEC, and CFA facilities at the INEEL, as shown in Figure 17. NODA is reported to have been used as an ordnance and nonradioactive hazardous material disposal area by the U.S. Navy during the 1940s. Following the establishment of the National Reactor Testing Station (now the INEEL), the NODA came under the control of the AEC (now DOE). From about 1967 to 1985, approximately 3,175 kg (7,000 lb) of reactive materials were treated (burned) at the NODA. Between 1967 and 1985, the NODA was also used as a storage area for hazardous waste generated at the INEEL. Until 1982, solvents, corrosives, ignitables, heavy metal contaminated solutions, formaldehyde, polychlorinated biphenyl materials, waste laboratory chemicals, and reactives were stored at this site. By October 1985, all these materials had been removed for off-Site disposal as hazardous waste or treated on-Site by open burning, as allowed by RCRA regulations (DOE-ID 1998).

In 1985, NODA was added to the RCRA, Part A, permit application as a thermal treatment unit. The last treatment of hazardous waste occurred in 1988 (except for one emergency action/detonation in 1990). In June 1990, a Memorandum of Understanding (MOU) was developed between the Environmental Programs (EP) and Waste Reduction Operations Complex (WROC) under which EP agreed to fund and manage all activities necessary to formally close the NODA, including soil sampling and analysis, removal of contaminated soil, emergency removal of ordnance, maintenance of access signs and barricades, and preparation and submittal of all required documentation. In 1997, the Interim Status of the NODA was terminated by the IDEQ with the agreement that the CERCLA program would perform the final evaluation of the site in accordance with the FFA/CO.

The 1994 removal action defined the cleanup area as 16 ha (40 acres) centered approximately 762 m (2,500 ft) north of the current INEEL security force gun range on Portland Avenue. The area of contamination of the NODA Area 2 site is an estimated 0.8 ha (2 acres) (DOE-ID 2001). More detailed information about the NODA site can be found in the OU 10-04 Comprehensive RI/FS report (DOE-ID 2001).

9.5.1 Site Investigation

During the 1994 removal action, 11.7 ha (28.92 acres) were cleared of ordnance and pieces of explosives to a depth of 1.2 m (4 ft). An additional 1.6 ha (3.89 acres) were cleared to a depth of 1.2 m (4 ft) from Lincoln Boulevard to the NODA to accommodate an access road. Because of the lack of information pertaining to tests performed in the pits at the NODA site, none of the pits were addressed

during the 1994 removal action. The removal action was continued during the summer of 1995 when an additional 9.1 ha (22.56 acres) were cleared to a depth of 0.61 m (2 ft). The depth was reduced to 0.61 m (2 ft) from 1.2 m (4 ft) based on the results of the 1994 removal action. At this time, five pits were remediated. Two pits were remediated with a remote excavator, two pits were remediated with a backhoe, and one pit was hand excavated. The pits were excavated until the geophysical search revealed that no additional anomalies were identified (DOE-ID 1998).

During the 1996 field assessment, the area outside the site was cleared during the 1994 and 1995 removal actions and was searched on foot by field crews using approximately 10-m (33-ft) spacing beginning at the west boundary. This search was continued outward, until the last piece of fragmentation was found. All four sides of the original removal action site were assessed. Multiple types of UXO were recovered from this site (DOE-ID 1998).

During the 1996 field assessment, seven live 12.7-cm (5-in.) projectiles and one split-open 12.7-cm (5-in.) projectile with a live fuze were found. Scattered TNT and RDX were found on the south side and southeast corner of the area. What appears to have been a munitions burn facility (crumbled concrete box) was found just west of the Big Lost River. No ordnance or ordnance waste was found at this site; however, what appears to have been fuel-stained soil was observed on the berm on which this facility was constructed (DOE-ID 1998). Although UXO has been previously detected and cleared from this site, clearance cannot be considered complete for unrestricted land use.

In 1999, surface soil samples were collected as described in the *Field Sampling Plan (FSP) for Operable Unit (OU) 10-04 Explosive Compounds* (DOE-ID 1999c). The results of this sampling effort were evaluated in the OU 10-04 Comprehensive RI/FS report (DOE-ID 2001), and presented below in Section 9.5.3.

9.5.2 Nature and Extent of Contamination

The location of the NODA site is shown in Figure 17. The 1999 sampling event sampled the surface soils at NODA. Contaminants were detected between 0 to 0.61 m (0 to 2 ft) below the ground surface; however, the highest detected concentrations were mainly located in the top 15 cm (0.5 ft) of the surface soil. The maximum detected RDX concentration was 328 mg/kg. Based on the sampling results, only two acres of the 138-acre site pose a risk to human health and ecological receptors. Unexploded ordnance removal activities were conducted in 1994, 1995 and 1997 at the site. However, there is still some potential for UXO to remain in the area.

9.5.3 Summary of Site Risks

The 1999 samples yielded concentrations of 2-pentanone, 4-chloro-3-methylphenol, antimony, benzo(a)pyrene, benzo(g,h,i)perylene, copper, lead, methapyrilene, phenanthrene, RDX, thallium, TNT, and TPH-diesel in excess of contaminant screening levels for human health. Of these contaminants, 2-pentanone, 4-chloro-3-methylphenol, lead, and methapyrilene could not be evaluated for hazardous effects or carcinogenic risks because slope factors and reference doses are not available. Concentrations of 1,3 DNB, 1,3,5-trinitrobenzene, 2-amino-4,6-dinitrotoluene, 2-hexanone, 2-methylnaphthalene, 2-pentanone, 4-amino-2,6-dinitrotoluene, 4-methyl-2-pentanone, 4-nitrophenol, antimony, barium, bis(ethylhexyl)phthalate, cadmium, chlorobenzene, chromium, chrysene, cobalt, copper, HMX, lead, manganese, methapyrilene, mercury, nickel, nitrate, nitrite, pentachlorophenol, picric acid, RDX, selenium, silver, strontium, tetryl, TNT, TPH-diesel, vanadium, and zinc were above screening levels for the ecological risk assessment. Of these contaminants, 2-hexanone, 2-pentanone, 4-nitrophenal, chlorobenzene, methapyrilene, and picric acid could not be evaluated for ecological risks because available toxicity data are insufficient for developing toxicity reference values. There still remains a potential for UXO to be located within the site presenting a risk to human health. The results of the human health and ecological risk assessments are given below.

The NODA area was divided into three separate areas (areas 2, 3, and 4) for the human health and ecological risk assessments (more detailed information about these three areas can be found in Section 12 of the OU 10-04 RI/FS [DOE-ID 2001]). In the human health assessment the inhalation and groundwater pathways were evaluated cumulatively across all three areas, whereas all other pathways were evaluated separately for each area. Areas 2 and 4 posed the greatest risk in the human health risk assessment and areas 2 and 4 showed the greatest risk for ecological receptors. These areas were grouped in the remediation evaluation.

9.5.3.1 Human Health Risk Assessment Summary. RDX was identified as a COC based on human health risk estimates. The exposure pathways of concern are ingestion of groundwater and homegrown produce. Contribution of all other contaminants to total risk and hazard index is insignificant. A summary of the information about the human health COC in soil at the NODA site is given in Table 20.

Table 20. Soil concentrations for the human health contaminant of concern at the NODA site.

Contaminant of Concern	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Frequency of Detection	Background Concentration (mg/kg)	Exposure Point Concentration (mg/kg)	Statistical Measure[a]
RDX	0.22	328	24/64	NA	328	Maximum

a. The lower of either the maximum or the 95% UCL (95% upper confidence limit on the mean soil concentration) was used in the assessment.

The total risk for all pathways for the current occupational scenario is less than 1E-04 and the noncarcinogenic hazard index for the current occupational scenario is less than 1.0.

The total estimated risk for all pathways for the 100-year future residential scenario is 1E-02 from RDX. The noncarcinogenic hazard index of 100 for the future residential scenario is from RDX.

The total estimated risk for all pathways for the 100-year future occupational scenario is less than 1E-04, and the noncarcinogenic hazard index for the future occupational scenario is less than 1.0.

9.5.3.2 Ecological Risk Assessment Summary. RDX was identified as a COC for the NODA site for ecological receptors. A summary of the information about the ecological COC in soil at the NODA site is given in Table 21.

The HQs for exposure to RDX in the surface and subsurface soil at the NODA site (Area 2) ranged from 3 for the Townsend's western big eared bat to a maximum of 4,000 for the pygmy rabbit. The mule deer and the deer mouse also have HQs exceeding 1.0. The pygmy rabbit is classified as a species of special concern by the State of Idaho.

Table 21. Soil concentrations for the ecological contaminants of concern at the NODA site.

Contaminant of Concern	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Frequency of Detection	Background Concentration (mg/kg)	Exposure Point Concentration (mg/kg)	Statistical Measure[a]
RDX	0.22	328	24/64	NA	328	Maximum

a. The lower of either the maximum or the 95% UCL (95% upper confidence limit on the mean soil concentration) was used in the assessment.

9.6 Remediation Objectives for the TNT/RDX Contaminated Sites

Remedial Action Objectives for the TNT/RDX contaminated sites were developed in accordance with the *National Oil and Hazardous Substances Contingency Plan* (NCP) (40 CFR 300) and EPA guidance (EPA 1988) and through the consensus of DOE-ID, EPA, and IDEQ participants. The RAOs are based on the results of both the human health risk assessments (HHRAs) and ecological risk assessments (ERAs) and are specific to the COCs and exposure pathways developed for OU 10-04.

The conclusions from the RI/BRA that were used to develop RAOs are summarized below:

- Ingestion of homegrown produce, dermal adsorption of soil, ingestion of soil, and ingestion of groundwater are the only human health exposure routes with unacceptable estimated risks for the TNT/RDX soil sites.
- Risks associated with the air pathway are well below 1E-04 (i.e., 1 in 10,000). Therefore, RAOs for the air pathway are not required. (Note: Appropriate safety measures, as determined by air emissions calculations, will be implemented during remedial actions to ensure that dust emissions do not exceed the limits specified by ARARs.)

The RAOs specified for protecting human health are expressed both in terms of risk and exposure pathways, because protection can be achieved through reducing contaminant levels as well as through restricting or eliminating exposure pathways. The overall intent of the human health RAOs is to limit the cumulative carcinogenic human health risk to less than or equal to 1E-04, and noncarcinogenic exposure to less than or equal to an HQ of 1. The RAOs specified for protecting ecological receptors inhibit adverse effects from contaminated soil on resident populations of flora and fauna.

The RAOs developed to protect human health and ecological receptors are as follows:

- Inhibit dermal exposure to and ingestion of contaminated soils and food crops with a total excess cancer risk level of greater than 1E-04 and noncarcinogenic COCs with HQs greater than 1 for current and future workers and future residents.
- Prevent contamination of groundwater.
- Inhibit ecological receptor exposures to soil contaminated with COCs, primarily concentrations in soils that result in an HQ greater than or equal to 10.0. The RAO excludes naturally occurring elements and compounds that are not attributable to historic releases.
- Inhibit any inadvertent contact with potential UXO by onsite workers and members of the public, since potential UXO exists at these areas.

To meet these objectives, remediation goals were established. The remediation goals for the TNT/RDX contaminated sites and the basis for each goal are provided in Table 22. These goals are at the upper end of the acceptable risk range because of the conservatism used in the risk assessment methods used to develop these values.

Remediation goals can be satisfied by cleaning up to the identified contaminant concentration (see Table 22). Removing the principal threat wastes TNT and RDX will be protective because surface exposure will be reduced or eliminated and reduce the potential groundwater risk. The estimated soil volumes exceeding cleanup goals for the TNT/RDX soil contaminated sites are provided in Table 23. An approximate total of 612 m^3 (800 yd^3) of contaminated soil will be remediated.

Table 22. Remediation goals for the OU 10-04 TNT/RDX contaminated sites.

Site	Contaminant of Concern	Soil Concentration Remediation Goal[a]	Derivation	Reference	Risk Scenario
Naval Ordnance Disposal Area	RDX	4.4 mg/kg	1E-04 Groundwater and ingestion of homegrown produce	EPA, Region 9 human health preliminary remediation goal (2001a); EPA Soil Screening Level Guidance for Ecological Receptors (EPA 2000) recommends 5.8 mg/kg for RDX	Ecological and human health
National Oceanic & Atmospheric Administration	TNT	16 mg/kg	1E-04, Ingestion of homegrown produce and dermal absorption	EPA, Region 9 human health preliminary remediation goal (2001a); the ecological final remediation goal for TNT is 17 mg/kg (as indicated in memo, WAG 10-01-02, written to S. G. Wilkinson)	Ecological and human health
	RDX	4.4 mg/kg	1E-04, Ingestion of homegrown produce	EPA, Region 9 human health preliminary remediation goal (2001a); EPA Soil Screening Level Guidance for Ecological Receptors (EPA 2000) recommends 5.8 mg/kg for RDX	Ecological and human health
	1,3 DNB	6.1 mg/kg	HQ greater than 10 for ecological receptors	EPA, Region 9 human health preliminary remediation goal (2001a); ecological final remediation goal for 1,3 DNB is 15 mg/kg (OU 10-04 RI/FS, Appendix E6, [DOE-ID 2001])	Ecological
Fire Station II Zone & Range Fire Burn Area	TNT	16 mg/kg	1E-04, Ingestion of homegrown produce	EPA, Region 9 human health preliminary remediation goal (2001a); ecological final remediation goal for TNT is 17 mg/kg (as indicated in memo, WAG 10-01-02, written to S. G. Wilkinson)	Ecological and human health
	RDX	4.4 mg/kg	HQ greater than 10 for ecological receptors	EPA, Region 9 human health preliminary remediation goal (2001a); EPA Soil Screening Level Guidance for Ecological Receptors (EPA 2000) recommends 5.8 mg/kg for RDX	Ecological
Experimental Field Station	TNT	16 mg/kg	Hazard Index greater than 1, Ingestion of homegrown produce	EPA, Region 9 human health preliminary remediation goal (2001a); the ecological final remediation goal for TNT is 17 mg/kg (as indicated in memo, WAG 10-01-02, written to S. G. Wilkinson)	Ecological and human health
	1,3 DNB	6.1 mg/kg	HQ greater than 10 for ecological receptors	EPA, Region 9 human health preliminary remediation goal (2001a); ecological final remediation goal for 1,3 DNB is 15 mg/kg (OU 10-04 RI/FS, Appendix E6, [DOE-ID 2001])	Ecological
Land Mine Fuze Burn Area	TNT	16 mg/kg	1E-04, Ingestion of homegrown produce, dermal absorption, and groundwater	EPA, Region 9 human health preliminary remediation goal (2001a); ecological final remediation goal for TNT is 17 mg/kg (as indicated in memo, WAG 10-01-02, written to S. G. Wilkinson)	Ecological and human health

a. The EPA, Region 9 human health preliminary remediation goals were selected as the soil concentration remediation goals for all sites because these values are protective of both human health and ecological receptors. The EPA soil screening level guidance for ecological receptors fell below the Region 9 preliminary remediation goal for all contaminants (see reference column).

Table 23. Areas and volumes of contaminated media for OU 10-04 TNT/RDX soil sites.

Site Name	Area of Site m^2 (yd^2)	Contaminated Soil Volume m^3 (yd^3)
TNT/RDX soil sites		
Experimental Field Station	20,300 (24,300)	76.5 (100)
Fire Station	137,000 (164,000)	76.5 (100)
NOAA	257,200 (307,600)	268 (350)
Land Mine Fuze Burn Area	123,500 (147,700)	153 (200)
NODA Area 2	6,900 (8,300)	38 (50)

The response action selected in this Record of Decision is necessary to protect the public health and welfare and the environment from actual or threatened releases of hazardous substances into the environment. Such a release, or threat of release, may present an imminent and substantial endangerment of public health, welfare, or the environment.

9.7 Description of Alternatives for the TNT/RDX Contaminated Soils

Four remedial alternatives were developed to address TNT/RDX contaminated soils: no action; limited action; removal and disposal; and removal, ex situ treatment, and disposal. Alternative 1 (No Action) and 2 (Limited Action) were not considered for selection because they do not meet the threshold criteria for protection of human health and the environment and compliance with law. However, the No Action Alternative was evaluated in detail to provide a baseline for comparison of the alternatives as required under CERCLA.

An alternative involving removal and treatment of the TNT/TDX fragments and contaminated soil, by composting using a method developed at the INEEL (Alternative 4c), was developed but eliminated from consideration because of high cost, the extensive time required to complete remediation, and significant implementation difficulties. Under Alternative 4c, contaminated soil and TNT/RDX fragments would be excavated together and treated in a special reactor with a solvent, such as acetone, to break down the TNT/RDX fragments such that the material would degrade during subsequent composting. A large volume of acetone, a highly flammable solvent, is required to dissolve the TNT and RDX fragments. Because of safety concerns, a specially designed facility with air emission controls and fire protection would have to be constructed to provide a controlled environment for the composting process and control acetone emissions during treatment. From results of the treatability study (see Section 2.4.2.3), 55 gallons of acetone are required to treat one cubic yard of soil, and it will take approximately 34 days of treatment to achieve the remediation goals. The preliminary design for a full-scale reactor system will allow treatment of soil in 10 yd^3 batches. Because of the safety concerns associated with the use of large amounts of acetone, a larger reactor capacity is not considered feasible. Since only 10 batches could be treated in a year, it would take approximately 8 years to compete remediation. The estimated cost to implement this alternative is $20 million (DOE-ID 2001).

9.7.1 Alternative 1: No Action

Formulation of a no action alternative is required by the *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP) (40 CFR 300.430[e][6]) and guidance for conducting feasibility studies under CERCLA (EPA 1988). The no action alternative serves as the baseline for evaluating other remedial action alternatives. The alternative includes environmental monitoring, but does not include any actions to reduce potential exposure pathways, such as fencing, deed restrictions, or administrative controls (EPA 1988).

9.7.2 Alternative 3: Removal, Ex Situ Treatment, and Disposal or Return to Excavations

Removal, treatment of TNT/RDX fragments, and disposal of soil alternatives for WAG 10 TNT/RDX-contaminated sites would be preceded by a visual or geophysical survey for UXO, with subsequent removal of detected UXO, if required, to proceed with soil removal. Otherwise, UXO will be removed during remediation of the UXO areas. Contaminated soil will be excavated by hand, and the fragments of TNT and RDX will be manually segregated from the soil unless safety analysis indicates it is safe to use conventional mechanical soil excavation and screening equipment. The fragments of TNT and RDX will be detonated at the MDA. The soil will be disposed on the INEEL or at an approved facility off the INEEL. Verification sampling will be performed at the removal sites to ensure that all contamination at concentrations exceeding final remediation goals is removed. The concentrations of TNT in soil removed are expected to be less than 10% and hence will not be regulated under RCRA; however, if some soil is found to exceed 10% TNT/RDX, it will be sent to a RCRA permitted facility for thermal treatment and disposal. The excavations exceeding 0.3 m (1 ft) in depth will be backfilled with clean soil or contoured to blend with the existing landscape and revegetated. Institutional controls will be implemented for continued monitoring and to restrict access because buried, undetected TNT/RDX fragments could exist after remediation. Frost heave and erosion could bring these items to the surface in the future and pose an unacceptable risk. Under Alternative 3a, the excavated soils would be disposed on the INEEL, while under Alternative 3b excavated soils would be disposed off the INEEL. These alternatives are discussed in the following subsections.

9.7.2.1 Alternative 3a: Removal, Treatment of TNT/RDX Fragments and Disposal of Soil at the INEEL. Implementation of this alternative requires excavation of all soils with concentrations above final remediation goals, segregation of the TNT and RDX fragments with subsequent detonation at the MDA, and the transport of the soils to an INEEL waste disposal facility such as the proposed INEEL CERCLA Disposal Facility (ICDF) or the CFA landfill.

9.7.2.2 Alternative 3b: Removal, Treatment of TNT/RDX Fragments and Disposal of Soil Off the INEEL. Implementing this alternative will involve excavation of all soils with concentrations above final remediation goals, segregation of the TNT and RDX fragments with subsequent detonation at the MDA, and transport of soils off the INEEL to an approved disposal facility. A probable disposal location would be the Waste Management Northwest landfill in Arlington, Oregon, which receives RCRA waste and industrial nonhazardous waste. This landfill is located approximately 885 km (550 mi) from the INEEL in Gilliam County, Oregon. Compliance with appropriate waste characterization, transportation, and possible treatment requirements are required under this alternative.

9.7.3 Alternative 4: Removal, Ex Situ Treatment, and Disposal or Return to Excavations

Removal, ex situ treatment, and disposal alternatives for WAG 10 TNT/RDX contaminated sites will be preceded by a visual or geophysical survey for UXO, with subsequent removal of detected UXO, if required to proceed with soil excavation. Otherwise, UXO will be removed during remediation of the UXO areas. Contaminated soil and fragments of TNT and RDX would be excavated by hand unless safety analysis indicates it is safe to use conventional mechanical soil excavation and screening equipment. The soil would be incinerated at a permitted facility off the INEEL or treated biologically on the INEEL. Verification sampling will be performed at the removal sites to ensure that all contamination at concentrations exceeding final remediation goals is removed. The excavations exceeding 0.3 m (1 ft) in depth will be backfilled with clean soil following the excavation. Shallow excavations will be recontoured to blend with the existing landscape. Institutional controls will be implemented to restrict access, and monitoring will be performed since buried, undetected UXO and TNT and RDX fragments could exist after remediation. Frost heave and erosion could bring these items to the surface in the future and pose an unacceptable risk.

Under Alternative 4a, the TNT and RDX fragments will be segregated from the soils during excavation and detonated at the MDA. Then the contaminated soils would be incinerated and disposed at a RCRA permitted facility off the INEEL. Under Alternative 4b, the TNT and RDX fragments will be segregated from the soils during excavation and detonated at the MDA, and the contaminated soils will be composted at the INEEL and returned to the excavation sites.

9.7.3.1 Alternative 4a: Removal, Off-Site Incineration and Disposal. Implementing this alternative would involve excavation of all soils with concentrations above final remediation goals, segregation of the TNT and RDX fragments with subsequent detonation at the MDA, and transport of the soils to an approved incineration and disposal facility off the INEEL. A probable incineration and disposal facility off the INEEL would be the Onyx Environmental Services Treatment Complex at Port Arthur, Texas. Compliance with appropriate waste characterization and transportation requirements would be required under this alternative.

9.7.3.2 Alternative 4b: Removal, On-Site Soil Composting, and Return of Soil to the Excavations. Implementing this alternative would involve excavation of all soils with concentrations above final remediation goals, segregation of the TNT and RDX fragments with subsequent detonation at the MDA, and treatment on the INEEL by composting in a temporary portable building at a central location, such as the CFA. The temporary building would be required to control gases released during composting and to ensure optimum conditions for the composting process are maintained. Composting would involve the addition of water and soil amendments, such as manure, sawdust, and potato waste to the contaminated soil. The amended soil would be placed into windrows and turned several times a day with special mixing equipment to ensure the compost receives sufficient oxygen, release trapped heat, water vapor and gases, and break up clumps of soil. Treatment time is expected to be between 15 days and 30 days. Following treatment the soils would be returned to the excavation sites.

9.7.4 Comparison of Elements and Distinguishing Features of Each Alternative

The relative performance of each alternative is described in Table 24.

9.8 Comparative Analysis of Alternatives for the TNT/RDX Contaminated Soils

The alternatives were evaluated using the nine evaluation criteria as specified by CERCLA (40 CFR 300.43[f][5][i]). The purpose of this comparison is to identify the relative advantages and disadvantages associated with each alternative. The comparative analyses of alternatives for the nine criteria are summarized below.

9.8.1 Overall Protection of Human Health and the Environment

The primary measure of this criterion is the ability of an alternative to achieve RAOs for WAG 10 sites. Alternative 1, no action, would not prevent exposures resulting in risks greater than 1E-04 or HIs greater than 1.0 for the TNT/RDX soil sites. For the TNT/RDX contaminated soil sites, Alternatives 4a and 4b (excavation, incineration and disposal off the INEEL, and excavation, composting and disposition on the INEEL) would provide effective long-term protection of human health and the environment. This is because all contamination above risk-based levels would be removed and destroyed through treatment. Alternative 4a, which includes incineration, is considered effective in destroying TNT and RDX contamination. Alternative 3a and 3b (excavation and disposal on and off the INEEL) would provide effective long-term protection of human health and the environment because the TNT and RDX fragments, the source of the soil contamination, will be destroyed and all detected soil contamination above risk-based levels would be removed from the TNT/RDX sites and disposed in secure landfills.

Table 24. Detailed analysis summary for the OU 10-04 TNT/RDX contaminated soil sites.

Criteria	Alternative 1 No action	Alternative 3a Removal, Treatment of TNT/RDX Fragments, and Disposal of Soil on the INEEL	Alternative 3b Removal, Treatment of TNT/RDX Fragments, and Disposal of Soil off the INEEL	Alternative 4a Removal, Incineration, and Disposal off the INEEL	Alternative 4b Removal, Composting, and Disposition on the INEEL
Overall Protection of human health and the environment					
Human health protection	No reduction in risk	Minimizes potential exposure to contaminated soil by removing detected contamination from the site	Minimizes potential exposure to contaminated soil by removing detected contamination from the site	Minimizes potential exposure to contaminated soil by removing detected contamination from the site	Minimizes potential exposure to contaminated soil by removing detected contamination from the site
Environmental protection	Allows continued ecological exposures	Minimizes potential exposure to contaminated soil by removing detected contamination from the site	Minimizes potential exposure to contaminated soil by removing detected contamination from the site	Minimizes potential exposure to contaminated soil by removing detected contamination from the site	Minimizes potential exposure to contaminated soil by removing detected contamination from the site
Compliance with ARARs					
Chemical Specific					
Idaho Ground-water Quality Standards—IDAPA 58.01.11.200	Would not meet ARAR	Will meet ARAR by removing contamination and monitoring	Will meet ARAR by removing contamination and monitoring	Will meet ARAR by removing contamination and monitoring	Will meet ARAR by removing contamination and monitoring
Action Specific					
Military Munitions Rule – 40 Code of Federal Regulations 266, Subpart M	Not applicable	Would meet ARAR	Would meet ARAR	Would meet ARAR	Would meet ARAR
Idaho Fugitive Dust Emissions – IDAPA 58.01.01.650 et seq.	Not applicable	Would meet ARAR	Would meet ARAR	Would meet ARAR	Would meet ARAR

Table 24. (continued).

Criteria	Alternative 1 No action	Alternative 3a Removal, Treatment of TNT/RDX Fragments, and Disposal of Soil on the INEEL	Alternative 3b Removal, Treatment of TNT/RDX Fragments, and Disposal of Soil off the INEEL	Alternative 4a Removal, Incineration, and Disposal off the INEEL	Alternative 4b Removal, Composting, and Disposition on the INEEL
Rules and Standards for Hazardous Waste in Idaho – IDAPA 57.01.05.010.006, .008, and .011	Not applicable	Would meet ARAR	Would meet ARAR	Would meet ARAR	Would meet ARAR
Rules and Standards for Hazardous Waste in Idaho—IDAPA 58.01.05.009	Not applicable	Would meet ARAR	Would meet ARAR	Would meet ARAR	Would meet ARAR
Location Specific					
Native American Graves Protection and Repatriation Act—25 USC 32	Would meet ARAR	Would meet ARAR through surveys and assessments and actions deemed necessary	Would meet ARAR through surveys and assessments and actions deemed necessary	Would meet ARAR through surveys and assessments and actions deemed necessary	Would meet ARAR through surveys and assessments and actions deemed necessary
National Historic Preservation Act—36 Code of Federal Regulation 800	Would meet ARAR	Would meet ARAR through surveys and assessments and actions deemed necessary	Would meet ARAR through surveys and assessments and actions deemed necessary	Would meet ARAR through surveys and assessments and actions deemed necessary	Would meet ARAR through surveys and assessments and actions deemed necessary
TBCs					
Real Property Contaminated with Munition, Explosives, or Chemical Agents – DoD Standard 60559, Chapter 12	Would not meet TBC because no controls would be implemented	Would meet TBC through removal of contamination and UXO institutional controls	Would meet TBC through removal of contamination and UXO institutional controls	Would meet TBC through removal of contamination and UXO institutional controls	Would meet TBC through removal of contamination and UXO institutional controls
Long-term effectiveness and permanence					
Magnitude of residual risk	No change from existing risk	No detected contamination would remain at the sites	No detected contamination would remain at the sites	No detected contamination would remain at the sites	No detected contamination would remain at the sites

Table 24. (continued).

Criteria	Alternative 1 No action	Alternative 3a Removal, Treatment of TNT/RDX Fragments, and Disposal of Soil on the INEEL	Alternative 3b Removal, Treatment of TNT/RDX Fragments, and Disposal of Soil off the INEEL	Alternative 4a Removal, Incineration, and Disposal off the INEEL	Alternative 4b Removal, Composting, and Disposition on the INEEL
Adequacy and reliability of controls	No control and, therefore, no reliability	TNT and RDX fragments will be destroyed. Disposal facility is assumed to provide adequate and reliable control over soil disposed of for the period of institutional controls.	TNT and RDX fragments will be destroyed. Disposal facility is assumed to provide adequate and reliable control over soil disposed of for the period of institutional controls.	Treatment will destroy all hazardous contaminants and the disposal facility is assumed to provide adequate and reliable control of the treated soil	Treatment will destroy the TNT and RDX contamination in the soil, which will be verified through testing
Reduction of toxicity, mobility, or volume through treatment					
Treatment process used	No treatment process used	TNT and RDX fragments will be destroyed through detonation. Contamination in soil will not be treated	TNT and RDX fragments will be destroyed through detonation. Contamination in soil will not be treated	TNT and RDX fragments will be destroyed through detonation. Contamination in soil will be destroyed through incineration.	TNT and RDX fragments will be destroyed through detonation. Contamination in soil will be destroyed through composting
Amount destroyed or treated	No treatment process used	TNT and RDX fragments will be destroyed through detonation. Contamination in soil will not be treated	TNT and RDX fragments will be destroyed through detonation. Contamination in soil will not be treated	Approximately 100%	Approximately 90%
Reduction of toxicity, mobility, or volume	No reduction in toxicity, mobility, or volume	Detonation of TNT and RDX fragments will result in significant reduction of the toxicity, mobility, and volume of the source material contributing to soil contamination	Detonation of TNT and RDX fragments will result in significant reduction of the toxicity, mobility, and volume of the source material contributing to soil contamination	100% reduction in toxicity, 100% reduction in mobility, 20% reduction in volume	90% reduction in toxicity, 90% reduction in mobility, 300% increase in volume
Irreversible treatment	No treatment process is used	TNT and RDX fragments will be permanently destroyed through detonation	TNT and RDX fragments will be permanently destroyed through detonation	Not reversible, but affords long-term stability	Not reversible, but affords long-term stability
Type and quantity of residuals remaining after treatment	No treatment process used	Detected contamination would not remain at the site	Detected contamination would not remain at the site	Detected contamination would not remain at the site. Incinerator residuals would remain after treatment of the soil.	Detected contamination would not remain at the site. The compost after treatment would be an organically enriched soil.
Statutory preference for treatment	Not applicable	Meets preference	Meets preference	Meets preference	Meets preference

Table 24. (continued).

Criteria	Alternative 1 No action	Alternative 3a Removal, Treatment of TNT/RDX Fragments, and Disposal of Soil on the INEEL	Alternative 3b Removal, Treatment of TNT/RDX Fragments, and Disposal of Soil off the INEEL	Alternative 4a Removal, Incineration, and Disposal off the INEEL	Alternative 4b Removal, Composting, and Disposition on the INEEL
Short-term effectiveness					
Community protection	Increase in potential risks to the public	No increase in potential risks to the public	Slight increase in potential risks to the public during off-Site transportation	Slight increase in potential risks to the public during off-Site transportation	No increase in potential risks to the public
Worker protection	Increase in potential risk to worker	Workers protected by administrative and engineering controls.	Workers protected by administrative and engineering controls.	Workers protected by administrative and engineering controls.	Workers protected by administrative and engineering controls.
Environmental impacts	No change from existing conditions	Limited to disturbances from excavation. The use of dust suppressants would limit the potential for airborne contamination in the form of fugitive dust.	Limited to disturbances from excavation. The use of dust suppressants would limit the potential for airborne contamination in the form of fugitive dust.	Limited to disturbances from excavation. The use of dust suppressants would limit the potential for airborne contamination in the form of fugitive dust.	Limited to disturbances from excavation. The use of dust suppressants would limit the potential for airborne contamination in the form of fugitive dust.
Time until action is complete	Not applicable	Approximately 18 to 24 months	Approximately 18 to 24 months	Approximately 18 to 24 months	Approximately 18 to 24 months
Implementability					
Ability to construct and operate	No construction or operation implemented	Easy; involves available excavation and transportation technology	Easy; involves available excavation and transportation technology	Easy; involves available excavation, treatment, and transportation technology	Easy; involves available excavation, transportation, and composting technology
Ease of implementing additional action if necessary	May require repeat of feasibility study and record of decision process	Easy; any undetected contamination that may remain can be removed and disposed in the future	Easy; any undetected contamination that may remain can be removed and disposed in the future	Easy; any undetected contamination that may remain can be removed, treated, and disposed in the future	Easy; any undetected contamination that may remain can be removed, treated, and disposed in the future
Ability to monitor effectiveness	Monitoring of conditions is readily implemented	The effectiveness in removing all detected contaminated materials associated with site is easily monitored	The effectiveness in removing all detected contaminated materials associated with site is easily monitored	The effectiveness in removing all detected contaminated materials associated with site is easily monitored	The effectiveness in removing all detected contaminated materials associated with site is easily monitored
Ability to obtain approvals and coordinate with regulatory agencies	No approvals required	No difficulties identified	No difficulties identified	No difficulties identified	No difficulties identified

Table 24. (continued).

Criteria	Alternative 1 No action	Alternative 3a Removal, Treatment of TNT/RDX Fragments, and Disposal of Soil on the INEEL	Alternative 3b Removal, Treatment of TNT/RDX Fragments, and Disposal of Soil off the INEEL	Alternative 4a Removal, Incineration, and Disposal off the INEEL	Alternative 4b Removal, Composting, and Disposition on the INEEL
Availability of services and capacity	None required	Services available on-Site and through subcontractor	Services available either on-Site or through subcontractor; disposal capability is assumed to exist at the INEEL	Services available on-Site and through subcontractor	Services available on-Site and through subcontractor
Availability of equipment, specialists, and materials	None required	Equipment and materials are readily available at the INEEL or within surrounding communities	Equipment and materials are readily available at the INEEL or within the surrounding community	Equipment and materials are readily available at the INEEL or within the surrounding community	Equipment and materials are readily available at the INEEL or within surrounding communities
Availability of technology	None required	Readily available at the INEEL	Readily available at the INEEL.	Readily available at the INEEL and commercially	Readily available at the INEEL
Cost (net present worth, 5% discount rate)					
Capital Cost	$0.6 million	$1.3 million	$1.4 million	$2.1 million	$2.0 million
Operating and Maintenance Cost	$2.9 million	$2.6 million	$2.6 million	$2.6 million	$2.6 million
Total Cost	$3.5 million	$3.9 million	$4.0 million	$4.7 million	$4.6 million

9.8.2 Compliance with ARARs

The ARARs for Alternative 1 (no action) will not be met. Alternatives 3a, 3b, 4a, and 4b all meet ARARs.

9.8.3 Long-Term Effectiveness and Permanence

Alternative 1 (no action) would provide the least long-term effectiveness and permanence. Alternatives 4a and 4b (excavation, incineration and disposal off the INEEL; and excavation, composting, and disposition on the INEEL) provide the highest degree of long-term effectiveness and permanence because all detected TNT/RDX contamination would be destroyed through treatment. Alternatives 3a and 3b (removal, treatment of TNT/RDX fragments, and disposal of soil on and off the INEEL, respectively) provides long-term effectiveness and permanence by destroying the source of the soil contamination (the TNT and RDX fragments) and disposing of the contaminated soil in a secure landfill.

9.8.4 Reduction of Toxicity, Mobility, or Volume through Treatment

For the TNT/RDX-contaminated soil sites, Alternatives 4a and 4b would achieve maximum reduction of toxicity mobility, and volume through treatment of the TNT and RDX fragments by detonation and treatment of the soils to destroy chemical contamination. Alternatives 3a and 3b includes segregation of TNT and RDX fragments for subsequent detonation, which will destroy the source of soil contamination, thus reducing the toxicity, mobility, and volume of the TNT/RDX contamination. However, no treatment of the contaminated soils is associated with Alternatives 3a and 3b.

9.8.5 Short-Term Effectiveness

Alternative 1 (no action) is the most effective in the short-term because no actions resulting in additional worker exposure would be performed. No additional environmental impacts would result from this alternative other than the conditions already existing. Contaminant migration from surface soils via wind and water infiltration is of concern.

Alternatives 3b and 4a are considered equally effective for short-term protection. Both alternatives involve about the same degree of soil excavation and transport off the INEEL. Alternative 3a would be considered more effective as contaminated soils would not be transported off the INEEL and, hence, there would not be potential risk to the public. Alternative 4b is less effective than Alternatives 3a, 3b, and 4a in the short-term because additional worker exposure would result from the increased handling of contaminated soil during the composting process.

9.8.6 Implementability

Each of the alternatives retained for detailed analysis is technically implementable. Alternative 1 (no action) is the most implementable for the TNT/RDX soil sites because it requires no change in existing site conditions.

Alternatives 3a, 3b, and 4a are equally implementable. All use conventional excavation equipment and rely on available disposal and treatment facilities. Alternative 4b is considered less implementable, because a temporary building would have to be constructed and specialized equipment obtained for composting the soil.

9.8.7 Cost

Alternative 1 (no action) has an estimated $3.5 million cost resulting mainly from long-term monitoring, which would be required for at least 100 years. The estimated cost for Alternative 3a is

$3.9 million. The estimated cost of Alternative 3b is $4.0 million. The Alternative 3b cost is slightly higher because of the additional cost to transport soil several hundred miles to a disposal facility off the INEEL. Alternative 3a is the lowest of the four alternatives that meet threshold criteria.

The estimated cost of Alternative 4a is $4.7 million. The estimated cost of Alternative 4b is $4.6 million. The Alternative 4a cost would be higher because of the additional cost to transport soil several hundred miles to a disposal facility off the INEEL. Detailed cost estimates are included in the OU 10-04 Comprehensive RI/FS (DOE-ID 2001, Appendix I).

9.8.8 State Acceptance

The IDEQ has been involved in the development and review of the OU 10-04 RI/FS report (DOE-ID 2001), the Proposed Plan (DOE-ID 2002), and this ROD. All comments received from IDEQ on these documents have been resolved and the documents revised accordingly. In addition, IDEQ has participated in public meetings where public comments and concerns have been received and responses offered. The IDEQ concurs with the selected remedial alternative for the TNT/RDX Contaminated Sites contained in this ROD and is a signatory to the ROD with DOE and EPA.

9.8.9 Community Acceptance

Community participation in the remedy selection process and Proposed Plan reviews included participation in the public meetings held February 7 and 12, 2002 (see Section 3). The 30-day public comment period was extended an additional 30-days from January 28, 2002, through March 29, 2002. The Responsiveness Summary, presented as Part 3 of this ROD, includes verbal and written comments received from the public and the DOE responses to these comments. Representatives of the EPA and IDEQ assisted in the development of the responses.

All comments received on the Proposed Plan were considered during the development of this ROD. Public concerns generally centered on the cost to perform geophysical surveys and remove the TNT and RDX contamination. Consequently, a phased approach to remediation of the TNT/RDX soil sites will be developed during the remedial design phase to reduce costs.

9.9 Selected Remedy for the TNT/RDX Contaminated Sites

The selected remedy for the OU 10-04 TNT/RDX contaminated soil sites is Alternative 3a, removal, treatment, disposal of soil on the INEEL, and institutional controls. This remedy was selected based on the results of the comparative analysis of alternatives. Alternative 3a would be protective of human health and the environment and comply with laws. The long-term effectiveness is high because TNT/RDX contamination will be removed. Reduction of toxicity, mobility, and volume is moderate; although TNT and RDX fragments would be treated by detonation, the rest of the contaminated soil would be removed and disposed but not treated. However, the contaminants would be contained, protecting humans and ecological receptors from exposure. Short-term effectiveness would be moderate, because of the possibility for worker exposure during excavation, treatment, transport, and disposal activities. Implementability of Alternative 3a is high because equipment, technologies, and personnel are all available.

Remediation of the TNT/RDX contaminated soil sites will include the following activities:

- Establish and maintain institutional controls such as access controls and land-use restrictions, and other restrictions such as signs and fences until the TNT/RDX contamination is removed or reduced to acceptable levels. The specific goals of the institutional controls are to control human activity at sites with TNT/RDX contamination and prevent harm from direct exposure to toxic chemicals. Institutional controls will restrict access and monitoring will be performed since buried, undetected TNT and RDX fragments could exist after remediation.

- Perform a visual survey for UXO and TNT/RDX fragments and stained soil and a geophysical survey for UXO.
- Excavate soil contaminated with concentrations in excess of the remediation goals by hand unless it is determined that mechanical excavation equipment can be used. UXO will be removed, if required, to proceed with soil excavation. Otherwise UXO removal will be performed during remediation of the ordnance areas.
- Manually segregate fragments of TNT/RDX from the soil unless safety assessment indicates it is safe to mechanically screen the soil.
- Dispose of the TNT/RDX fragments by detonation at the MDA. Waste generated during detonation activities will be addressed using current disposal practices.
- Use field screening methods and soil sampling with laboratory analysis to determine the extent of soil removal required to meet remediation goals.
- Sample and analyze removed soil to determine the TNT and RDX concentrations and if the soil exhibits any RCRA hazardous waste characteristics. If the soil is less than 10% TNT and RDX and not RCRA regulated, it will be disposed at an approved landfill on or off the INEEL. If the TNT and RDX concentration is above 10% and considered RCRA regulated, the soil will be transported to a permitted RCRA TSD facility for thermal treatment and disposal.
- Backfill areas excavated to depths greater than 0.3 m (1 ft) with uncontaminated soil or contour to match the surrounding terrain and vegetate.
- Monitor air and soil until the TNT/RDX contamination and UXO contamination is removed or reduced to allow unrestricted use.

The UXO surveys and removal, if required, will be performed using standard military techniques. Soils will be characterized and excavated either manually or mechanically, as permitted by safety analysis. The TNT and RDX fragments will be segregated from the soil and detonated at the MDA. Sampling will be performed to determine if products of incomplete combustion are present after detonation events at the MDA. Although detectable levels are not expected, remediation of soil contamination of the MDA will be performed at post remediation if residual risk exceeds 1E-04. Therefore, the MDA will be investigated for remediation after remediation of the ordnance areas and the TNT/RDX sites is complete.

Following separation of the TNT and RDX fragments, the contaminated soil will be disposed at an approved facility on or off the INEEL. Verification sampling will be performed to confirm soils above the remediation goals are removed. The sites will be restored in accordance with the INEEL revegetation procedures.

Institutional controls will be maintained at these sites until the TNT/RDX contamination is removed or reduced to acceptable levels. Controls are required to restrain human activity at areas with TNT/RDX contamination and prevent harm from direct exposure to toxic and hazardous secondary explosive material. In April 1999, the EPA Region 10 developed a policy for institutional controls. During the OU 10-04 remedial design/remedial action (RD/RA) phase for the TNT/RDX contaminated soil sites, an operation and maintenance (O&M) plan will be developed that will contain the institutional controls for the TNT/RDX sites that will follow the guidelines in the policy. This plan will establish uniform requirements of the institutional control remedy components for all TNT/RDX sites and specify the monitoring and maintenance requirements.

Institutional controls will reside with DOE or other government agency until 2095, based on the Comprehensive Facility and Land Use Plan, or until a remedy review or INEEL-wide 5-year statutory review concludes unrestricted land use is allowable.

9.9.1 Estimated Cost for the Selected Remedy

The estimated cost for implementing Alternative 3a, removal, treatment, on-Site disposal of soil and institutional controls, is $3.9 million. The elements of the cost estimate are summarized in Table 25 and details of the cost estimate are provided in the OU 10-04 Comprehensive RI/FS report (DOE-ID 2001, Appendix I). The costs are presented in net present values, which allows for the equal comparisons of long-term and short-term alternatives while factoring in inflation. Cost estimates are based on the use and operation of excavation equipment and disposal. Cost allowances were included to account for waste characterization, packaging, and continuing institutional controls. By implementing the remedy in phases, the cost for implementing this remedy can be reduced.

9.9.2 Estimated Outcomes of the Selected Remedy

Remediation of the identified contaminated soil sites to meet the remediation goals (see Table 22) will be achieved by removal of the TNT/RDX fragments and contaminated soil, which will reduce risk to ecological receptors, future workers, and residents. Verification sampling will be performed to confirm soils above the final remediation goals are removed.

However, the total amount of TNT/RDX at the site is not well documented and complete recovery may not be possible. It is possible that buried TNT and RDX fragments may still exist after remediation, that could come to the surface in the future through frost heave and erosion and continue to present an unacceptable risk. Therefore, periodic surveys will be performed and institutional controls established and maintained.

Access to the INEEL is currently restricted for purposes of security and public safety. Site-wide access restrictions will limit accessibility at least until 2095 based on the Comprehensive Facility and Land Use Plan for ordnance areas containing possible UXO that lie within the INEEL boundary. The areas containing TNT and RDX contamination are within known ordnance areas. Based on the possible presence of UXO, access at these sites may also be limited by the installation of additional fences or relocation of the existing fences. Other access control measures may include warning signs, assessing trespassing fines, and establishing training requirements for persons allowed access. Land-use restrictions will be specified if government control of the INEEL is not maintained throughout the institutional control period.

Table 25. Cost estimate summary for OU 10-04 TNT/RDX contaminated soil sites selected remedy.

Description	Cost (Net Present Value)	Totals
Capital Costs		**967,000**
Remedial Design	**514,000**	
Remedial design/remedial statement of work	76,000	
Remedial design work plan	10,000	
Environmental, safety and health plan	94,000	
Sampling and analysis plan	102,000	
Quality assurance project plan	23,000	
Site operation and maintenance plan	34,000	
Draft final design/report preparation	23,000	
Remedial action work plan	59,000	
Plans and specifications	70,000	
Miscellaneous environmental documents	23,000	
Remediation Support	**147,000**	
Quality assurance	22,000	
Project office operations	125,000	
Remediation/Technical Support Activities	**42,000**	
Engineering and technical support	42,000	
Remedial Action	**220,000**	
Mobilization & prep. work	6,000	
Site work	183,000	
Site restoration	8,000	
Demobilization	6,000	
Other	17,000	
Removal Action	**44,000**	
Summary report	44,000	
Operations Cost		**2,021,000**
Cleanup Tech. Admin. Activities Program Management	**1,471,000**	
Project and baseline management/report	1,471,000	
Post ROD Ops and Maintenance	**0**	
Caretaker maintenance	0	
Monitoring	**550,000**	
Field sampling plan	11,000	
Sampling	313,000	
5-year reviews	226,000	
General and Administrative (G&A)		**6,000**
SUBTOTAL COSTS		**2,994,000**
Plus 30% Contingency		**898,000**
TOTAL PROJECT COST IN NET PRESENT VALUE		**3,892,000**

NOTE: Net present value is the cumulative worth of all costs, as of the beginning of the first year of activities, accounting for inflation of future costs. Net present values are estimated assuming variable annual inflation factors for the first 10 years, in accordance with DOE Order 430.1, followed by a constant 5% annual inflation rate. A constant 5% discount rate is assumed.

9.10 Statutory Determinations for the TNT/RDX Contaminated Sites

9.10.1 Overall Protection of Human Health and the Environment

Alternative 3a provides effective, long-term protection of human health and the environment. The removal of all TNT and RDX fragments, and contaminated soil from the TNT/RDX soil sites will minimize potential long-term human health and environmental concerns associated with future exposure to, or contaminant migration from, uncontrolled release sites. Detonation of the TNT and RDX fragments will effectively destroy the material. Contaminated soil will be disposed in a facility designed for long-term isolation and protection. Institutional controls will be maintained to limit access and activity at the sites and monitoring would be performed because there is the potential for buried, undetected TNT and RDX to reach the surface from frost heaves and erosion, thereby posing an unacceptable risk.

Alternative 3a is protective of the environment during implementation because mitigative measures to prevent contaminant migration during excavation activities will be implemented. However, short-term protection of human health is less effective because workers will be exposed to health hazards from the TNT and RDX contamination. However, all potential risks during implementation will be controlled through administrative and engineering controls. Waste generated during remedial actions will consist of TNT/RDX fragments, contaminated soil, and small quantities of equipment decontamination fluids and discarded personal protective equipment.

9.10.2 Compliance with ARARs and To-Be-Considered Guidance

The selected remedy meets the ARARs as shown in Table 26. Available data indicate the soils should contain less than 1% (10,000 ppm) TNT and RDX when excavated, and hence, the soil will not be considered hazardous and can be sent to an industrial waste landfill. This will be confirmed during remediation. If the TNT and RDX concentration is above 10% and considered RCRA regulated, the soil will be transported to a permitted RCRA facility for thermal treatment and disposal. Removal and detonation of TNT and RDX fragments complies with the Military Munitions Rule and the Open Burning, Wastes Explosives provisions of the RCRA. Groundwater ARARs will be met by reduction in TNT and RDX contamination. Compliance with the emission control ARARs will be ensured by implementing dust suppression techniques during excavation. The DoD Standard 6055.9, Chapter 12, "Real Property Contaminated with Ammunition, Explosives, or Chemical Agents," will be met through the survey for UXO, removal and detonation of the TNT and RDX fragments, removal and disposal of contaminated soil, and implementation of institutional controls. All areas affected by WAG 10 remedial activities will be evaluated for cultural resource concerns before disturbance. Activities in sensitive areas will be modified, as required, to meet ARARs. Therefore, the selected remedy complies with ARARs and TBCs.

9.10.3 Cost Effectiveness

The selected remedy is cost-effective because it is the least costly alternative that satisfies threshold criteria. When compared to other potential remedial actions, the selected remedy provides the best balance between cost and effectiveness in protecting human health and the environment.

9.10.4 Use of Permanent Solutions and Alternative Treatment Technologies

The selected remedy provides effective, long-term protection of human health and the environment. The removal of all detected TNT and RDX fragments and contaminated soil will minimize potential long-term human health and environmental concerns associated with future exposure to, or contaminant migration from, uncontrolled release sites. Detonation of the TNT and RDX fragments will effectively destroy the material. The contaminated soil will be disposed in an approved facility on or off the INEEL designed for long-term isolation and protection.

Institutional controls will be maintained to limit access and future activity at the sites and monitoring will be performed because there is the potential for buried TNT and RDX to reach the surface from frost heaves and erosion, thereby posing an unacceptable risk.

9.10.5 Preference for Treatment as a Principal Element

The selected remedy uses permanent solutions through removal and disposal of the TNT and RDX fragments, principal threat wastes, through treatment by detonation. However, no treatment of the contaminated soils is associated with this alternative.

9.10.6 Five-Year Reviews

The effectiveness of the institutional controls and the need for surveys or removal actions will be evaluated as part of the 5-year review process to assure that final remedial actions for the TNT/RDX sites on the INEEL remain protective.

Table 26. ARARs and TBCs for the selected alternative— removal, treatment of TNT/RDX fragments, and disposal of soil on the INEEL—for OU 10-04 TNT/RDX contaminated soil sites.

Category	Citation	Reason	Relevancy[a]
Chemical-specific applicable, relevant, and appropriate requirements (ARARs)			
Idaho Ground Water Quality Rule	IDAPA 58.01.11.200	TNT/RDX leaching from the site must not adversely affect groundwater quality; standards for groundwater quality must be met.	A
Action-specific ARARs			
Rules for the Control of Air Pollution in Idaho	Fugitive Dust IDAPA 58.01.01.650 and .651	Requires control of dust at all times, especially during excavation of the soil.	A
Resource Conservation and Recovery Act – Standards Applicable to Generators of Hazardous Waste	Hazardous Waste Determination IDAPA 58.01.05.006 (40 CFR 262.11)	A RCRA hazardous waste determination is required for the TNT/RDX fragments, any recovered UXO, excavated soil, and other secondary waste generated during remediation, which is to be treated or disposed of on or off the INEEL.	A
Resource Conservation and Recovery Act – Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Units	General Facility Standards for Owners and Operators of Remediation Waste Management Sites IDAPA 58.01.05.008 (40 CFR 264.1[j][1-13])	General RCRA performance standards must be met during remediation.	A
	Equipment Decontamination IDAPA 58.01.05.008 (40 CFR 264.114)	All equipment used during remediation that contact hazardous waste must be decontaminated in accordance with RCRA requirements.	A
	Use and Management of Containers IDAPA 58.01.05.008 (40 CFR 264.171-177)	Hazardous waste generated during remediation that is managed in containers must meet RCRA requirements.	A
	Open Burning, Waste Explosives IDAPA 58.01.05.008 (40 CFR 265.382)	Detonation of TNT/RDX fragments and UXO must be performed in a manner that does not threaten human health or the environment.	A

Table 26. (continued).

Category	Citation	Reason	Relevancy[a]
Resource Conservation and Recovery Act – Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities	Military Munitions Rule 40 CFR 266.205 and 206	TNT/RDX fragments and UXO identified as hazardous waste under RCRA must meet RCRA requirements for storage, if required during remediation on an interim basis, and transport. Any emergency response conducted during remediation involving munitions or explosives will be exempt from RCRA waste generator and transporter requirements.	A
Location Specific ARARs			
National Historic Preservation Act	Historic properties owned or controlled by Federal agencies 16 USC 470 h-2 Identifying Historic Properties 36 CFR 800.4 Assessing Effects 36 CFR 800.5	In accordance with federal requirements, the site must be surveyed for cultural and archeological resources before construction and appropriate actions must be taken to protect any sensitive resources.	A
Native American Graves Protection and Repatriation Act	Custody 25 USC 3002 (43 CFR 10.6) Repatriation 25 USC 3005 (43 CFR 10.10)	In accordance with federal requirements, the site must be surveyed for cultural and archeological resources before construction and appropriate actions must be taken to protect any sensitive resources.	A
TBC			
Real Property Contaminated with Munitions, Explosives, or Chemical Agents	DoD Standard 6-55.9, Chapter 12	Establishes requirements for disposition of real property known or suspected to be contaminated with ammunition, explosives, or chemical agents.	

a. A = Applicable; RA = Relevant and Appropriate