EA-1206; Remedial Action on the Belfield and Bowman Sites, North Dakota

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List of Acronyms

DOE
U.S. Department of Energy
EPA
U.S. Environmental Protection Agency
FWS
Department of the Interior, Fish and Wildlife Service
MCL
maximum concentration limit
NRC
U.S. Nuclear Regulatory Commission
TDS
total dissolved solids
UMTRA
Uranium Mill Tailings Remedial Action
UMTRCA
Uranium Mill Tailings Radiation Control Act
USACE
U.S. Army Corps of Engineers

1.0 SUMMARY

1.1 BACKGROUND

The Uranium Mill Tailings Radiation Control Act (UMTRCA), Public Law 95-604 (42 USC §7901 *et seq*.) authorized the U. S. Department of Energy to perform remedial action at inactive uranium processing sites designated by the

Secretary of Energy. Under UMTRCA, the U.S. Environmental Protection Agency (EPA) established the standards to be met by the DOE, that the U.S. Nuclear Regulatory Commission (NRC) must concur that DOE has met EPA's remedial action standards, and that the affected states must pay 10 percent of DOE's cost of selecting and performing remedial action. EPA has promulgated its standards for the designated processing sites in 40 CFR Part 192.

The Belfield and Bowman sites were not included on the original congressional list of processing sites to be designated by the Secretary of Energy in Section 102(a)(1). Instead, the sites were nominated for designation by the Dakota Resource Council in a letter to the DOE (September 7, 1979). In a letter to the DOE (September 12, 1979), the state of North Dakota said that it did not believe the sites would qualify as "processing sites" under UMTRCA because the activities at the sites involved only the ashing of uraniferous lignite coal and the ash was shipped out of state for actual processing. Nevertheless, on October 11, 1979, the state of North Dakota agreed to the designation of the sites because they met the spirit of the law (reduce public exposure to radiation resulting from past uranium operations). Therefore, these sites were designated by the Secretary of Energy for remedial action. Because of the relatively low health impacts determined for these sites, they were ranked as low priority and scheduled to be included in the final group of sites to be remediated.

Remedial action was scheduled to begin at the sites in the spring of 1996. However, the state of North Dakota informed the DOE on March 14, 1995, that it would not have the necessary appropriations to pay for its required 10 percent cost-share of the remedial action. In addition, the state requested that DOE close out the state's Cooperative Agreement to perform remedial action and to revoke the designation of the Belfield and Bowman processing sites, citing "minimal public support for the project, limited state funding, and the very small risk to the public and the environment." Since DOE is prohibited from performing remedial action at the sites without North Dakota's required 10 percent cost share, DOE is proposing not to perform any remedial action at Belfield and Bowman. Further, at the state's request, DOE is proposing to revoke the designation of the Belfield and Bowman sites as processing sites, at which time contamination on the sites would be classified as source material by the NRC, subject regulation by the state of North Dakota under agreement with the NRC.

1.2 DESCRIPTION OF THE BELFIELD AND BOWMAN SITES

The Belfield and Bowman designated sites were used by Union Carbide and Kerr-McGee, respectively, to process uraniferous lignite in the 1960s (Figure 1.1). Uranium-rich ash from rotary kiln processing of the lignite was loaded into rail cars and transported to uranium mills in Rifle, Colorado, and Ambrosia Lake, New Mexico (DOE, 1983a,b; FBDU, 1981). As a result of the ashing process, there are approximately 186,400 cubic yards (yd^3) [142,400 cubic meters (m^3]) of radioactive ash-contaminated soils between the two sites. There are no piles of contamination. The contaminated material consists mainly of soil that was dusted with lignite ash from the kiln exhausts and ash-handling operations, and ash that was dispersed across the site due to wind and water erosion. The average depth of contaminated soil is 1.1 foot (ft) (0.34 meters [m]) at the Belfield site and 1.2 ft (0.37 m) at the Bowman site (DOE, 1989). There are possible sludge pit areas at the Belfield site (Mount, 1987) and areas where lignite ore was stockpiled at the Bowman site, resulting in isolated areas of deeper contamination.

The 10.7-acre (ac) (4.3-hectare [ha]) Belfield site, about 1 mile (mi) [1.6 kilometers (km]) southeast of the town of Belfield in Stark County (Figure 1.2). The site is used for commercial, light industrial, and agricultural activities. The Belfield site and the land around it are privately owned. The North Branch of the Heart River is immediately north of the site, and the tracks of the Burlington Northern Railroad border the site on the south. Interstate 94 (I-94) is approximately 0.9 mi (0.6 km) north and U.S. Highway 85 (US-85) is west of the site. North of the designated site is an oil and gas exploration company. To the west is a state highway department maintenance and equipment yard where an agricultural cooperative maintains liquid petroleum gas tanks. The area north of the site is used for grazing. The city's sewage lagoons are northeast of the site across the North Branch of the Heart River. Offsite commercial areas are in Belfield and along US-85 south of I-94. Two original Union Carbide buildings are present at the designated site. One of the buildings was actively used during the ashing process. The western building is used for storage. The eastern building is not currently used; however, it is expected that in the future this building will be used for storage also. The entire site area was contaminated during the ashing process. Windblown, ash-contaminated soil covers an additional 21 ac (8.5 ha) around the site. This additional area includes grazing land, wetlands, and a wooded habitat. The total quantity of contaminated materials is approximately 58,000 yd^3 (44,300 m^3) at the Belfield site.

The 12.1-ac (4.9-ha) Bowman site is about 7 mi (11 km) northwest of the town of Bowman and about 8 mi (13 km) southeast of Rhame, in Bowman County (Figure 1.3). Bowman is about 65 mi (104 km) southwest of the Belfield site (Figure 1.1). The Bowman site and the land around it are privately owned and have been used for agricultural purposes. The tracks of the Burlington Northern Railroad border the site on the north. An unpaved county road that runs north-south separates the site into two tracts. The site is not cultivated and the land immediately south of the site is fallow; other contaminated land outside the designated site but with vicinity property status has been used for grazing. An inactive gas metering station is just outside the southeast corner of the western tract; and a grain elevator complex is 100 ft (30 m) east of the eastern tract. There is an occupied residence 500 ft (152 m) north of the site.

Structures and equipment used at the site have been removed, and only a small amount of concrete rubble and a few pieces of piping remain. Windblown ash-contamination covers an additional 59 ac (24 ha) around the site that include cultivated fields, wetlands, and a shelterbelt at the residence north of the site. The total quantity of contaminated materials is approximately 128,400 yd^3 (98,100 m^3).

In addition to the Belfield and Bowman sites, seven properties in Belfield and one property in Bowman were identified that have been contaminated by the radioactive ash. These properties are called vicinity properties because they are located in the vicinity of the designated processing sites and were contaminated by material originating from the designated processing sites. These properties most likely were contaminated by ash-contaminated soils dispersed through wind and water erosion.

Ground water at the two sites was contaminated as a result of the lignite processing activities. Concentrations of several hazardous constituents exceed the proposed EPA ground water standard maximum concentration limits (MCL). Due to naturally occurring uranium and poor water quality, the ground water currently is not used as a public drinking water supply and is not expected to be so used in the future. However, it is used for watering stock and other nondrinking domestic purposes.

2.0 PROPOSED ACTION AND ALTERNATIVES TO THE PROPOSED ACTION

2.1 PROPOSED ACTION

The proposed action is that the Belfield and Bowman sites would be left as they are, with the contaminated soils and other contaminated materials in their present condition. This is in response to the state of North Dakota's request to the DOE to revoke the designation of the sites under the UMTRCA. Under this action the sites would not comply with the EPA standards as outlined in 40 CFR Part 192. However, once the sites are revoked, 40 CFR Part 192 would no longer apply and the state would then be responsible for regulating the sites.

2.2 ALTERNATIVES TO THE PROPOSED ACTION

2.2.1 Stabilization on the Bowman site alternative

An alternative to the proposed action is to relocate all contaminated materials from the Belfield site to the Bowman site for codisposal. This alternative would comply with EPA standards. The major design features are summarized below and detailed in the Belfield and Bowman remedial action plan (DOE, 1990).

The remedial action would be performed using conventional construction practices and techniques that would comply with all applicable federal, state, and local regulations. The remedial action also would ensure the safe and environmentally sound stabilization of the tailings and other contaminated materials in accordance with the EPA standards.

The principal feature of the final conditions is the stabilization of the contaminated materials from the Belfield and Bowman sites in a location on and adjacent to the Bowman designated site. Disposal would be almost entirely above grade, except for some Bowman-contaminated materials left in place below the disposal cell (Figure 2.1). Contaminated soils and contaminated demolition rubble from both sites would be placed in the disposal cell along with contaminated soils from the vicinity properties. The quantities of contaminated soils are as follows:

- 58,000 yd^3 (44,300 m^3) of contaminated Belfield site soils.
- 28,000 yd^3 (21,400 m^3) of contaminated soil left in place at the Bowman site.
- 100,400 yd^3 (76,700 m^3) of contaminated Bowman site soils outside the disposal cell footprint.

Rock and other construction material for the cover would be hauled from borrow sites in the vicinity of the disposal cell (Figure 2.2).

2.2.2 Stabilization in place alternative

Stabilization in place was another alternative. This alternative would have permanently stabilized all contaminated materials at the two designated sites using the same major design features as the design for the proposed action. The individual cell dimensions would have been dependent on the volumes of material present at each site. Stabilization in place was rejected for the Belfield site because the designated site lies within the 100-year floodplain of the Heart River (FEMA, 1983). More rigorous design considerations and additional volumes of larger-diameter rock would be needed to resist erosion during flooding or heavy precipitation and to ensure the Heart River wetland environment would not be destroyed, degraded, or lost. This alternative was not considered reasonable, and therefore, is not analyzed further here.

3.0 ENVIRONMENTAL CONSEQUENCES

3.1 ENVIRONMENTAL RESOURCES NOT AFFECTED

Only the issues that actually may be affected by the proposed action or the alternative are discussed here. The environmental issues listed below would not be affected:

- Weather.
- Air quality (not including radiation).
- Geology.
- Soils.
- Recreational resources.

The nearest known capable faults are in the Black Hills region. The largest recorded earthquake (magnitude 3.6) within a 124 mi (200 km) radius of the Bowman site occurred 76 mi (123 km) from the site (DOE, 1992).

The Bowman and Belfield site areas were evaluated by the state of North Dakota Soil Conservation Service Office for the presence of prime or unique farmlands regulated under the Farmland Policy Protection Act (7 CFR 658); none was found.

3.2 INTRODUCTION

With the proposed action, the general population would continue to be exposed to radon decay products and airborne radioactive particles from the ash-contaminated soils. Contaminated materials could be removed from the sites since there are no effective barriers in place to prevent unauthorized removal. In addition, contaminants would continue to leach from the soils and migrate into the ground water of the uppermost aquifer.

However, exposure to the contaminants due to these mechanisms is expected to be minimal. As the distance from the site increases, the radioactivity concentration decreases. Future removal of the contaminated materials is not considered likely since they were not disturbed in the past. Minimal dispersion of the ash-contaminated soils through wind and water erosion is expected, since most areas on the sites have been covered over the years by gravel and naturally occurring grass. Lastly, source concentrations of hazardous constituents will decrease over time, causing contaminants in the ground water of the uppermost aquifer to gradually attenuate and dilute. Over time, potentially adverse human health and environmental effects associated with the contaminants would no longer be of concern.

Under the proposed action, an additional 1.3 cancer-related fatalities would occur over amortization of 1000 years. This would be equivalent to 2 people contracting and dying of cancer, if 1,000,000 people spent an entire year on one of the ashing sites (DOE, 1996a). With the alternative action, 0.15 excess health effect is estimated to occur with remedial action.

3.3 MINERAL RESOURCES

Mineral resources of economic value in the Belfield area include lignite coal, oil, and gas, uranium, and sand and gravel (aggregate). Most subsurface mineral rights are privately owned throughout North Dakota (DOE, 1992).

Mineral resources in the vicinity of the Bowman site area are similar to those in the Belfield site area. However, economic deposits are not as common. Mineral rights are owned principally by the Burlington Northern Railroad (DOE, 1992).

Under the proposed action, mineral resource use would not change. Under the alternative action, disposal at the Bowman site likely would preclude future development of any mineral resources beneath the site, and local mineral resources would be used for disposal cell-cover construction.

3.4 RADIATION

Elevated levels of radium-226 are present on both the Belfield and Bowman processing sites. The radium-226 causes elevated levels of gamma radiation and radon gas. Tables 3.1 and 3.2 provide levels of contamination at the Belfield and Bowman sites, respectively.

Exposure rates decrease with increasing distance from the sites, approaching background within 0.5 mi (0.8 km) of both sites in all directions. Gamma radiation levels are close to background levels for most areas surrounding the ashing sites (vicinity properties), and are no more than double the background level at the vicinity property located 500 ft (152 m) north of the Bowman site. For this vicinity property, indoor gamma radiation levels do not exceed the 40 CFR Part 192 standard and the soil around the house does not contain radium in excess of the standard.

3.4.1 Radiation exposure pathways

The four principal radiation exposure pathways for which fatal cancer risks have been calculated are:

- Inhalation of radon decay products, primarily imparting radiation doses to the lungs.

- Direct exposure to gamma radiation from the contaminated materials, or during transport through the local communities, giving radiation doses to the entire body.
- Inhalation of airborne radioactive particles, causing internal doses from alpha, beta, and gamma radiation.
- Ingestion of food or water contaminated by radioactive materials from the sites, resulting in internal doses of radiation.

Risk from ingesting contaminated drinking water has been calculated in assessments for other Uranium Mill Tailings Remedial Action (UMTRA) Project sites (DOE, 1992, 1985, 1984, 1983c). Results of these conservative assessments show that the health risks (fatal cancers) from ingesting food or water contaminated by radioactive materials are very minor compared with exposures to radon decay products, gamma radiation, and radioactive particles, and are not included in this analysis.

Radon (Rn-222), an inert gas (i.e., does not react chemically with other elements) that emits alpha radiation during its radioactive decay, is produced from the radioactive decay of radium-226 (Ra-226) in the uranium-238 (U-238) decay series. As a gas, radon can diffuse through the contaminated materials and into the atmosphere, where it may be transported by atmospheric winds over a large area. In the atmosphere, radon decays into its solid decay products, which attach to airborne dust particles and can be inhaled by humans. These dust particles, with the radon decay products attached, may adhere to the lining of the lungs; when the radon products decay further, alpha radiation is released directly into the lungs.

Gamma radiation, also emitted by many members of the U-238 decay series, behaves independently of atmospheric conditions and travels in a straight line until it interacts with matter. Gamma radiation emitted from contaminated materials delivers an external exposure to the whole body. Exposure to gamma radiation may cause somatic health effects (manifested in the exposed individual), as well as genetic health effects (manifested in the descendants of the exposed individual). This analysis of excess health effects (health risks) reflects only somatic health risks.

Airborne radioactive particles are particles of contaminated soils containing radioactivity that have been suspended in the air. The smaller particles can be transported by wind and may disperse over a large area, similar to radon gas. The particles may then be inhaled by humans, and deliver internal doses from alpha, beta, and gamma radiation to different parts of the body.

At the Belfield and Bowman sites, inhalation of radon decay products would be the exposure pathway of primary concern to the general population. Inhalation of radioactive airborne particles would be of secondary importance. Direct exposure to gamma radiation would be the least significant pathway. Both short- and long-term health risks to the general population are not uniformly distributed. Health risks to the general population principally are dependent on the volume of contaminated materials and the number of people who live nearby. People who live near the ashing sites generally would be at greater risk than those living farther away.

Table 3.1 Radiation and radioactivity levels, Belfield, North Dakota, ashing site

	Range	**Average**	**Source**
Gamma exposure rate[a]			
Background[b]	11.4-13.2 microR/hr	12.4 microR/hr	BFEC, 1986a
Onsite contaminated areas	12-249 microR/hr	NA	BFEC, 1986a
Radon-222[c]			
Onsite flux	1-63 pCi/m^2/s	20 pCi/m^2/s	
	(0.0-2.33 Bq/m^2/s)	(0.74 Bq/m^2/s)	FBDU, 1981
Soil radioactivity-background[b]			

Radium-226	1.0-1.9 pCi/g	1.4 pCi/g	
	(0.037-0.07 Bq/g)	(0.05 Bq/g)	BFEC, 1986a
Thorium-230[d]	1.8 pCi/g	1.8 pCi/g	BFEC, 1986a
	(0.07 Bq/g)	(0.07 Bq/g)	
Soil radioactivity-onsite[e]			
Radium-226	1.3-1374.1 pCi/g	NA	BFEC, 1986a
	(0.05-50.84 Bq/g)		
Stream sediments-Heart River			
Radium-226	1.3-5.1 pCi/g	NA	BFEC, 1986a
	(0.05-0.19 Bq/g)		
Thorium-230	2.0-3.0 pCi/g	NA	BFEC, 1986a
	(0.07-0.11 Bq/g)		

[a]Taken 3 ft (0.91 m) above the ground.
[b]Areas 1.5 mi (2.4 km) from ashing site.
[c]Under the alternative action, long-term radon measurements would be made before, during, and after remedial action.
[d]Single measurement only.
[e]Uranium decay chain is in equilibrium at Belfield and Bowman.

Notes:

1. microR/hr-microroentgens/hour.
2. pCi/m^2/s-picocuries square meter per second.
3. pCi/g-picocuries/gram.
4. NA-not available.
5. pCi-0.037 Becquerels (Bq).
6. Bq-disintegration per second.

Table 3.2 Radiation and radioactivity levels, Bowman, North Dakota, ashing site

	Range	Average	Source
Gamma exposure rate[a]			
Background[b]	11.9-13.4 microR/hr	12.8 microR/hr	BFEC, 1986b
Onsite contaminated areas	11-358 microR/hr	NA	BFEC, 1986b
Radon-222[c]			
Onsite flux	15-94 pCi/m^2/s	58 pCi/m^2/s	FBDU, 1981
	(0.56-3.48 Bq/m^2/s)	(2.15 Bq/m^2/s)	
Soil radioactivity-background[b]			

Radium-226	0.8-2.0 pCi/g	1.4 pCi/g	BFEC, 1986b
	(0.03-0.07 Bq/g)	(0.52 Bq/g)	
Thorium-230	1.0-1.9 pCi/g	1.4 pCi/g	BFEC, 1986b
	(0.04-0.07 Bq/g)	(0.05 Bq/g)	
Soil radioactivity-onsite[d]			
Radium-226	0.4-415.0 pCi/g	42.8 pCi/g	BFEC, 1986b
	(0.01-15.36 Bq/g)	(1.6 Bq/g)	

[a]Taken 3 ft (0.91 m) above the ground.
[b]Areas 1.5 mi (2.4 km) from ashing site.
[c]Under the alternative action long-term radon measurements would be made before, during, and after remedial action.
[d]The uranium decay chain is in equilibrium at Belfield and Bowman.

Notes:

1. microR/hr-microroentgens/hour.
2. pCi/m^2/s-picocuries/meter squared-second.
3. pCi/g-picocuries/gram,
4. NA-not available.
5. pCi-0.037 Becquerels (Bq).
6. Bq-1 disintegration per second.

3.4.2 Short-term health risks

Under the alternative action, short-term health risks are expected to be greater than under the proposed action. This is because the remedial alternative action would disturb the ash-contaminated soils, causing increased airborne radioactive contamination. Remedial action workers also would be exposed to direct gamma radiation during remediation. Exposure would be minimized, however, since dust is strictly controlled on all UMTRA Project remedial action sites and remedial action workers are monitored.

The alternative action is estimated to result in a total excess health effect of 880 x 10^{-6} for the general population during the remedial action, based on the present population distribution in the vicinity of the Belfield and Bowman sites (DOE, 1989). This is a 0.00002 percent chance per individual (based on a total exposed population of 3604 people) of contracting a fatal cancer due to radiation from the ashing sites, or about 2 chances in 10 million.

These estimated fatal cancer risks are very small compared to the natural incidence of cancer. In the United States, an individual has a 19 percent, or one in five, lifetime chance of contracting a fatal cancer (NAS, 1990). This would mean that of 3604 people, approximately 685 would be expected to die of cancer induced by causes other than ashing site-radiation exposure.

3.4.3 Long-term health risks

The proposed action would continue to allow the general population to be exposed to gamma radiation and airborne radioactive particles originating from the contaminated soils. Radon releases would be greater than the 20 picocuries per square meter per second (pCi/m^2/s) (0.74 Becquerels per square meter per second [Bq/m^2/s]) allowed by the EPA standard. These releases would result in potential annual health risks for persons living in the area. The total cumulative health effect is estimated to be 1.3 cancer related fatalities over 1000 years. This represents a lower risk than the 1 in 10,000 lifetime risk given in the proposed 40 CFR Part 192 standard. This estimate reflects a stable population; total health risks would increase if the nearby population increased.

Under the alternative action, once the remedial action is completed, the contaminated materials would be stabilized properly in a permanent disposal cell at the Bowman site. There would be no further exposure to radioactive particles and gamma radiation levels would be reduced to within background. The earthen infiltration/radon barrier would be designed to reduce the release of radon to 20 pCi/m^2/s (0.74 Bq/m^2/s) or less in accordance with the EPA standards. The health effects associated with the alternative action in 1000 years is estimated to be 0.15 cancer-related fatalities (DOE, 1989).

3.5 GROUND WATER

3.5.1 Belfield site

The Belfield site is underlain by sediments of the Sentinel Butte Formation (uppermost unit of the Tertiary Fort Union Group). The Sentinel Butte Formation consists of an interbedded sequence of silty sandstone, sandy claystone, and silty claystone ("upper zone"), underlain by a lignite unit ("lignite zone"), that in turn overlies claystone of undetermined thickness. The Sentinel Butte Formation is approximately 450 ft (137 m) thick in the region (DOE, 1992).

Ground water occurs in the upper zone and in the lignite zone under unconfined and semiconfined conditions with water levels ranging from 15 to 38 ft (5 to 12 m) below the surface. The ground water system is recharged directly by precipitation, seepage from intermittent streams, and standing surface water. There is no evidence of discharge of ground water to the land surface or surface water in the site vicinity. Ground water in the upper zone generally flows south and southeast, and ground water in the lignite zone generally flows east. The vertical hydraulic gradient beneath the Belfield site is downward toward the lignite zone. The average hydraulic conductivity calculated from slug tests in monitor wells completed in the upper zone was 0.7 ft/day (2.5 x 10^4 centimeters per second [cm/s]). The average hydraulic conductivity calculated from one monitor well completed in the lignite zone was 2.6 ft/day (9.2 x 10^4 cm/s). The average linear ground water velocity for the upper zone was 0.07 ft/day (2.5 x 10^5 cm/s), and the average linear ground water velocity for the lignite zone was 0.27 ft/day (9.6 x 10^5 cm/s).

Background ground water quality in the upper zone has been determined by chemical analysis of water samples collected from three monitor wells upgradient from the site. Evaluation of ground water quality data from background monitor wells completed in the upper zone shows that maximum background concentrations (except lead and selenium) are below MCLs.

Contaminant concentrations in the soil pore fluid were analyzed in a sample collected from a suction lysimeter to determine the source term. Concentrations of molybdenum, nitrate, selenium, and uranium exceeded MCLs. Concentrations of nitrate probably are related to agriculture (fertilizer) or effluent from nearby septic tanks.

Contaminants in ground water that are related to the uranium ashing activities do not form a discrete plume in the upper zone downgradient from the processing site. The contaminants are concentrated in areas generally beneath and adjacent to the processing site. This is a result of the diffuse nature of the contaminant source related to the lignite ashing process. In the upper zone, average concentrations of chromium, molybdenum, selenium, and uranium exceeded the MCLs in the site vicinity. In the lignite zone, average molybdenum and selenium concentrations exceeded MCLs.

Shallow wells in the Sentinel Butte aquifer system provide water for watering livestock and some domestic purposes, but not for drinking water supplies. The excess lifetime cancer risk from ingesting milk and meat from ground water-fed livestock in the vicinity of the Belfield site is less than 1 x 10 . This would be the equivalent of 1 person's getting cancer, if one million people ate and drank the milk of ground water-fed livestock daily for 50 years (DOE, 1994a).

The Belfield municipal water supply is derived from several wells within the city limits, at depths greater than 1000 ft (300 m). These wells are at least 1000 ft (300 m) upgradient from the site. Alternative water supplies in the site vicinity are available from deeper aquifer systems.

3.5.2 Bowman site

The Bowman site is underlain by sediments of the Bullion Creek Formation (part of the Tertiary Fort Union Group). The Bullion Creek Formation consists of an interbedded sequence of silty sandstone, silty claystone, and thin discontinuous lignite stringers ("upper zone"). This layer is underlain by a relatively extensive lignite unit that varies from 4 to 7 ft (1 to 2 m) thick (middle "lignite zone"), which in turn is underlain by an interbedded sequence similar to the upper zone ("lower zone").

Ground water occurs under unconfined conditions in the upper zone, to confined conditions in the lower zone, with semiconfined conditions possibly existing in the lower part of the upper zone and in the lignite zone. Water levels range from 6 to 20 ft (1.8 to 6 m) below the surface. The ground water system is recharged directly by precipitation, seepage from intermittent streams, and standing surface water. Ground water recharge to the lignite zone and the lower zone is influenced by downward leakage through the upper zones, as well as by subsurface underflow. There is no evidence of natural discharge of ground water from the upper zone or the lignite zone to the land surface or surface water in the site vicinity. Ground water in the upper zone generally flows northeast and southwest, away from a local ridge. Ground water in the lignite zone generally flows southeast, and ground water in the lower zone generally flows east and southeast. The vertical hydraulic gradient beneath the Bowman site is downward toward the lignite zone. The average hydraulic conductivity calculated from aquifer pumping tests in monitor wells completed in the upper zone was 0.23 ft/day (8.1 x 10^5 cm/s). The average hydraulic conductivity calculated from aquifer pumping tests in monitor wells completed in the lignite zone was 10.21 ft/day (3.6 x 10^{-3} cm/s). The average hydraulic conductivity calculated from an aquifer pumping test in a monitor well completed in the lower zone was 0.15 ft/day (5.3 x 10^5 cm/s). The average linear ground water velocity for the upper zone was 4.6 x 10^3 ft/day (1.6 x 10^6 cm/s); for the lignite zone was 0.20 ft/day (7.1 x 10^5 cm/s); and for the lower zone was 3.8 x 10^{-3} ft/day (1.3 x 10^6 cm/s).

Background ground water quality in the three hydrogeologic units was determined by chemical analysis of water samples collected from monitor wells upgradient from the site. Evaluation of water-quality data from background monitor wells completed in the upper zone shows maximum background concentrations are below MCLs. Data from monitor wells completed in the lignite zone show maximum background concentrations are below MCLs, except chromium and selenium. Data from monitor wells completed in the lower zone show maximum background concentrations are below MCLs.

Contaminant concentrations in the soil pore fluid were analyzed from samples collected from five suction lysimeters. Average concentrations of cadmium, chromium, lead, molybdenum, selenium, and uranium exceeded MCLs. Analytical results from the lysimeter samples were used as an estimate of the existing source concentrations of the contaminated materials.

Ground water contaminants related to the uranium ashing activities do not form a discrete plume in the upper zone downgradient from the designated site. These contaminants are concentrated in areas generally beneath and adjacent to the site. This is a result of the diffuse nature of the contaminant source related to the lignite ashing process. In the upper zone, concentrations of cadmium, chromium, lead, molybdenum, selenium, and uranium exceeded MCLs. concentrations exceeded the MCL in one monitor well. Since nitric acid was not used in the uranium processing activities at the Bowman site, it is believed that concentrations in ground water most likely result from the application of fertilizer to adjacent cultivated lands and effluent from nearby septic tanks. The extent of ground water contamination in the lignite zone is significantly less than ground water contamination in the upper zone. This is a result of dilution by ground water flowing through the more transmissive fractured lignite, and the relative reducing capacity of the lignite (which would tend to cause uranium and other constituents to precipitate out of solution). In the lower zone, all constituent concentrations were below MCLs.

Ground water in the shallow aquifers is not considered a significant resource because of marginal water quality (associated with the nature of the sediments and the presence of mineralized zones) and limited yield from the fine-grained sediments. The only use of ground water within the site vicinity is from two existing wells completed in the Bullion Creek aquifer system on a farm 500 ft (152 m) north of the disposal site. These wells supply water for livestock and domestic purposes (bathing, watering vegetation, etc.) for a household, but are not used as a source of drinking water. The excess lifetime cancer risk for ingesting milk and meat from ground water-fed livestock in the vicinity of the Bowman site is less than 8×10^6. This would be equivalent to 8 people developing cancer, if 1,000,000 people ate and drank the milk of ground water-fed livestock daily for 50 years (DOE, 1994b).

The Bowman municipal water supply is derived from several wells within the city limits and southeast of town at depths greater than 1000 ft (300 m). Alternative water supplies in the site vicinity are available from deeper aquifer systems underlying the Bullion Creek and Upper Ludlow aquifer system. Although the Bowman's municipal wells are downgradient from the designated site, no impact from the contamination has been observed or is anticipated because the wells are approximately 7 mi (11 km) from the Bowman site and produce ground water from much lower aquifer systems (depth greater than 1000 ft [300m]) than those at the site.

3.5.3 Proposed action

In the proposed action, contaminants would continue to leach from the soils and migrate into the ground water in the uppermost aquifer. Source concentrations of hazardous constituents would decrease over time, and ground water contaminants in the uppermost aquifer would gradually attenuate and dilute to the extent that any potentially adverse effects on human health and the environment would be negligible.

3.5.4 Alternative action

The alternative action would remove all contaminated materials from the Belfield site, eliminating the source of contamination to the ground water. All contamination would be combined with the contamination at the Bowman site and covered with a low-permeability material. Since the flow of precipitation through the contaminated materials would be significantly reduced due to the presence of the low-permeability cover, the amount of contaminated leachate that could enter the ground water also would be significantly reduced. Natural flushing would continue in the uppermost aquifers at both sites, resulting in decreased contaminant concentrations over time.

3.6 SURFACE WATER

3.6.1 Belfield site

At the Belfield site, the North Branch of the Heart River (the only surface water feature in the immediate site vicinity) flows primarily during spring runoff and after heavy rainfall. For the remainder of the year, stagnant water ponds at low points in the channel, which is 10 to 15 ft (3 to 4.6 m) below the general site elevation. Water in the site area either ponds onsite or drains to the river. The railroad tracks are an effective barrier to water entering the site area from the south.

Except for a small area along the southwestern portion of the site, the Belfield site is within the boundaries of the 100- and 500-year floodplain on the North Branch of the Heart River (FEMA, 1983). Estimates of expected peak flow rates for the North Branch of the Heart River in the immediate site vicinity were taken from a U.S. Geological Survey analysis (DOE, 1996b). The estimated 100-year flood is 8000 cubic feet per second (ft^3/s) (227 m^3/s). The estimated probable maximum flood) of 48,000 ft^3/s (1359 m^3/s) in the site area would overflow the banks of the North Branch of the Heart River and submerge the processing site.

Limited water quality analyses are available for the water in the North Branch of the Heart River above and below the Belfield designated site. Water quality analyses of two surface water samples collected from the river 1 mi (1.6 km) southeast and downgradient from the site in 1987 indicate the EPA and state drinking water standards were exceeded for cadmium, chromium, iron, manganese, lead, sulfate, and total dissolved solids (TDS) (DOE, 1989). These elevated contaminant levels are the result of naturally occurring conditions and not the result of contamination derived from the site. Surface waters may have been contaminated in the past due to the ashing operations. Currently, downstream surface water quality does not appear to be contaminated from the sites (DOE, 1990).

3.6.2 Bowman site

The Bowman site is on a low drainage divide within the Spring Creek watershed. A broad, ephemeral stream west of the site area is the only surface water feature in the immediate area. This site is not subject to flooding.Water from the eastern portion of the site tends to pond on either side of the unpaved county road that separates the two tracts of the site. Water from areas north of the railroad tracks is diverted from the site area. Two culverts along US-12 divert water from the western portion of the site to low-lying areas where the ephemeral stream west of the site intersects the highway. On the eastern side of the drainage divide, water is diverted to a small ephemeral stream 0.5 mi (0.8 km) east of the site. This stream joins Spring Creek, an intermittent stream, 1.5 mi (2.4 km) southeast of the site area.

Since the flow in Spring Creek is ephemeral, water quality sampling data are very limited for this area. Water quality analysis of one surface-water sample collected from a pond on Spring Creek 1 mi (1.6 km) south of the site indicates cadmium, chromium, lead, molybdenum, sulfate and TDS exceed EPA and state drinking water standards (DOE, 1989). These elevated contaminant levels are the result of naturally occurring conditions and not the result of contamination derived from the site. Surface waters may have been contaminated in the past due to the ashing operations. Currently, the downstream surface water quality does not appear to be contaminated from the sites (DOE, 1990).

3.6.3 Proposed action

Under the proposed action, contaminants may continue to be dispersed to nearby surface waters. However, since the contaminated soils are covered by gravel and naturally occurring grass, dispersion would be minimal. In addition, over time the contamination gradually would attenuate and dilute.

3.6.4 Alternative action

During remedial action dispersion of contaminants into surface water would be controlled by constructing temporary drainage ditches and wastewater retention ponds (to evaporate contaminated water). These features would prevent contaminated water from leaving the site areas. The design would be in accordance with Section 404 of the Clean Water Act (33 USC §1251 *et seq.*) and state discharge permit requirements. Once the sites were remediated, contaminants could no longer disperse into surface water.

3.7 FLORA AND FAUNA

The Belfield and Bowman sites are in the Upper Missouri Basin and Broken Land physiographic region within the short grass-wheatgrass-needlegrass plant association (Kuchler, 1975). The Belfield/Bowman floodplains/wetlands assessment presents more details regarding the wooded draw habitat at the Belfield site and the wetland at the Bowman site (DOE, 1996b).

3.7.1 Belfield site

Three grass-dominated types and one wooded community type were identified at the Belfield site. The first plant community type is dominated by nonnative grass species along the easement between the Burlington Northern Railroad and a county road just south of the railroad. This area is dominated by smooth brome and a variety of herbaceous plants (DOE, 1983a). The second plant community is also grass-dominated and occurs adjacent to the woody vegetation along the Heart River. This area is grazed actively; its plant species composition is similar to the nonnative grassland plant community (crested wheatgrass and smooth brome are common) (DOE, 1983). The third grass-dominated plant community type is a cultivated hay field south of the county road.

The fourth plant community, a wooded draw along the Heart River, is the *Fraxinus pennsylvania/Ulmus americana/Prunus virginianus* type, according to Girard et al.(1984). The vegetation in the wooded draw consists of deciduous trees and shrubs growing in a narrow band along the river. The dominant tree species are American elm and green ash. Chokecherry is an abundant tall shrub in the understory while the most abundant common low-growing shrub is snowberry. The ground cover is dominated by grass; various herbaceous plant species also were observed. Emergent aquatic vegetation grows in narrow bands along the river. Various species of rushes, sedges, bulrushes, and arrowhead were common. This wooded draw is a US Army Corps of Engineers (USACE**)** jurisdictional wetland (Disbro, 1986; Zschomler, 1986). It is also designated as unique habitat in North Dakota by the Department of the Interior, Fish and Wildlife Service (FWS) (Collins, 1987).

Detailed studies of reptiles and amphibians in the site vicinity have not been conducted.

Thirty-six species of breeding birds were observed in the wooded draw. Fifty-one species of birds were observed during surveys at the site (TAC, 1992, 1986, 1985) including nesting waterfowl along the Heart River.

Detailed field studies of wild mammals were not conducted; however, a total of 32 wild mammal species may occur at the Belfield site area.

3.7.2 Bowman site

The Bowman site area is dominated by gently rolling hills vegetated by species typical of the short-grass prairie habitat. Some of the area is used for dryland farming. Wooded areas in the form of shelter belts and small wetlands are scattered throughout the area.

Five plant community types were identified at the Bowman site and associated contaminated areas (TAC, 1986, 1985). Three plant communities were grass-dominated. The fourth plant community type is an ephemeral wetland west of the designated site area along an unnamed tributary to Spring Creek. This area is not mowed or grazed and is dominated by cordgrass; blue-grass, sedges, and rushes were also observed. This is a USACE-jurisdictional wetland area (Disbro, 1986; Zschomler, 1986).

The only woody plant community is a shelterbelt associated with the farm complex just north of the site. Elm is the dominant tree species; some of these trees are up to 55 ft (17 m) tall. Smaller trees growing in this area are Russian olive and juniper. The ground cover is a dense growth of grass and herbs in more open areas, while the ground cover is fairly sparse in areas with a closed canopy. The major flowering species in this area in June 1986 was dame's rocket (TAC, 1986).

Very few species of amphibians or reptiles were recorded at the Bowman site. Forty-eight bird species were recorded in the Cowman site vicinity (TAC, 1992, 1987, 1986). Sixteen bird species were recorded in the shelterbelt; the western kingbird and mourning dove were the most common species observed (TAC, 1987, 1986). The sharp-tailed grouse was the only upland game bird observed near the site (TAC, 1987). The short-grass prairie habitat is optimum habitat for this species (Harrington and Associates, 1984).

Five duck species were observed at or near the site. Waterfowl were not observed within the boundary of the contaminated area.

Eight species of birds of prey were observed in the site area. The great-horned owl and kestrel were observed in the shelterbelt. They may nest there, although no nests were observed. The turkey vulture, golden eagle, northern harrier, Swainsons hawk, and red-tailed hawk were observed flying in the area; no evidence of these species nesting in the area was obtained. The ferruginous hawk was observed near the site and two inactive nests also were observed in 1986 and 1987; these nests were not active in 1992 (TAC, 1992, 1987, 1986).

A total of 32 species of mammals may occur at the Bowman site; 12 species were observed at or near the site. White-tailed deer were the most abundant big game species recorded onsite. A few pronghorn antelope and mule deer were observed in the rolling hills 0.75 mi (1.26 km) north of the site (TAC, 1992, 1987, 1986). These species may use the site area to a limited extent.

3.7.3 Threatened or endangered species and other species of concern

The determination of threatened and endangered species and other species of concern that may occur at the Belfield or Bowman sites was accomplished through consultation with the FWS and the North Dakota Game and Fish Department. The state indicated that no state-listed plant or animal species occur near the two sites (Henegar, 1985). Informal consultation with the FWS occurred in 1986, 1989, and 1992 (Bowman, 1986; Sapa, 1992, 1989). A list of agencies consulted is provided in Section 4.0. A letter received from FWS in 1992 indicates the following endangered species have the potential to occur at the sites (Sapa, 1992).

- The bald eagle is a migrant in North Dakota. However, the wintering population occurs principally along the Missouri River; one nesting pair occurs in the state. An occasional bald eagle may occur at the sites during migration. The eagle's occurrence (Dryer, 1992) is expected to be sporadic since no preferred habitat associated with large bodies of water occurs near the sites (Harrington and Associates, 1984).

- The peregrine falcon has not been recorded as a breeding species in North Dakota since 1954. An occasional migrant may occur near the sites; however, this may be very sporadic since stop-over areas during migration consist of river bottoms that have an abundance of avian prey species (FWS, 1982).

- The whooping crane occurs during migration in North Dakota. Occasional individuals stray west of the river during migration, and an occasional migrant whooping crane may occur in the wetland areas near the Belfield and Bowman sites.

- The black-footed ferret is not known to occur in North Dakota. However, this species is closely associated with the prairie dog and all prairie dog towns are considered potential black-footed ferret habitat (Hillman and Clark, 1980). Observations at the Belfield and Bowman sites and the proposed Griffin borrow site indicate the prairie dog does not occur at any of these sites (TAC, 1992, 1987, 1986, 1985).

- The American burying beetle occurs in the Black Hills of South Dakota. This species would not be expected to occur near the identified commercial rock quarry site in South Dakota (Dryer, 1992).

Consultation with the FWS indicates the following five candidate species may occur near the sites.

- The regal fritillary butterfly occurs in southern North Dakota in undisturbed native mid- to tall-grass prairie habitat (Royer and Marrone, 1992). Royer and Marrone estimate that at least 1000 ac (405 ha) of such habitat are required to maintain a viable population of this species. Because this type of habitat does not occur at or near the Belfield and Bowman sites, the occurrence of this species at these sites is very unlikely.

- The ferruginous hawk and its nests were observed near the Bowman designated site in 1986 and 1987 (TAC, 1987, 1986). In July 1992, these nests had disappeared and new nests were not observed in the site area. This species does not presently nest at or near the Bowman site.

- The Baird's sparrow occurs in central and western North Dakota and prefers to nest in undisturbed or lightly disturbed prairie habitat (De Smet and Miller, 1989). This species has the potential to occur in the area of the Bowman site. However, the habitat at or near this site is crop land or heavily grazed prairie grasslands, which would not support a nesting population of this species. In addition, nesting-bird surveys in 1986, 1987, and 1992 did not result in the observation of this species. Therefore, a nesting population of the Baird's sparrow does not occur at or near the Bowman site.
- The loggerheaded shrike nests throughout North Dakota and nests in wooded draws and shelterbelts. This species was recorded near the Bowman site in 1986 and has the potential to nest in the shelterbelt near this site and within the wooded draw at the Belfield site (TAC, 1986).
- Originally, the swift fox occurred throughout the prairie habitat of North Dakota. It is now very rare in North Dakota; the last confirmed observation was in 1976 (Harrington and Associates, 1984; McKenna and Seabloom, 1979). This species was not observed at the Belfield and Bowman sites during site-specific surveys (TAC, 1987, 1986; DOE, 1983a,b) or during intensive field studies in western North Dakota (Harrington and Associates, 1984; Seabloom et al., 1978).

3.7.4 Proposed action

The proposed action would maintain the status quo and adverse impacts to plants, animals, and ecological relationships are not anticipated. An assessment of potential effects to threatened or endangered species indicates the proposed action would not affect these species.

3.7.5 Alternative action

Alternative action would result in both direct (long- or short-term) and indirect (for the duration of the remedial action) impacts to the ecosystems at the two designated sites and the borrow sites. Direct impacts would be the loss of wildlife habitat due to surface disturbances (e.g., cleaning up contaminated soils, upgrading roads, and borrow activities), the destruction of less mobile wildlife such as small mammals and reptiles, and the displacement of larger mammals and birds from affected areas. In addition, displaced wildlife may be forced to compete with other resident wildlife for habitat or forced to inhabit marginal habitat, which could result in a reduced survivorship for the displaced wildlife.

3.8 LAND USE

The Belfield site and the land around it are privately owned. The site contains two buildings. The eastern building formerly was used for honey processing. The western building is leased to a drilling mud company and is used for miscellaneous storage (Huschka, 1992). The site is bordered on the north by the North Branch of the Heart River and on the south by the Burlington Northern Railroad. Land uses in the site area include a maintenance yard for the state highway department and liquid petroleum gas tanks maintained by an agricultural cooperative. The town of Belfield is within 0.5 mi (0.8 km) of the designated site. The surrounding area is used for agriculture.

The Bowman designated site is 7 mi (11 km) northwest of the town of Bowman and immediately north of US-12. The designated site and the surrounding land are privately owned. The site is bordered on the north by the Burlington Northern Railroad and bordered on the south by US-12. The designated site and land immediately south of the site are not under cultivation. A farm is approximately 500 ft (152 m) north of the designated site. The primary agricultural uses include dryland farming for wheat or small grains and raising cattle and sheep. There are no prime farmlands as defined by the Farmland Protection Policy Act of 1981 in the affected areas (7 CFR Part 658).

The proposed action would not affect current land use. Future use of land or ground water may be affected by the continued dispersion from the site of the ash-contaminated soils and subsequent contamination of the environment. Continued dispersion of the contaminated soils is expected to be minimal due to the presence of gravel and naturally occurring grass.

The alternative action would require the temporary disturbance of an estimated 139 ac (56 ha) at the Belfield and Bowman ashing sites and the Griffin and Bowman borrow sites, and for construction of an access road to the Belfield site. There would be a permanent loss of use of 12.1 ac (4.9 ha) at the Bowman site for the disposal cell. Approximately 3 ac (1 ha) of the 12.1 ac (4.9 ha) are within the designated site boundary and are not currently in use.

3.9 CULTURAL RESOURCES

The Belfield and Bowman designated sites were evaluated for the presence of cultural resources in 1987 and 1988.

Three historic sites and four prehistoric isolated artifacts were found in the Belfield site area. Two of the three historic sites appear to be north of the Heart River and therefore out of the designated site area. None of the three sites have been characterized as significant or eligible for listing on the National Register of Historic Places. Two of the four isolated artifacts have a high potential for being significant. Additional subsurface archaeological testing is necessary to verify the presence or absence of additional cultural resources in the area. Clearance from the State Historic Preservation Office has not been obtained for any of these finds (UNDAR-WEST, 1988, 1987).

Inventory of the Bowman site resulted in identifying 23 historical structures, which included standing and razed structures. These structures are thought to be related to the former townsite of Griffin. Griffin was founded in 1907 as Atkinson; the name subsequently was changed to Griffin in 1908. By the 1920s, the town consisted of 50 people and had a post office, church, general store, grain elevator, hotel, lumber company, and school. By 1930, the post office was removed and the town subsequently abandoned. The result of the survey evaluation was that a qualified historian should further assess the significance of the occupational history and ownership of the town site (UNDAR-WEST, 1988). The proposed action would have no effects on cultural resources.

For the alternative action, prior to any ground-disturbing activities, the DOE would perform cultural resource surveys at the Bowman borrow site if necessary, and collect additional data where warranted. Since the Bowman borrow site is on an existing sand and gravel lease, cultural resource evaluation may not be necessary. Prior to remedial action, the State Historic Preservation Office would be contacted to ensure that all potentially disturbed areas have been appropriately evaluated. If cultural resources were identified during the remedial action, all work would be stopped in the area of the find until proper evaluation was completed and either the find collected or sufficient data retrieved.

3.10 SOCIOECONOMIC CHARACTERISTICS

3.10.1 Population and housing

The towns of Belfield and Bowman were severely affected by the declines in the oil industry that began in 1982. As can be seen from the population table (Table 3.3), the population of Belfield decreased by approximately 50 percent between 1982 and 1990. The population is composed of people that own and farm land or own a small business in the area. Area towns are small, with populations between several hundred and several thousand.

The total number of vacant housing units in Stark and Bowman Counties is unavailable. However, due to population shifts resulting from oil industry-related unemployment, rental units, including trailers, are expected to be available in the general area (Eiseman, 1992; Woodley, 1992).

Table 3.3 Summary of population for Stark and Bowman Counties, North Dakota

Location	1980 (census)	1982 (est.)	1990 (census)	1995 (est.)
Stark County	23,697	28,107	22,832	22,434
Dickinson	15,224	19,351	16,097	NA
Belfield	1,274	1,757	887	NA
Bowman County	4,229	4,314	3,596	3,229
Bowman	2,071	2,068	1,730	NA

Ref.: Hogue, 1992.

3.10.2 Employment

Oil exploration and development, mining, and agriculture historically have provided the employment base for the Belfield and Bowman areas. Employment opportunities in the area today, however, are related to agriculture and to businesses that provide local services (e.g., service station, restaurant). The 1991 labor force for Stark and Bowman counties were reported as 11,451 and 1980, respectively. The unemployment rate for Stark County averaged 5 percent in 1991 and likely reflects unemployment in Dickinson, North Dakota. Bowman County has a lower unemployment rate (3.1 percent) than Stark County, which likely is due to the more rural nature of the area. Employment levels in this part of North Dakota have stabilized since the decline that started in 1982. The loss of oil industry-related jobs in the early 1980s resulted in workers leaving the area to pursue employment opportunities in other areas.

According to the Dickinson job service office, which covers an eight-county area, about 170 workers were qualified to drive a semitrailer truck registered for work in 1992. In the same area, 120 heavy equipment operators were registered for work. Training for tractor semitrailer truck driving is available at Dickinson State University in Dickinson, North Dakota (Lisko, 1992).

3.10.3 Community services

Dickinson, which is 19 mi (31 km) east of Belfield, is considered the trade center for Stark, Slope, and Bowman Counties. The city of Bowman, however, is considered a minitrade center for the area, as well (Hogue, 1992). The eight western counties of Adams, Billings, Golden Valley, Hettinger, Dunn, Slope, Stark, and Bowman are administered through the Roosevelt-Custer Regional Council, which provides planning and technical assistance to communities and the counties. The Council consists of 21 members and an executive director and meets monthly. The towns of Belfield and Bowman each have a mayor. Both towns report surplus infrastructure related to population declines. School enrollment is under capacity. Emergency services are available, although both county staffs are small. Emergency medical care is available through the sheriff's department for both Stark and Bowman Counties. There is a full-service, 129-bed capacity hospital in Dickinson, as well as a full-service, 36-bed hospital in Bowman with airlift capability to Bismarck, North Dakota. Average bed use in the Bowman hospital is 16 percent (Paulson, 1992). Belfield does not have a hospital but does have a clinic that opens one day per week for minor problems.

3.10.4 Proposed action

The proposed action would not affect socioeconomic characteristics, other than those associated with future land use described above.

3.10.5 Alternative action

An estimated 73 workers would be required for the alternative action. Due to the requirements of this construction project, workers primarily would be truck drivers and heavy equipment operators. Although both Belfield and Bowman are small rural towns, most of the work force is expected to be available in the region. Workers from outside the area likely would commute to work during the remedial action.

3.11 ENVIRONMENTAL JUSTICE CONSIDERATIONS

Executive Order No. 12898 states that federal programs and actions shall not disproportionately affect minority or low-income populations. None of the alternatives (proposed and remedial action) addressed in this environmental assessment would adversely affect any cultural or socioeconomic group more than the population as a whole. The towns of Belfield and Bowman and the surrounding communities, which would be affected by the alternatives, are culturally and economically diverse.

3.12 TRANSPORTATION

3.12.1 Proposed action

The proposed action would not affect transportation.

3.12.2 Alternative action

During the alternative action, US-85 and US-12 would be used to transport the contaminated materials from the Belfield site to the Bowman disposal site. These federal highways are two-lane, paved, undivided rural principal arterials. US-85 is the north-south route that provides access to US-12 in Bowman. US-12 provides east-west access between the city of Bowman, the Bowman disposal site, the Griffin borrow site, and the Bowman borrow site (Figure 2.2). All trucks hauling the contaminated materials from the Belfield site would need to go through downtown Bowman.

Based on the most current information (collected in 1988), the average daily traffic (ADT) volume for US-85 just south of Belfield was an estimated 1050 vehicles. In Bowman, the ADT on US-85 was 1000 vehicles. Just south of the Bowman site on US-12, the ADT was 800 vehicles. Truck traffic comprises 10 to 20 percent of the current ADT on these roadways (Steinwand, 1992). The ADT reflects all vehicles passing a specific point and therefore would include traffic in all directions.

Both highways are at a Level of Service A and can sustain ADT volumes of up to 10,000 vehicles of all types. The Level of Service ratings refer to the amount of congestion occurring on the highway. Level of Service A means there is no current congestion (Johnson, 1987). Current usage is below road-carrying capacity.

County roads would be used to haul borrow materials from the Bowman borrow site. The degree of use on county roads is unknown. There are no official road designations for area county roads and use is local. Existing use likely does not exceed 100 vehicles per day.

For the remedial action alternative, the heaviest use of area roads would occur during the 2 months when the Belfield contaminated material is transported to the Bowman site.

3.13 NOISE

No recent noise surveys have been conducted in the areas of the Belfield and Bowman sites. Noise levels at the

Belfield site would likely be higher than at the Bowman site due to the existing commercial uses in the area. However, ambient noise levels in both areas are expected to be low due to the rural nature of the area. The proposed action would not affect noise levels.

The remedial action alternative would require the use of heavy equipment at the disposal site to properly consolidate and cover the contaminated materials. The residence adjacent to the disposal site (500 ft [152 m]) and the construction workers would be most affected by noise resulting from the remedial action alternative. However, all project activities would be subject to state and federal noise regulations.

4.0 CONSULTATION AND COORDINATION

The following state and federal agencies have been instrumental in providing information and assessing UMTRA Project impacts on their resources.

- North Dakota Geological Survey
  Bismarck, North Dakota
  David Brekke

- North Dakota State Game and Fish Department
  Bismarck, North Dakota
  D. L. Henegar
  Alex Doxbury

- North Dakota State Department of Health and Consolidated Laboratories
  Division of Environmental Engineering
  Air Pollution Control Program
  Bismarck, North Dakota
  Steve Weber

- North Dakota State Department of Health
  Bismarck, North Dakota
  Gene Christianson

- North Dakota State Department of Health
  Division of Environmental Engineering
  Bismarck, North Dakota
  Dana Mount

- North Dakota Department of Transportation
  Bismarck, North Dakota
  Kurt Johnson

- U.S. Army Corps of Engineers
  Omaha, Nebraska
  Sam Disbro

- Fish and Wildlife Service
  Bismarck, North Dakota
  Roger Collins, Mark Dryer
  Stan Zscholmer, Allyn J. Sapa

- Fish and Wildlife Service
  Grand Island, Nebraska

David Bowman, Dennis Buechler

- Geological Survey, Bismarck District Office
  Bismarck, North Dakota
  Norm Haffield

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