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EPA Superfund
Record of Decision:

Bruno Co-Op Association/
Associated Properties
Bruno, NE
9/30/1998

RECORD OF DECISION

Bruno Cooperative Association/Associated Properties Site
Bruno, Nebraska

U.S. Environmental Protection Agency
Region VII

Kansas City, Kansas

September, 1998

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Abbreviations and Acronyms

1,2-DCA	1,2-dichloroethane
ARARs	Applicable or Relevant and Appropriate Requirements
Argonne	Argonne National Laboratory
AWQC	Ambient Water Quality Criteria
bgs	below ground surface
BVSPC	Black & Veatch Special Projects Corporation, an EPA contractor
CCC/USDA	Commodity Credit Corporation/United States Department of Agriculture
cfs	cubic feet per second
COC	Chemical of Concern
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	chloroform
CFR	Code of Federal Regulations
CT	carbon tetrachloride
E&E/FIT	Ecology and Environment/Field Investigation Team
EPA	United States Environmental Protection Agency
ESC	Expedited Site Characterization
et. seq.	(et sequentia) and succeeding sections
FS	Feasibility Study
GAC	granular activated carbon
gpm	gallons per minute
MCL	Maximum Contaminant Level
MSL	mean sea level
MW	Monitoring well
N/A	not available, or not applicable
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NDEQ	Nebraska Department of Environmental Quality
NDOH	Nebraska Department of Health
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NRD	Natural Resources District
ng/L	nanograms per liter
NPL	National Priorities List
NPDES	National Pollution Discharge Elimination System
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Act
OSWER	Office of Solid Waste and Emergency Response
PA	Preliminary Assessment
POTW	Publicly Owned Treatment Works

ppb	parts per billion
PRP	Potentially Responsible Party
PWS	Public Water Supply
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SI	Site Investigation
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
USC	United States Code
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

I. DECLARATION

Declaration for the Record of Decision

Bruno Cooperative Association/ Associated Properties Site Bruno, Nebraska

Site Name and Location

The Bruno Cooperative Association/Associated Properties Site ("Bruno Co-op Site"), CERCLIS identification number NED981713829, is located in Bruno, Nebraska. Bruno is an agricultural community in the northeast section of Butler County, about 60 miles west of Omaha, Nebraska.

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Bruno Co-op Site, in Bruno, Nebraska, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and other amendments, and, to the extent practicable, the remedy also follows the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for this site.

Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of Selected Remedy

This ROD addresses groundwater and soil. The principal threat at this site is volatile organic compounds (VOCs) in the groundwater at the site. The specific VOCs which have been identified as contaminants of concern (COCs) are carbon tetrachloride, 1,2-dichloroethane, chloroform (abbreviated CT, 1,2-DCA, and CF respectively) in this document. The presence of these contaminants in the groundwater at the site presents a threat to an adult or child resident of Bruno consuming water from the affected aquifer.

The major components of the selected remedy include the following:

- Active restoration of the aquifer by pumping out and treating the contaminated groundwater.
- Groundwater monitoring and a periodic analysis of the results.
- Treatment of contaminated groundwater by air stripping using tray aeration techniques.
- Discharge of treated groundwater to the nearby tributary of Skull Creek. At the option of state and local authorities, some of the water may be beneficially reused rather than discharged.

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. This remedy also satisfies the statutory preference for remedies that employ treatment as a principal element (i.e., reduce toxicity, mobility, or volume of contaminants through treatment). Because hazardous substances above health-based levels are expected to still be on site in 5 years, a review will be conducted within 5 years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Dennis Grams, P.E.
Regional Administrator
United States Environmental Protection Agency
Region VII

9/30/98
Date

II. DECISION SUMMARY

Decision Summary

1.0 Site Name, Location, and Description

This Record of Decision (ROD) was developed by the U.S. Environmental Protection Agency (EPA), as lead agency, with support from the Nebraska Department of Environmental Quality (NDEQ).

The Bruno Cooperative Association/Associated Properties Site ("Bruno Co-op Site"), CERCLIS identification number NED981713829, is located in Bruno, Nebraska. Bruno is an agricultural community in the northeast section of Butler County, about 60 miles west of Omaha, Nebraska, as shown on Figure 1. The population of the community is approximately 150. The village is largely residential except for the Bruno Co-op (a farmers' grain cooperative), a post office, a school, a community center, a sanitary sewer treatment facility, and a variety of small stores.

The Bruno Co-op site is a former U.S. Department of Agriculture grain storage site where carbon tetrachloride (CT) was used as a grain fumigant. The site is located on the northwest edge of town, adjacent to the former tracks of the Chicago and North Western Railway Company, and lies in the flood plain of a tributary to Skull Creek as shown on Figure 2.

2.0 Site History and Enforcement Activities

The first indication of contamination by volatile organic compounds (VOCs) came from a routine screening for VOCs in Bruno's public water supplies by the Nebraska Department of Health (NDOH) in the mid-1980's. The NDOH analysis of a water sample collected by the well operator from one of the Public Water Supply (PWS) wells detected carbon tetrachloride (CT) at 40.1 micrograms per liter (μg/L) (these μg/L measurements are approximately equivalent to parts per billion or ppb), chloroform (CF) (often found as an impurity or breakdown product in connection with CT) at 4.2 μg/L, and 1,2-dichloroethane (1,2-DCA) (a grain fumigant or solvent compound) at 7.3 μg/L, but the well was not specified. Subsequent sampling by the same operator and analysis by the NDOH in December 1985 confirmed CT levels of 4.5 μg/L in one well and 3.9 μg/L in the other well, but the wells again were not identified. In January 1986, the NDOH sampled both PWS wells. The VOC analysis detected levels of CT at 39 μg/L, CF at 4.1 μg/L, and 1,2-DCA at 5.9 μg/L in Well 65-1 and CT at 38.3 μg/L, CF at 4.2 μg/L, and 1,2-DCA at 8.1 μg/L in Well 36-1.

A preliminary assessment (PA) of the Bruno PWS was completed in April 1987 for EPA by an EPA contractor, the Ecology and Environment Inc. field investigation team (E&E/FIT). The PA concluded that the PWS wells were contaminated with

VOCs, but the source of contamination was undocumented. The report suggested that the most likely source of contamination was the former Commodity Credit Corporation/United States Department of Agriculture (CCC/USDA) grain storage site (now owned by the Co-op) and other local grain storage facilities where CT may have been used as a grain fumigant. Additional sampling by the EPA in February 1988 confirmed the presence of VOC contamination of the groundwater. The VOC analysis detected 38 μg/l of CT, 4.6 μg/l of CF and 16 μg/l of 1,2-DCA in Well 36-1; and 13 μg/l of CT, 93 μg/l of CF, and 5,3 μg/l of 1,2-DCA in Well 65-1.

In May 1988, E&E/FIT carried out a potentially responsible party (PRP) search for the area now occupied by the Bruno Co-op. After evaluating the evidence presented in this report, EPA sent out notice letters identifying CCC/USDA and the Chicago and Northwestern Railway as PRPs. CCC, the Commodity Credit Corporation, is part of the federal government, an agency of the U.S. Department of Agriculture. (The same parties were again notified of their potential liability in 1993.)

In October and December 1988, E&E/FIT performed a site investigation (SI), submitting a final report to the EPA on May 8, 1989. As its primary task, E&E/FIT was directed by the EPA to conduct a soil gas survey to define the approximate geographic extent of the subsurface plume associated with the CT identified in the two PWS wells. E&E/FIT collected 27 soil gas samples to create a map of the CT plume and identify the source or sources of the VOCs found in the PWS wells. The survey failed to identify a contaminant plume, but two isolated soil gas samples collected on the Bruno Co-op property had CT levels of 144 and 370 nanograms per liter (ng/L). The remaining samples were less than the soil gas confidence limit (40 ng/L).

In May 1989, the EPA began to supply bottled water to the 150 residents of Bruno as a temporary measure until an alternate water supply could be provided. The PWS wells (Wells 36-1 and 65-1) were disconnected, and two replacement PWS wells (Wells 90-1 and 90-2) were completed about 1 mile west of the village and connected to the village's water system in October 1990.

In June 1996, the Bruno Co-op site was placed on the EPA National Priorities List (NPL).

3.0 Community Participation

The Human Health Baseline Risk Assessment prepared by the Nebraska Department of Health, the Phase II Expedited Site Characterization report prepared by USDA, EPA's July 1998 Final Feasibility Study (FS), USDA's April 1998 report on its contractor's groundwater modeling efforts (Argonne Final Report, April 1998), and other site-related documents, were made available to the public for a public comment period which began on July 16, 1998, and which concluded on August 22, 1998. EPA's Proposed Plan for the Site was made available at a public meeting on July 23, 1998. The Proposed Plan was placed, along with the other site documents discussed above, in a local repository at the Bruno Post Office.

Notice of the availability of these documents and the time and location of the public meeting was published in a local newspaper, the David City, NE *Banner-Press*. A fact sheet summarizing the Proposed Plan and EPA's preferred alternative was mailed to residents and local and state elected officials and federal elected representatives.

As noted above, a public meeting was held during the public comment period at Bruno Village Hall, Bruno, Nebraska, on July 23, 1998. EPA presented the results of the site studies, to highlight the reasons why it was recommending its preferred remedial alternative, and listened to questions and comments from the public.

Comments received at the public meeting, as well as written comments submitted during the comment period, are addressed in the Responsiveness Summary Section of this ROD.

4.0 Site Characteristics

The equivalent of EPA's required Remedial Investigation (RI) was conducted to determine the nature and extent of contamination at the site and potential fate and transport scenarios. In 1994-1995, Argonne National Laboratory (Argonne) of Argonne, Illinois, performed two phases of RI-like work for the USDA, an identified PRP. USDA's Phase I "Expedited Site Characterization" (ESC) investigation was completed and reported in November 1994. The USDA Phase II ESC investigation, which EPA considered the equivalent of its required Remedial Investigation to gather the data needed to decide on a remedy for this site, was completed and reported in 1995. The investigations included monitoring well installation, subsurface soil sampling and analysis, surface water sampling and analysis, groundwater sampling and analysis, and characterization of the site physical properties. Continued monitoring of the site by Argonne was conducted to establish a database which would later be used to produce a hydrogeologic model of the site. The fate and transport of contamination at the site was evaluated using groundwater and contaminant transport hydrogeologic computer models. Further results of its modeling efforts were reported by Argonne in April 1998.

Efforts to characterize the nature and extent of soil and groundwater contamination at the Bruno site were performed by Argonne during field programs conducted since April 1994. The results of the site characterization investigations were presented in Argonne's reports. Figure 3 is a map of all sampling locations, as well as the locations of temporary wells, public wells, municipal test wells, and domestic wells.

The investigation efforts were focused on CT and CF, both of which were identified in both soil and groundwater. Investigation efforts to determine the extent of 1,2-DCA contamination were not performed, but 1,2-DCA behaves similarly in the environment to CT and CF.

4.1 Soil Contamination

Soil contamination was found in the vadose zone (the soil zone above the water table) at the site. The highest concentration of CT, 2,700 micrograms per kilogram (2,700 μg/kg, or ppb) occurred in the surface soil sample taken in the immediate vicinity of the location where grain storage bins once existed on the former site. No CF contamination was detected in the surface soils at these locations. CF was detected in one surface soil sample taken from soil boring SB15, just to the north of the former grain storage bins. Figure 4 illustrates results of the CT soil sampling investigations. CT and CF contamination was also detected in subsurface soil samples collected in the vicinity of the former CCC/USDA grain storage bins, which were removed in the 1960's. Soil contamination was detected on the site in samples taken from soil borings SB16 and SB20 from depths of approximately 7 feet below ground surface (bgs) to approximately 40 feet bgs. At the sampled locations, CT concentrations ranged from 8 to 87 μg/kg. Maximum values were 87 μg/kg at a depth of approximately 29 feet bgs in soil boring SB20 and 30 μg/kg at a depth of 23 feet bgs in soil boring SB16. Detected CF concentrations ranged from 6 to 110 μg/kg in subsurface soil samples taken at SB16. No CF was detected at SB20. In subsurface soil samples collected at SB15 (north of the location of the former grain storage bins), only CF was detected in minor concentrations (approximately 5 μg/kg). CT was also detected (approximately 4 μg/kg) in a single soil sample taken from an approximate depth of 23 feet bgs at SB19, located to the southwest of the former CCC/USDA site.

4.2 Groundwater Contamination

Bruno lies over a shallow Pleistocene aquifer. The shallow aquifer consists of four distinct stratigraphic units. The uppermost layer is a clay silt layer which is approximately 40 feet thick. This layer is believed to be a windblown loess deposit. Underlying the loess is the upper sand unit which ranges in thickness from 5 to 25 feet. Underlying the upper sand unit is a complex sequence of fine silt with stringers of clay and fine grained sand. This sequence was termed the middle silty unit and it ranges in thickness from 10 to 35 feet. Underlying the middle silty unit is the lower sand unit which is approximately 20 to 30 feet thick. Underlying the lower sand unit is a clay unit approximately 10 feet thick. Underlying this clay unit is a Cretaceous shale bedrock unit. The clay and the Cretaceous shale are an aquiclude which hydraulically isolates the surficial aquifer from any underlying water bearing units.

Groundwater elevations in wells indicate the regional direction of groundwater flow is primarily north. The depth to the groundwater piezometric surface is approximately 15 to 20 feet bgs at the site. Recharge to the aquifer is believed to be primarily through infiltration of precipitation and has been estimated to range from 2 inches to 5 inches per year.

The surface water stream which runs from southwest to northeast along the north side of the site is believed to only impact groundwater during periods of high rainfall. The base of the stream is above the elevation of the water table; therefore, the stream is not a point of discharge for the aquifer.

Bruno's first PWS well was completed in the shallow aquifer in 1936 on a site now occupied by the Bruno Co-op and was identified as Well 36-1. A second well, Well 65-1, was installed in 1965 near the center of the village, at the intersection of Pine and Third Streets. These wells were taken off-line in 1990 because of the contamination discussed in Section 2.0. Two new wells were drilled to the west of the village and put on-line in 1990. These wells are identified as Wells 90-1 and 90-2.

A groundwater contaminant plume is present in the aquifer in the vicinity of the former CCC/USDA grain storage site at Bruno. The contaminated aquifer has been broadly divided into three layers: the upper sandy layer, the middle silty layer, and the lower sandy layer. The contamination is migrating both vertically and laterally across all three aquifer layers. The highest concentrations of CT (1,300 μg/L) were found in the middle layer of the aquifer directly beneath the former CCC/USDA site. CF concentrations were generally much lower, ranging from below the detection limit (5 μg/L) to 63 μg/L. Figures 5 through 10 show the areal extent of the CT and CF plumes in the upper, middle, and lower portions of the aquifer at Bruno.

5.0 Current and Potential Future Site and Resource Uses

The site is currently an active farmers' grain cooperative surrounded by residential and agricultural areas. There are no restrictions at present on the future use of the site.

The aquifer below the site is used as a potable water resource for the town and individual farmsteads. Public water supply wells have been contaminated and have been taken out of service because of the contamination. The community has expressed a strong interest in being able to return at least one of their former wells to service in the near future.

6.0 Summary of Site Risks

The baseline risk assessment estimates what risks the site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk assessment for this site.

6.1 Human Health Risk Assessment

A human health baseline risk assessment for the site was prepared by the NDOH.

The risk assessment is an analysis of the potential adverse health effects that may result from human exposure to chemical contaminants present at the site. Exposure to contaminated groundwater from ingestion, dermal contact while bathing, and inhalation of chemicals that volatilize while bathing were evaluated. Several potential pathways of exposure to contaminated soil were also evaluated.

To ensure protection of human health, the risk assessment assumes that no action has been taken at the site to remove the contamination, and the highest exposure that may reasonably be expected to occur at the site is evaluated.

For example, in the Bruno risk assessment it was assumed that a future Bruno resident drills a new well within the area of the groundwater contamination and is concurrently exposed to contaminated soil. The individual is assumed to be drinking and bathing with contaminated groundwater and working or playing in contaminated soil on a daily basis.

The COCs at the Bruno site include CT and CF. Both of these chemicals may pose adverse health effects and both are considered to be probable human carcinogens. To evaluate the potential for adverse health effects, excluding cancer, a hazard index is used. The evaluation of non-carcinogenic risks for future adult and child through the groundwater exposure pathway resulted in hazard indices of 36.5 and 85.2 respectively. A hazard index calculated for a site in excess of 1.0 indicates that potential adverse health effects may occur from exposure to the site contaminants. In Bruno, hazard indices exceeded 1.0 for future adult and child residents, who were assumed to drink and bathe in the groundwater contaminated with CT and CF. In other words, there is a potential for adverse health effects to occur if the contaminated water is ingested, comes in contact with the skin, or if the volatilized chemicals are inhaled while bathing.

With one exception, no adverse health effects were determined, in NDOH's baseline risk assessment, for exposure to contaminated soil. The one exception was that for a future child resident exposed to CT in the soil at the location of highest soil contamination, adverse health effects may occur from exposure to chemicals evaporating from the soil. This calculation assumes the child is playing and digging in the soil at this location on a daily basis, and it also assumes that the highest level in soils, 2,700 µg/kg, is spread uniformly over an area 45 meters on one side. However, nearby samples as close as 25 feet away showed non-detect values, as was pointed out by a comment made during the public comment period, causing EPA to reevaluate this calculation.

Although EPA initially believed there could be adverse health effects for a hypothetical future child resident from levels observed in soil on-site at or near the former bin storage location, any potential health hazard to workers at the site from soil exposure to CT, CF, and 1,2-DCA was calculated to be at an acceptable level.

The cancer risk associated with exposure to a chemical is evaluated differently than the risk from exposure to noncarcinogens. The cancer risk is presented as the probability that an individual exposed to a carcinogen will develop cancer in his/her lifetime (70 years). The cancer risk associated with exposure to chemical contamination, presented in the Bruno risk assessment, is the excess cancer risk or *risk in excess* of the national background cancer risk in the United States of roughly 1 in 3. In Bruno, the highest excess cancer risk associated with the site was calculated for a future adult resident ingesting CT in groundwater. An excess cancer risk of 1.4 in 1,000 was calculated this future adult resident. In other words, a future Bruno resident assumed to consume contaminated groundwater has a background probability of developing cancer in his/her lifetime of about 1 in 3 plus an *additional* risk 1.4 in 1,000. Cancer risks associated with dermal contact and inhalation of volatilized chemicals are also added to this risk but were estimated to be 1 to 2 magnitudes lower than the risk from ingestion.

Based on the information discussed above, EPA finds that actual or threatened releases of hazardous substances from this site, if not addressed by implementing a response action such as the one selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

The above summary presents an overview of the Bruno risk assessment report prepared by the NDOH in 1995. The full September 1995 risk assessment report may be consulted in the Administrative Record File for a more detailed evaluation of the site risks.

6.2 Ecological Risk Assessment

A four-step process was utilized for assessing site-related ecological risks for a reasonable maximum exposure scenario:

1) Problem Formulation- a qualitative evaluation of contaminant release, migration, and fate; identification of COCs, receptors, exposure pathways, and known ecological effects of the contaminants; and selection of endpoints for further study. 2) Exposure Assessment- a quantitative evaluation of contaminant release, migration, and fate; characterization of exposure pathways and receptors; and measurement or estimation of exposure point concentrations. 3) Ecological Effects Assessment- literature reviews, field studies, and toxicity tests, linking contaminant concentrations to effects on ecological receptors. 4) Risk Characterization- measurement or estimation of both current and future adverse effects.

The ecological risk assessment was conducted by NDOH and showed no danger to sensitive animal populations, vegetation near streams, ponds, or rivers since contaminant levels appear to be below established ecological benchmark values for surface water and sediment. Currently, there are no generally accepted values available for soil.

7.0 Remediation Objectives

The unacceptable risks at the Bruno site are attributable to ingestion, inhalation, and dermal contact with contaminants of concern in groundwater. Risks associated with inhalation and direct contact with soils in potential source areas were determined by EPA to be below levels of concern. As discussed in Section 6.1 above, one calculation that led to EPA finding an unacceptable risk from soil to a possible future child resident on-site was recalculated based on a comment received during the public comment period, and corrected.

Remedial Action Objectives (RAO) provide a general description of how the unacceptable risks at the site will be addressed. The RAO for the Bruno Co-op site is to prevent human exposure to contaminated groundwater. This will be accomplished at the Bruno site by restoring the groundwater to drinking water quality in the contaminated area (Figure 11) so that future generations of residents may use the aquifer. This objective is based on available information and relies the baseline risk assessment and on standards such as applicable or relevant and appropriate requirements (ARARs) of other environmental laws.

The following final cleanup levels were established for the Bruno site contaminants of concern for restoring groundwater to drinking water quality. Each of the cleanup levels are based on the drinking water maximum contaminant levels (MCLs) for these contaminants.

CT	–	5 μg/L (MCL)
CF	–	100 μg/L (MCL for total trihalomethanes)
1,2-DCA	–	5 μg/L (MCL)

RAOs were not developed to address soil contamination at the site because it was ultimately determined, based on additional information received after the preparation of the Proposed Plan, that soil contamination did not pose an unacceptable risk through inhalation, ingestion, and dermal contact and, in addition, that the soil did not represent a significant continuing source of contaminants of concern to site groundwater. Therefore, no additional active measures to address soil contamination are expected to be needed to protect human health and the environment.

8.0 Description of Alternatives

CERCLA requires that the selected site alternative be protective of human health and the environment, be cost effective, comply with other environmental laws, and utilize permanent solutions, alternative treatment technologies, and resource recovery alternatives to the maximum extent practicable. In addition, the statute includes a preference for the use of treatment as a principal element for the reduction of toxicity, mobility, or volume of the hazardous substances.

EPA's July 1998 Feasibility Study (FS) Report evaluated remedial alternatives (including the no action alternative, which EPA is required to consider by law) for addressing the contamination associated with the groundwater plume at the site. The Feasibility Study considered four alternatives in detail: 1) no action (required to be considered under the NCP); 2) pumping and treating the groundwater to contain the plume; 3) pumping and treating the groundwater more aggressively in order to achieve the cleanup standards throughout the aquifer in a reasonable time; and 4) an innovative approach, in-situ vapor extraction.

The goals of the remedial action for the Bruno site are to prevent exposure by ingestion, inhalation, or direct contact to the contaminants of concern (CT, CF, and 1,2-DCA) found in the site's groundwater. As part of the process of choosing a remedy, the above remedial alternatives from the FS are compared and evaluated using nine criteria that appear in the NCP. (These are discussed in Section 9 below.)

For the purpose of analyzing and comparing the remedial alternatives, EPA assigned specific costs to the alternatives by making certain assumptions to allow costs to be estimated, such as estimating the relative gallonage of water to be pumped out of the ground in Alternatives 2 and 3 (containment pump-and-treat and pump-and-treat to clean the aquifer to MCLs), for example. EPA Superfund policy is to try to assign costs with "+50/-30" accuracy. The accuracy is only approximate. The estimates are acceptable if the costs estimated are in a range as much as 50% greater or 30% less than the estimates.

In the discussion below, numerical features (such as gallons per minute, number of wells estimated to be required, or dollar estimates) are highlighted, but what is really being compared are the four broad remedial alternatives focused on in the FS, which are no action, containment pump-and-treat to prevent the plume from spreading or migrating, aggressive pump-and-treat to clean up the aquifer more quickly, and in-situ vapor extraction, an innovative technique for cleaning the groundwater without having to pump it out of the ground.

The analysis of remedial alternatives within the FS report, and the conceptual design cost estimates, were assembled by Black & Veatch Special Projects Corporation (BVSPC, the EPA contractor that prepared EPA's July 1998 Feasibility Study Report).

The present worth of each alternative, a summary measure of cost that, for comparison purposes, turns a stream of payments or costs over a future period of years into the equivalent of single lump sum in the present, was calculated by BVSPC for all alternatives assuming a 5 percent discount rate for up to 30 years. The cost estimates, as discussed above, are conceptual, with an estimated +50 percent to-30 percent level of accuracy. The alternatives from the FS report are described below, in the remainder of Section 8. Section 9 compares the alternatives. Section 10 discusses the selected alternative, which is Alternative 3, cleanup of the aquifer to MCLs. Section 10 also discusses several additional measures that will be taken as part of the selected remedy, including measures added in response to comments which were received during the public comment period.

8.1 Alternative 1: No Action

- Capital Cost: $0.
- Present Worth of Annual O&M Cost: $0.
- Total Present Worth Cost: $41,700.
- Construction time: 0.
- Cleanup time: Indefinite, unknown.
- Pump rate: N/A.
- Groundwater treatment technology: N/A.
- Disposal: N/A.

Alternative 1 would not involve any remedial actions, and the site would remain in its present condition. This alternative, required by the NCP and CERCLA, is a baseline alternative against which the effectiveness of the other alternatives can be compared. Under the no action alternative, the site is left "as is" and no funds would be expended for monitoring, control, or cleanup of the contaminated groundwater. However, a 5-year review of the site would be required under CERCLA, and so the computed "total present worth" cost was estimated to include funds that would be expended to conduct the review.

8.2 Alternative 2: Containment/Air Stripping with Tray Aeration

- Capital Cost: $215,000.
- Present Worth of Annual O&M Costs: $647,400.
- Total Present Worth Cost: $862,400.
- Construction time: 1-2 years.
- Estimated cleanup time: +100 years.
- Pump rate: 40 gallons per minute total.

- Estimated number of extraction wells: 4.
- Groundwater treatment technology: Tray aeration.
- Disposal: Discharge to tributary of Skull Creek.

Alternative 2 would entail the extraction of contaminated groundwater through extraction wells to establish a hydraulic barrier and prevent migration of the contaminated plume. The hydraulic barrier would be created by placing the extraction wells at locations and pumping them at rates sufficient to modify the groundwater flow gradient, preventing further contaminant migration. Although contaminated groundwater would be removed, the well locations and pumping rates would not be adequate for active restoration of the plume. The groundwater would be treated by air stripping with tray aeration to meet discharge standards and discharged to a tributary of Skull Creek.

The proposed location, pumping rate, depth and size for the extraction wells were determined using groundwater modeling conducted by Black & Veatch. The wells would be located so that the radii of influence overlap the extent of the contaminant plume. The groundwater modeling conducted during the FS suggested that two well nests consisting of two wells each could create the required hydraulic barrier, each well nest consisting of one well screened in the upper sand aquifer zone at an approximate depth of 50 feet and a second screened in the lower sand aquifer zone at an approximate depth of 105 feet. The wells would pump at approximately 10 gallons per minute (gpm) each for a total of 40 gpm. The actual location, pumping rate, depth and size of the extraction wells needed for containment of the plume of contaminated groundwater would need to be determined during the remedial design.

It was assumed that the groundwater would be pumped to an on-site treatment system through double contained underground piping equipped with a leak detection system. The exact location of the piping treatment system and discharge point would need to be determined during remedial design.

The groundwater treatment system could be a packaged system that would be delivered to the site. It was assumed that the treatment system would be housed in a prefabricated structure to reduce noise, improve appearance, insulate the treatment process, and protect equipment. The prefabricated structure would be placed on a concrete foundation. A chain link security fence would be constructed around the treatment facility to limit general accessibility to the facility and the potential for public exposure. Piping, controls, valves, and pumps would be housed within the building for year-round operation. Power lines would be connected, and wiring would be installed to operate pumps, fans, lighting, and other equipment. Signs would be posted to prevent unknowing entry into the building, and security measures, such as alarms, would be implemented.

The treatment system would remove and transfer the contaminants from the groundwater to the air using a shallow tray aeration process. Contaminated groundwater enters at the top of the treatment system and flows across a series of aeration trays. Air passes upward through openings in the trays and bubbles through the water forming a foamy/frothy surface which provides high turbulence and excellent volatilization. Size of the trays and treatment system components would be determined during treatability study and remedial design. The system could be readily expanded to accommodate an increase in influent flow or contaminant concentrations by addition of another series of trays, which are stacked vertically onto existing trays.

The treated groundwater would be discharged to the tributary of Skull Creek at the site, and sampled to insure compliance with the substantive requirements of the Clean Water Act and the parallel state regulations. Treatment plant influent and effluent would be monitored. It was assumed the influent and effluent would be analyzed for CT, CF, and 1,2-DCA.

Although a surface discharge route will need to be designed and established, EPA would also be willing to try to make some or all of the pumped and treated water available for beneficial reuse, provided it is understood that EPA is not in a position to arrange for the removal of other possible contaminants (such as nitrates or other common groundwater contaminants not within the scope of this cleanup), or to guarantee that the treated water is safe for any particular use.

For example, despite removal of the contaminants of concern (CT, CF, and 1,2-DCA) to the surface water discharge limits or to the MCLs, the water may not be potable because of other impurities.

If the water is to be used rather than discharged (at the expense of the State, regional, or local authorities and/or local water users), EPA would consult with the State, the Lower Platte North Natural Resource District, and the Village of Bruno concerning the possible recipients of the water and concerning what state or local governmental entity would plan to take responsibility for the water's further treatment and distribution.

A concrete plan or design for the beneficial use of the discharge water would need to be developed by one or more of the above identified parties and provided to EPA for its review prior to the due date for the preliminary design documents (i.e. the date the initial design deliverable is due to EPA) in order to allow adequate time for any beneficial reuse plans to be incorporated into design. (The project schedule, once it is established, can be obtained by a request to the EPA project manager.)

Regardless of the above limitations, the pump-and-treat piping system will be designed with a point of hookup built in, to accommodate any beneficial reuse plans that may later be established.

Treatment of off-gases is not expected to be needed. The expected emission rate of the chemicals of concern is 0.11 ton/year of CT, 8.1×10^{-3} ton/year of CF and 1.4×10^{-3} ton/year of 1,2-DCA. According to the Nebraska Air Pollution Control Rules and Regulations, Title 129, Chapter 27, Section 002; the allowable emission rate is 2.5 ton/year of any hazardous air pollutant or an aggregate of 10 ton/year of hazardous air pollutants. If these limits are exceeded, off-gases would need to be treated by Granular Activated Carbon (GAC). The GAC canisters would then need to be disposed of off-site. For the purpose of costing out this alternative, it was assumed that off-gas treatment would not be needed. Even if regulatory standards would not be exceeded, modeling, and if necessary (based on the modeling), monitoring, of the air emissions from the treatment unit would be required to ensure that air emissions do not pose a hazard to nearby persons or residences.

Groundwater monitoring would be included under this alternative. New and existing monitoring wells would be used to verify the hydraulic performance and containment of the contaminant plume. The new and existing monitoring wells would be sampled for VOCs including CT, CF, and 1,2-DCA. A detailed sampling and quality assurance plan would be prepared to specify the sample location, sample frequency (quarterly unless EPA determines otherwise), laboratory analysis, and sampling procedures. Monitoring wells would need to be maintained and replaced as needed to assure their continued effectiveness.

After eight quarters of monitoring results have been accumulated, a report will be prepared to evaluate the effectiveness of the ongoing remedy, which shall evaluate what adjustments or improvements or other changes to the system might be beneficial to further the cleanup. Such a report will be prepared every two years until the remedy is complete.

Based on modeling conducted by Black & Veatch, this alternative would take in excess of 100 years to reach the cleanup standards.

8.3 Alternative 3: Active Restoration/Air Stripping with Tray Aeration

- Capital Cost: $417,400.
- Present Worth of Annual O&M Costs: $639,600.
- Total Present Worth Cost: $1,057,000.
- Construction time: 1-2 years.
- Estimated cleanup time: 18 years.
- Pump rate: 200 gallons per minute total.
- Estimated number of extraction wells: 4.
- Groundwater treatment technology: Tray aeration.
- Disposal: Discharge to tributary to Skull Creek.

Alternative 3 is a more aggressive pump and treat aimed at restoring the aquifer, by lowering the COCs to below MCLs throughout the aquifer. This alternative includes the use of extraction wells, treatment of contaminated water by air stripping using tray aeration technology, and discharge of the treated groundwater to a tributary of Skull Creek, and/or beneficial reuse of the pumped and treated water. Many of the features of Alternative 2, as discussed above, would be included, but the key difference is achievement of MCLs throughout the aquifer in as fast a time frame as feasible for the Site.

The proposed locations, pumping rate, and screened intervals for the extraction wells used for conceptual and cost estimation purposes in this alternative were estimated using existing data and groundwater modeling. Modeling results indicated that using four groundwater extraction wells screened throughout both lower and upper sand and middle silty units and pumping at approximately 50 gpm each for a total rate of 200 gpm could remediate the aquifer in approximately 18 years. The actual location, pumping rate, and screened intervals of the extraction wells would need to be determined during remedial design, using additional site specific data acquired during remedial design investigations.

Contaminated groundwater would be pumped to an on-site treatment system consisting of air stripping with tray aeration. The treatment system, associated double-contained piping with leak detection, the fence and security measures, utilities and wiring, the along with the building housing the treatment system, would be as described in Alternative 2; however, the flow rates through the system would be higher than for Alternative 2, with the rate of pumping and number of wells and their locations chosen to ensure that the aquifer is cleaned up to the levels given in Section 7 in as fast a time frame as is feasible for the Site.

Even at the higher flow rate, treatment of the off-gases is not expected to be required, since the anticipated emissions were estimated as 0.57 tons/year of CT, 4.1×10^{-2} tons/year of CF and 7.0×10^{-3} tons/year of 1,2-DCA. These rates are below the Nebraska Air Pollution Controls and Regulations emission limits. However, even if regulatory standards would not be exceeded, modeling, and if necessary (based on the modeling), monitoring, of the air emissions from the treatment unit would be required to ensure that air emissions do not pose a hazard to nearby persons or residences.

Treated groundwater would be discharged to the tributary of Skull Creek and sampled to insure compliance with the substantive requirements of the Clean Water Act and the parallel state regulations. EPA is also willing to try to accommodate possible beneficial reuse of the water, subject to the limitations set forth in the detailed discussion that appears above under Alternative 2. Regardless of the limitations covered in detail above under alternative 2, the pump and treat system would be designed with a point of hookup built in, to accommodate any beneficial reuse plans that might later be established.

The final location of the components for this alternative will need to be determined during remedial design.

New and existing monitoring wells would be used to verify the hydraulic performance and to verify the active restoration of the contaminant plume. The new and existing monitoring wells would be sampled for VOCs including CT, CF, and 1,2-DCA. A detailed sampling and quality assurance plan would be prepared to specify the sample location, sample frequency (quarterly unless EPA determines otherwise), laboratory analysis, and sampling procedures. It was assumed for the purpose of developing this alternative that two new nests of monitoring wells would be installed. Monitoring wells would need to be maintained and replaced as needed to assure their continued effectiveness.

After eight quarters of monitoring results have been accumulated, a report will be prepared to evaluate the effectiveness of the ongoing remedy, which shall evaluate what adjustments or improvements or other changes to the system might be beneficial to further the cleanup. Such a report will be prepared every two years until the remedy is complete.

8.4 Alternative 4: Active Restoration/In-situ Vapor Extraction

- Capital Cost: $518,400.
- Present Worth of Annual O&M Costs: $476,500.
- Total Present Worth Cost : $994,900.
- Construction time: 1-2 years.
- Cleanup time: Unknown.
- In-situ pump rate: 20 gallons per minute.
- Estimated number of vapor extraction wells: 4.
- Groundwater treatment technology: In-situ air stripping.
- Disposal: N/A.

Alternative 4 would entail in-situ treatment of contaminated groundwater through the use of in-situ vapor extraction wells. The in-situ vapor extraction wells would be screened in both the upper sand aquifer zone and in the lower sand aquifer zone. Air would be injected below the water table into the well by use of a blower. The injected air causes a pressure gradient that draws groundwater from the lower screen which becomes aerated. The aerated water is allowed to rise until it meets a packer where the volatile organics are released. A vacuum blower is used to apply a vacuum on the upper well casing to remove the organic vapors from the well.

It was estimated that four in-situ vapor extraction wells would be placed in a staggered line within the plume to capture and treat the groundwater. The wells would be placed approximately 425 feet apart and would yield a treatment zone approximately 1,600 feet long and 500 feet wide. The final locations and depths of the wells would need to be established during a treatability study and remedial design.

No treatment of the off-gas is expected. It was determined that the emissions would be approximately 0.23 tons/year for CT, $1.6x10^{-2}$ tons/year for CF and $2.8x10^{-2}$ tons/year for 1,2-DCA. These emission rates are within the Nebraska Air Pollution Controls and Regulations emission limits. However, even if regulatory standards would not be exceeded, modeling, and if necessary (based on the modeling), monitoring, of the air emissions from the treatment unit would be required to ensure that air emissions do not pose a hazard to nearby persons or residences.

Groundwater monitoring, as discussed in Alternatives 2 and 3 above, would be performed under this alternative to verify hydraulic performance and to verify the active restoration of the aquifer. Groundwater monitoring wells would be sampled and maintained as described in Alternative 2 and 3, and reporting and evaluation of the groundwater results would be subject to similar requirements.

Because, under this alternative, the water is not removed from the ground for treatment, the discharge issues discussed in Alternatives 2 and 3 above do not arise under this alternative.

Under each alternative except Alternative 1, access restrictions would be implemented at the site during remediation efforts to prevent exposure to humans.

9.0 Comparative Analysis of Alternatives

During the comparative analysis of the alternatives, each alternative is assessed against nine evaluation criteria. These criteria are: overall protection of human health and the environment; compliance with applicable or relevant and appropriate requirements; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; short-term effectiveness; implementability; cost; and state and community acceptance.

The following comparative analysis presents the strengths and weaknesses of the alternatives relative to one another with respect to each of the nine criteria, and how reasonable variations of key uncertainties could change the expectations of their relative performance.

9.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Alternative 3 would be most protective of human health and the environment because all groundwater with contaminant concentrations greater than cleanup levels would be actively remediated. The technology used in Alternative 3 (extraction and treatment with air stripping) is proven effective for the removal of volatiles from groundwater and has been used at numerous sites. Alternative 4 may also be protective of human health and the environment, and the technology used in Alternative 4 (in-situ vapor extraction) is also effective in removing volatiles from groundwater. However, the in-situ extraction technology is an innovative technology and some concern has been expressed that it could result in groundwater mounding at the site that could cause the contamination to spread. Alternatives 1 and 2 would not meet cleanup goals at the site within a reasonable time frame and would require long-term institutional controls and monitoring to prevent consumption of groundwater to maintain protectiveness.

The containment and treatment system in Alternative 2 would be effective in ensuring that further migration of contaminants does not occur and the contaminants would not migrate further towards uncontaminated residential wells. However, only some protection of the environment would occur because although groundwater would be extracted and treated, it would not be actively remediated. Thus, contaminated groundwater would remain for an extended period.

Alternative 1 would not protect human health and the environment from the contaminants in the groundwater in the vicinity of the site. Because no actions would occur under Alternative 1, the groundwater contaminants may continue to migrate in the aquifer, endanger the public supply wells and down-gradient residential wells, and produce a larger contaminant plume.

Other than the contamination that remains until cleanup goals are met, no short-term risks due to the operation of the treatment systems are expected in each of the alternatives. Although contaminants are released into the air during treatment operations in Alternatives 2, 3, and 4; the emission concentrations are not expected to be significant and would have to conform with allowable emission rates set forth in the applicable regulations.

9.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Compliance with ARARs addresses whether or not a remedy would meet all of the applicable or relevant and appropriate requirements of other federal and state environmental statutes and requirements.

Alternatives 2, 3, and 4 would comply with all location- and action-specific ARARs and are anticipated to comply with all chemical-specific ARARs. However, Alternative 2 may require an unreasonably long time period to attain site remediation goals and also require the associated institutional controls and monitoring for this same period; and Alternative 4 would require additional investigation to determine whether the migration of the plume would be accelerated due to its implementation. Alternative 1 would not comply with ARARs.

9.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met.

Alternatives 3 and 4 would provide active removal of the contaminants. Alternative 3 is expected to reach cleanup levels in approximately 18 years and is the shortest predicted cleanup time frame of any of the alternatives. It is the best alternative in meeting long-term effectiveness and permanence. The time for Alternative 4 to reach cleanup goals is unknown. A long-term risk would not be associated with the treated groundwater in Alternatives 2, 3, and 4; however, a long-term risk would remain within the untreated aquifer until cleanup levels are met. The amount of time to reach cleanup levels if Alternative 2 is implemented is estimated to be greater than 100 years.

Because no remedial actions would occur, a long-term risk would be associated with Alternative 1 as long as cleanup goals would not be met. The possibility exists for greater volumes of contaminated groundwater to be generated with no active intervention. With Alternative 1, no mechanism would exist as part of that alternative to determine if concentrations are increasing or decreasing. Thus, the long-term risk would be greater with Alternative 1.

Five-year reviews would be required for all alternatives. Alternative 1 would require the largest number 5-year reviews because restoration (if reached) would take the longest. Fewer reviews would be required for Alternatives 3 and 4 than for Alternative 2.

The proposed monitoring/treatment technologies in Alternatives 2, 3, and 4 should adequately and permanently achieve the performance specifications established in the cleanup goals eventually, although the time to achieve them with Alternative 2 is excessively lengthy. No action and no monitoring would occur in Alternative 1, however, there would be no mechanism to determine if cleanup goals are being met.

Long-term management is required for all the alternatives with the exception of Alternative 1. A long-term monitoring program would be needed to determine if groundwater contaminant concentrations are decreasing. Maintenance, along with a long-term monitoring program, would need to be performed on a regular basis for Alternatives 2, 3, and 4. Maintenance would be more involved in Alternatives 3 and 4, because more wells or more equipment would be required. The monitoring program and maintenance for Alternatives 2, 3, and 4 would be extensive but easily implemented. Components of the treatment system such as pumps and valves in Alternatives 2, 3, and 4 may require replacement during the time of operation. However, proper maintenance of the equipment should be conducted in order to minimize the need for costly repairs and replacement. Monitoring wells will be maintained in good working order and repaired or replaced as needed for Alternatives 2, 3, and 4.

9.4 Reduction of Toxicity, Mobility, and Volume Through Treatment

Reduction of toxicity, mobility, or volume through treatment is the anticipated performance of the treatment technologies a remedy may employ.

A reduction in toxicity, mobility or volume would occur in Alternatives 2, 3, and 4. The reduction would take much longer under Alternative 2 than Alternatives 3 and 4. However, Alternative 4 is an innovative technology that has not been proven effective for this site. Alternative 4 has the potential of spreading the contamination due to mounding. Thus, it would potentially not reduce mobility of the contamination. Therefore, Alternative 3 appears to be the best choice in reducing toxicity, mobility, and volume of the contamination. The groundwater treatment would be irreversible. No residuals would be produced from any of the alternatives, beyond the small rate of discharge by the treatment systems to ambient air, and the discharge of the treated water in Alternatives 2 and 3. All the alternatives except Alternative 1 would meet the statutory preference for treatment as a principal element. Alternative 1 provides no mechanisms to determine if reduction is occurring; moreover at the present time there is no basis for asserting a reduction in toxicity, mobility, or volume under Alternative 1.

9.5 Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

The risk to the community and workers would be minimal for all alternatives. None of the risks would be uncontrollable. Nearby residents may be exposed to contaminated dusts during installation of monitoring and extraction wells. These risks would be controlled by the use of dust suppressants. The risk to workers would be controlled by proper use of personal protection equipment and monitoring during site activities.

Based on groundwater monitoring and contaminant fate and transport modeling, it is estimated that the time to achieve cleanup goals for Alternative 3 would be 18 years. Alternative 3 involves extracting the groundwater at approximately 200 gpm. Alternative 2 involves extracting the groundwater at a rate of only 40 gpm. Based on information received from vendors, the time to achieve cleanup levels for Alternative 4 may be shorter if this technology is proven to be applicable for this site. (The application of groundwater models for evaluating the effectiveness of Alternative 4 is still being researched.) The time to achieve cleanup levels would be greatest for Alternatives 1 and 2. Alternatives 1 and 2 would take a much longer time than Alternatives 3 and 4. Because no monitoring would be performed in Alternative 1, it would not be known if cleanup levels are ever met. In particular, though, it is estimated that they would not be met within the 30-year planning period typically used by EPA, as is also the case for Alternative 2.

9.6 Implementability

Implementability is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

Alternatives 2, 3, and 4 include installation of two monitoring wells nests and a groundwater sampling program, and also require the installation of extraction or treatment wells and treatment system components. Alternative 2 would be easier to implement than Alternatives 3 because the extraction wells are screened only in the upper and lower sand aquifer zones. In Alternative 3, each of the four extraction wells would be screened throughout all three aquifer zones. The groundwater treatment system components (pumps, piping, trays, etc.) in Alternative 3 would also be larger and may require more maintenance than in Alternative 2. Alternative 4 is an innovative technology whose reliability and effectiveness is less well-known in comparison to the more conventional pump-and-treat technologies of Alternatives 2 and 3. In addition, groundwater modeling performed by Argonne for the USDA suggests that Alternative 4 would potentially cause mounding of groundwater during the attempt to return water to the aquifer, and might cause possible spreading of the plume of contamination and potential for flooding because of the low transmissivity of the silty layer at this site. With the exception of Alternative 4, all the alternatives are proven and reliable.

9.7 Cost

Cost includes estimated capital and operation and maintenance costs, and net present worth costs. The cost comparisons for the alternatives include the detailed cost estimates for each alternative.

Only O&M costs converted to a total present worth would be associated with Alternative 1. The total present worth of Alternative 1 would be the lowest at a cost of $41,700. The total present worth costs of Alternatives 2 and 4 are, $862,400 and $994,900 respectively. The total present worth cost of Alternative 3 would be the greatest at a cost of $1,057,000. It should be noted that the vendors shorter cleanup time frame for Alternative 4 is an estimate which would be dependent on the proof of the effectiveness of this technology for this site.

9.8 State Acceptance

State acceptance indicates whether, based on its review of the RI/FS reports and Proposed Plan, the state concurs, opposes, or has no comment on the preferred alternative.

The State of Nebraska has been involved with this site since the beginning of site activities and has reviewed the FS and ROD. The State of Nebraska prefers that a permanent solution be selected.

9.9 Community Acceptance

Community acceptance of the selected remedy is further discussed in the responsiveness summary of this ROD. In general, the community supports a remedy that restores groundwater.

10.0 Selected Remedy

Alternative 3, a pump and treat cleanup of the groundwater as more fully described below, is the selected remedy for the Bruno Co-op site. Alternative 3 will provide the best balance of trade-offs among alternatives with respect to the evaluating criteria. EPA believes Alternative 3 will be protective of human health and the environment, will comply with ARARs, will be cost effective, and will utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The remedy also will meet the statutory preference for the use of treatment as a principal element.

10.1 Description of Selected Remedy

The selected remedy is an active pump and treat remedy to restore the aquifer, lowering the COCs to below MCLs throughout the aquifer as in the fastest time frame feasible for the Site. This alternative includes the use of extraction wells, treatment of contaminated water by air stripping using tray aeration, and discharge of the treated groundwater to a tributary of Skull Creek, and/or beneficial reuse of the pumped and treated water.

The pumping well locations, pumping rate, and screened intervals for the extraction wells will be determined during remedial design to provide coverage (overlapping cones of depression) over the entire contaminated area (Figure 11) and to clean up the aquifer in the fastest reasonable time frame.

Additional site specific data will be collected during remedial design investigations to determine the exact well locations, pumping rate, and screened interval. However, modeling results summarized in EPA's July 1998 FS suggested the possibility that using four groundwater extraction wells screened throughout both lower and upper sand units and pumping at approximately 50 gpm each for a total rate of 200 gpm could remediate the aquifer in approximately 18 years.

Contaminated groundwater will be pumped to an on-site treatment system consisting of air stripping with tray aeration. The treatment process and any on-site discharges of residuals will comply with the ARARs established in this ROD.

The treatment system will be housed in a structure to reduce noise, improve appearance, insulate the treatment process, and protect equipment. The structure will be placed on a concrete foundation. A chain link security fence will be constructed around the treatment facility to limit general accessibility to the facility and the potential for public exposure. Piping, controls, valves, and pumps will be housed within the building for year round operation, and sufficient additional soundproofing will be provided, if needed, to ensure that neighbors of the operation (nearby residences and businesses) are not disturbed. Power lines will be connected, and wiring installed to operate pumps, fans, lighting, and other equipment. Signs will be posted to prevent unknowing entry into the building, and security measures, such as alarms, will be implemented.

The treatment system will remove and transfer the COCs from the groundwater to the air using shallow tray aeration. Contaminated groundwater enters at the top of the treatment system and flows across a series of aeration trays in a process which volatilizes the contamination. Size and number of trays would be established during design, and may need to be revised from time to time. Based on the estimated rate of treatment, the treatment of off-gases is not expected to be required to comply with the applicable air regulations, since the anticipated emissions were estimated as 0.57 tons/year of CT, 4.1×10^{-2} tons/year of CF and 7.0×10^{-3} tons/year of 1,2-DCA, less than the 2.5 ton/year of a single contaminant or 10 ton/year of combined contaminants that would trigger Nebraska regulations. However, even if regulatory standards would not be exceeded, modeling, and if necessary (based on the modeling), monitoring, of the air emissions from the treatment unit will be required to ensure that air emissions do not pose a hazard to nearby persons or residences.

Treated groundwater will be discharged to the tributary of Skull Creek and sampled to ensure compliance with the substantive requirements of the Clean Water Act and the parallel state regulations. EPA is also willing to try to accommodate possible beneficial reuse of the water, but this is subject to the limitations set forth in Section 8.2 above. In any event, the pump and treat system will be designed and built with a point of hookup to accommodate any beneficial reuse plans, whether those plans are established now or later, to avoid the need to retrofit such a hookup later.

The location of the treatment system and other components of the remedy will be established as part of remedial design.

Groundwater monitoring using new and existing monitoring wells will be required in order to verify the hydraulic performance and to verify the active restoration of the contaminant plume, and the number and locations of wells will be sufficient to accomplish this goal. New and existing monitoring wells will be sampled for VOCs including CT, CF, and 1,2-DCA. A detailed sampling and quality assurance plan would be prepared to specify the sample location, sample frequency (quarterly unless EPA determines otherwise), laboratory analysis, and sampling procedures. Monitoring wells would need to be maintained and replaced as needed to assure their continued effectiveness.

After eight quarters of monitoring results have been accumulated, a report will be prepared to evaluate the effectiveness of the ongoing remedy, which shall evaluate what adjustments or improvements or other changes to the system might be beneficial to further the cleanup. Such a report will be prepared every two years until the remedy is complete.

The selected remedy also includes the abandonment of Bruno Supply Well #36-1 following State guidelines, and returning Bruno Supply Well #65-1 to use as a source of drinking water for the Village by placing treatment[1] of on this well in times of high demand. During use, the raw and treated water from this well will need to be monitored for the COCs.

During remedial design, a study will be conducted, called a "value engineering study" to ensure that, at the time of implementation of the remedy, opportunities are explored for achieving any possible economies utilizing technological improvements and alternative approaches to carrying out the preferred remedy and achieving the cleanup goals. Five-year reviews will also be required for this remedy, which will allow an opportunity for examination of more effective new technologies that may later arise. If a change in remedy is needed at a later date, EPA would follow the procedures required by the NCP to amend the ROD, if a fundamentally different remedy is selected, or, alternatively, would publish an "explanation of significant differences" for any significant changes to the remedy.

10.2 Summary of Estimated Costs

The estimated capital cost for the remedy is $417,400. The estimated present worth of annual O&M costs is $639,600. The estimated total present worth cost is $1,057,000 assuming a 5 percent discount rate. A detailed breakout of the costs are presented in Table 1.

10.3 Cleanup Levels

This remedy shall address groundwater contaminated above the following action levels:

- 5 μg/L carbon tetrachloride,
- 5 μg/L 1,2-dichloroethane, and
- 100 μg/L total trihalomethanes (chloroform is a trihalomethane).

These cleanup levels are protective of human health and the environment and are based on the drinking water maximum contaminant levels (MCLs) for these contaminants. The overall remedy will be monitored to make sure that these goals are met.

10.4 Expected Outcomes of the Selected Remedy

Contaminant fate and transport modeling has predicted attainment of the cleanup levels in approximately 18 years using the extraction scenario described for the alternative. A primary factor that may increase remediation time includes poor

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[1] Additional costs are as follows: Abandonment of well 36-1 is expected to cost $5,000. Treatment of well 65-1 is estimated to cost $84,800, which includes Capital costs of $77,000 and O&M of 7,800. See Table 2.

contaminant recovery from the middle silt unit. This uncertainty however, could be resolved during the value engineering study included as part of the remedy. The site aquifer is expected to be available as a drinking water resource as a result of successful completion of the remedy.

11.0 Statutory Determinations

CERCLA Section 121(d) requires that the selected remedy comply with all federal and state environmental laws that are applicable or relevant and appropriate to the hazardous substances, pollutants, or contaminants at the site or to the activities to be performed at the site. Therefore, to be selected as the remedy, an alternative must meet all ARARs or a waiver must be obtained. A discussion of how each ARAR applies to the selected remedy is provided in the following paragraphs.

11.1 Protection of Human Health and the Environment

The selected remedial action will protect human health and the environment through hydraulic extraction of contaminated groundwater, and subsequent treatment and disposal of the extracted groundwater. This will eliminate the groundwater pathways through which contaminants pose risks.

11.2 Compliance with ARARs

Section 121(d)(2) of CERCLA, 42 U.S.C. §9621(d)(2), requires that cleanup actions conducted under CERCLA achieve a degree or level of cleanup which, at a minimum, attains "any standard, requirement, criteria or limitation under any Federal environmental law...or any promulgated standard, requirement, criteria, or limitation under a State environmental or facility siting law that is more stringent than any Federal standard...[which] is legally applicable to the hazardous substance or pollutant or contaminant concerned or is relevant and appropriate under the circumstances of the release or threatened release of such hazardous substance or pollutant of contaminant...." The identified standards, requirements, criteria, or limitations thus adopted from other environmental laws, which govern on-site cleanup activities at this site, are referred to as "applicable or relevant and appropriate requirements", or "ARARs."

For on-site cleanup activities, under Section 121(e)(1) of CERCLA, EPA is not required to obtain any Federal, State or local permits for actions conducted on-site, complying only with the substantive (non-administrative) requirements of the identified Federal and State laws. On the other hand, for cleanup activities that will occur off-site, both the substantive as well as the administrative requirements of such laws will apply to cleanup activities.

This section identifies the ARARs which will apply to the on-site cleanup activities for this site. (The many laws and regulations which apply to off-site cleanup or disposal activities are not called "ARARs" and are not enumerated here.)

FEDERAL ARARs

Clean Air Act of 1963, as amended (42 U.S.C. §§7401-7671q)

<u>40 Code of Federal Regulations (CFR) Part 50</u>

Part 50 (containing national ambient air quality standards) is pertinent to excavation and materials handling activities.

Emissions from air strippers or from in-situ treatment of VOC-contaminated groundwater on site under CERCLA, resulting in air emissions of CT, CF, and 1,2-DCA under 10 tons per year, are not now regulated under the Clean Air Act.

Clean Water Act of 1977, as amended (33 U.S.C. §§1251-1376)

<u>40 CFR Parts 122- 125</u>

The National Pollutant Discharge Elimination System (NPDES) was established to control discharge of pollutants from any point source into waters of the United States. A permit will not be required since the site is being remediated as part of the Superfund program and the discharge point is on-site; however, the substantive requirements of the regulation must be met. This regulation applies to the discharge of treated groundwater and process water to surface water.

Discharge limits for the CT, CF, and 1,2-DCA will be established during remedial design and will be consistent with the requirements of the NPDES program. If established surface water discharge limits are not met, provisions for alternate effluent limits can be found in this part.

Under the Clean Water Act, states must establish ambient water quality criteria for the protection of surface water based on use classifications and the criteria stated under Section 304(a) of the Clean Water Act. These criteria are applicable (see the discussion under "State ARARs," below) and will be used to establish discharge limits for treated groundwater and process water.

Safe Drinking Water Act of 1986, as amended (40 U.S.C.§§300)

<u>40 CFR Part 144-158</u>

The substantive requirements of the underground injection regulations apply to any treated groundwater that is reinjected.

<u>40 CFR Part 141</u>

Primary Drinking Water Standards are established by this part. The Safe Drinking Water Act's MCLs are health-based standards for chemicals that may be found in public water supplies. The MCLs for CT, trihalomethanes, and 1,2-DCA would be applicable or relevant and appropriate if the treated water is beneficially reused for human consumption.

The discharge of treated groundwater or process water will otherwise not impact drinking water in a public water supply directly. However, the potential for residual contaminants percolating to groundwater exists. The NCP requires consideration of MCLs, where they exist, as relevant and appropriate to groundwater cleanup standards when the aquifer is a current or potential source of drinking water. MCLs for the COCs, CT, CF(the MCL for trihalomethanes), and 1,2-DCA, are relevant and appropriate for establishing cleanup standards to be met during implementation of the remedy.

Resource Conservation and Recovery Act (RCRA) of 1976, as amended (42 U.S.C. §§6901-6987)

<u>40 CFR Part 261</u>

The criteria set forth in this part will be used to determine if solid wastes excavated, created through treatment, or otherwise generated during the implementation of the remedy are hazardous or non-hazardous.

<u>40 CFR Part 262.11</u>

The methods for determining whether a solid waste is hazardous are set forth in this part. All generators of solid wastes are required to determine if a waste is hazardous. Wastes determined to be hazardous will be managed in accordance with the rules applicable to hazardous wastes.

<u>40 CFR Part 262.34</u>

The accumulation of hazardous waste on-site is addressed by this part. In the event any of the solid wastes excavated, created through treatment, or otherwise generated during the implementation of the remedy are hazardous, these regulations will apply.

RCRA regulations that apply to facilities for the treatment, storage or disposal of hazardous waste were determined not to be applicable or relevant and appropriate at this site.

STATE ARARs

Information supplied to Department of Water Resources to Facilitate the Listing of Wells. The substantive requirements of R.S. Neb. 46-602(1) are applicable or relevant and appropriate. EPA would like the location of its wells to be listed by the Department of Water Resources to ensure, for the duration of the project, that other wells which might interfere with cleanup or monitoring are not drilled near EPA wells.

Water Well Standards and Contractor Licensing Act. The substantive standards of Title 178 aimed at ensuring that those engaged in well drilling and well construction are qualified to do so are applicable.

Permits to withdraw water. As discussed above, under 121(e) of CERCLA, EPA does not require permits from the Natural Resources District (NRD) or from a state agency for placement or operation of monitoring or pump-and-treat wells on-site. However, EPA will cooperate with state agencies and the Lower Platte North Natural Resources District in carrying out cleanup activities and in making readily available to state agencies and the NRD groundwater information collected during the cleanup.

Air Quality. Title 129 would require carbon adsorption treatment if more that 2.5 tons per year of one of the COCs (CT, CF, or 1,2-DCA) would be discharged to ambient air, or if more than 10 tons per year would be discharged of all three COCs combined. Based on concentrations in the groundwater and the rates of treatment, it is unlikely those levels would be reached, however.

NDEQ will have an opportunity to review the remedial design and so will be able to review compliance with this requirement.

Hazardous Waste. If discharge gases are treated with GAC the spent carbon adsorption units will be shipped off-site and disposed of properly. While on-site, they would be governed by the applicable Title 128 requirements, which are hazardous waste determination and a limitation on-site accumulation times.

Groundwater Quality Standards and Use Classification. Title 118, Chapter 4, establishes numerical standards for contaminants introduced to groundwater by human activity. Title 118, Appendix A, Step 8, establishes a method for determining preliminary cleanup levels for the different classifications of protected groundwater.

Discharge of Treated Water. Any discharge to surface water on-site must meet the substantive requirements of the state NPDES program (Title 119 and 121), and must be consistent with the creek's use requirements and the accompanying numerical standards, as given in Title 117, Nebraska Surface Water Quality Standards.

If treated groundwater is reinjected Title 122 governing underground injection is applicable.

If treated groundwater is to be beneficially reused for human consumption, the MCLs for CT, total trihalomethanes, and 1,2-DCA would be applicable or relevant and appropriate.

Flood Plain Management. The Flood Plain Management Act, Neb. Rev. Stat. §31-1001 et seq., and Title 258- Rules Governing Flood Plain Management govern certain activities occurring in flood plains (Department of Natural Resources).

Endangered or Threatened Species. The Nebraska Nongame and Endangered Species Act, Neb. Rev. Stat. §37-430 to §37-438, and Title 163, Chapter 6, requires consultation with the Nebraska Game and Parks Commission regarding actions which may affect threatened or endangered species and their critical habitat in the State of Nebraska. These species are listed in Title 163 (Game and Parks Commission).

11.3 Cost Effectiveness

The selected remedial action is cost-effective, providing overall effectiveness proportional to its costs. The selected remedy will be effective in the long-term, providing a significant and permanent reduction of the toxicity, mobility, and volume of contaminated groundwater.

11.4 Utilization of Permanent Solutions and Innovative Treatment Technologies to the Maximum Extent Practicable

SARA specifies a preference for use of permanent solutions and innovative treatment or resource recovery technologies to the maximum extent practicable. The selected remedial action utilizes a permanent solution but not an innovative treatment technology. Of those alternatives that comply with the threshold criteria EPA, has determined that the selected alternative provides the best balance in terms of long-term effectiveness and permanence, reduction of toxicity, mobility, and volume through treatment, short-term effectiveness, and cost.

11.5 Preference for Treatment which Reduces Toxicity, Mobility, or Volume

By hydraulically containing and extracting groundwater containing COCs greater than the final cleanup goals, the selected remedial action addresses the principal threat posed by the site. The selected remedy also satisfies the statutory preference for remedial actions that employ treatment to significantly reduce toxicity, mobility, or volume of contaminants.

12.0 Documentation of Significant Changes

The selected remedy has not been significantly changed from the preferred alternative presented in the Proposed Plan.

III. RESPONSIVENESS SUMMARY

III. Responsiveness Summary For The Record of Decision
Bruno Cooperative Association/ Associated Properties Site
Bruno, Butler County, Nebraska

Overview

Public participation activities required under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) took place during the summer of 1998. An Administrative Record File was made available to the public at the Bruno Post Office beginning on July 16, 1998. A public meeting was held at 7:00 p.m. on July 23, 1998, at the Bruno Village Hall. EPA's Proposed Plan was distributed at that meeting, and placed at the Post Office the next day. A period of public comment period on the Proposed Plan and other documents in the Administrative Record File concluded on August 22, 1998.

During the public meeting, community members expressed concerns about and asked questions concerning the size of the treatment system, the location of the system, noise associated with cleanup activities, the length of time for the cleanup, the other alternatives considered, the effect of cleanup on nearby wells, and the potential for the old municipal water supply wells to be used again. The transcript from the public meeting will be included in the Administrative Record File.

During the public comment period, EPA received a letter from the Village of Bruno's Board of Trustees, signed by its Chairman, supporting EPA's preferred alternative. The Village Board's letter expressed hope that the preferred alternative would allow the Village to again use wells that were taken out of service because of the carbon tetrachloride contamination.

The Nebraska Department of Environmental Quality (NDEQ) stated at the public meeting that they were generally very positive about the alternative proposed by EPA. NDEQ also submitted a letter during the public comment period expressing their desire to work with EPA to ensure that community concerns are met.

The United States Department of Agriculture (USDA), a potentially responsible party (PRP) at the site, sent in detailed comments to EPA during the public comment period. In their comments, USDA put forth a number of technical arguments. EPA responses to those comments appear below, in a separate section devoted to USDA's comments.

Community and State Comments and EPA's Responses

This section provides a summary of major issues and concerns raised by community members and the state during the public comment period. Each comment is followed by EPA's response.

1) Comment: One citizen at the public meeting expressed the desire to see the groundwater cleaned up in order to have it be usable for the community in years to come. Another citizen commented in a letter that, in view of the cost of the cleanup and the time it would take, Alternative 1 (the no action alternative) should be implemented over Alternative 3 (pump and treat cleanup of the aquifer). This commenter suggested pumping water from a neighboring town (such as Abie, Nebraska, 4 miles from Bruno) if another municipal well is needed. (A similar question was also raised at the public meeting, asking who would be hurt if the contamination were left alone to disappear on its own.)

Response: Without some active measure, such as the selected alternative, the contamination in the aquifer in the area formerly used by the Village of Bruno as a source of drinking water is likely to remain in the aquifer, posing a threat to the health of any future users of that aquifer for drinking water purposes. The fact that the Village has used one of the affected wells, Supply Well #65-1, in the recent past as a backup source of water during a time of increased demand illustrates that current conditions at the site are not adequately controlled, and there is a need for action to permanently remove the threat presented by the contamination. EPA's goal for the cleanup action at the Bruno site is to restore the contaminated groundwater to Safe Drinking Water Act levels.

2) Comment: A commentor asked how much noise the remedial treatment system would generate.

Response: The type of air stripper used for the selected alternative (Alternative 3) is relatively quiet. The ROD calls for the aeration unit to be housed in a building and for sound insulation or other measures to be taken as needed to make sure that nearby residents or businesses are not disturbed.

3) Comment: A commentor asked if the treatment system pumping would have any effect on neighboring wells by taking water from them or lowering the water table.

Response: The extraction system will be designed to cover the horizontal extent of the contaminated area as shown on Figure 11 in the ROD and should have little or no impact on any wells beyond the contaminated area. Wells inside the contaminated area will experience some drawdown, but most current uses would be unaffected. The effects on nearby wells in the contaminated area will be looked at during remedial design.

4) Comment: A commentor asked if anyone living close to the remedial treatment system would be adversely affected by it.

Response: In addition to considering the potential for noise disturbance (discussed above, Comment #2), and possible effects on neighboring wells (discussed above, Comment #3), EPA has considered impacts that the selected action might have via the discharge of treated water and by emissions to air.

The treated water will be discharged to an on-site creek (unless beneficial reuse of some or all of the water is arranged by state or local authorities - see Section 8.2 of the ROD for more discussion about beneficial reuse). This treated discharge water should not present a threat to human health or the environment from the concentration of the contaminants of concern (CT, CF, or 1,2-DCA), since the water will have been treated to discharge standards; and the discharge rate of about 200 gpm (less than 0.5cfs) would not create any potential for flooding in the area.

Contaminants of concern (CT, CF, or 1,2-DCA), stripped from the contaminated groundwater, will be off-gassed to the atmosphere from the treatment unit. Initial calculations, discussed in the ROD, which are based on the highest concentrations of contaminants of concern in extracted groundwater and using expected pumping rates, indicate that air emissions from the treatment unit will fall far below allowable discharge limits established by Nebraska's Title 129 regulations. Air modeling of the discharge from the treatment unit will be performed during design, and air monitoring will be performed if the modeling shows that levels of concern could be generated by the treatment unit. If air monitoring detects levels of concern to human health or the environment, the air emissions can be treated using granulated activated carbon (GAC).

5) Comment: One commentor asked whether provisions had been made to allow for beneficial reuse of the water that is pumped out of the ground.

Response: The EPA's preferred remedy calls for the discharge of treated water to a tributary of Skull Creek with the water being monitored to ensure compliance with the substantive requirements of the Clean Water Act and the parallel State regulations. Alternatively, EPA would be willing to make the water available for beneficial reuse, provided it is understood that any such arrangements would necessarily be the responsibility of the appropriate state and local authorities, and that EPA is not in a position to arrange for the removal of other possible contaminants (e.g., nitrates, or other common groundwater contaminants not within the scope of this cleanup), or to guarantee that the water is safe for any particular use. For example, despite removal of the contaminants of concern (CT, CF, and 1,2-DCA) to concentrations below ARARs, the water may not be potable if other common contaminants are present. The ROD provides that if local, regional or state authorities can come up with a concrete beneficial reuse plan in a timely way (i.e. by the due date for the preliminary design), the remedial design for the remedy could take account of such a plan. If not, the piping for the remedy will still include a hookup point to accommodate plans for beneficial reuse that may be generated later, to avoid the need to retrofit such a link.

6) <u>Comment</u>: Other more effective technologies could become more promising in the future. The remedy should be reviewed two years after the site cleanup begins so that new, cheaper technologies could be considered as they become available.

<u>Response</u>: After the remedy is put in place, periodic groundwater monitoring will assess the remedy's continued effectiveness. After eight quarters of groundwater monitoring results have been accumulated, a report will be prepared to evaluate the effectiveness of the ongoing remedy which will evaluate what adjustments or improvements or other changes might be beneficial to further the cleanup. Such a report is to be prepared every two years thereafter until the remedy is complete.

<u>The following comments were submitted by USDA, a Potentially Responsible Party at the site. Each comment is followed by EPA's response</u>.

7) <u>Comment</u>: The Proposed Plan for the Bruno site does not include new information such as more recent and more accurate models of groundwater flow and solute transport from Argonne National Laboratory that were provided to EPA before the Proposed Plan was issued. This new information should have been used in calculating cleanup scenarios rather than the 1995 Argonne models that were used.

<u>Response</u>: The data collected during the extended monitoring program conducted by Argonne which is presented in the USDA's April 1998 Final Study (Argonne, April 1998) has been reviewed by EPA. USDA's April 1998 study is also included in the Administrative Record File. EPA's review of this report concluded that the new data and the modeling runs reported in the April 1998 study do not significantly change the previous understanding of the subsurface of the Bruno site. Two examples of modeling uncertainties are USDA's grain size analysis of the middle silty layer which shows considerable large grain material (sand) indicating

that contaminants could be induced to move from the middle silty layer at a higher rate than indicated by USDA's modeling runs. Moreover, USDA did not calibrate its model using their own pump test data generated as part of their investigation of the site, which could have illustrated how well their modeling predicts aquifer conditions.

8) Comment: The Proposed Plan does not address how the most contaminated section of the aquifer at the Bruno site, the middle silty aquifer unit, will be remediated to levels that meet the Preliminary Remediation Goals (PRGs) the EPA has established in its plan. As the NCP stipulates, the revised Proposed Plan should include alternatives that address both the technical feasibility of remediation of this section of the aquifer to the PRGs and the screening of the alternatives. If the EPA cannot provide technically feasible alternatives for cleaning up the middle silt unit to levels that meet the established PRGs, then the revised plan should include modified remediation goals that are protective of human health and the environment and take into account the technical impracticality of remediation of the middle silty zone to maximum contaminant level (MCL) cleanup levels.

Response: EPA and USDA (in its April 1998 study) agree that aquifer restoration should be pursued by using pump-and-treat methods. Additionally, the number, location, and pumping rates of extraction wells proposed by EPA in the FS and the Proposed Plan is not significantly different than the USDA proposal as presented in USDA's April 1998 submission. Groundwater sampling to monitor the progress/effectiveness of the system is included as part of the selected remedy. If future data indicates that the extraction system is having little impact on the middle silty layer, adjustments can be considered. If it can be shown that achievement of the cleanup goals for the middle silty layer is impracticable then the EPA can consider amending the remedy or granting a technical impracticability waiver under CERCLA. The conceptual design used for comparison purposes in the FS may be different from the remedial design. However, the EPA believes that it is possible to remediate all portions of the aquifer and that the final number, pumping rate, and placement of extraction wells should be designed to maximize the success of the system in the middle silty layer as well as the upper and lower sand layers. If USDA's grain size data is representative of the middle silty layer then it is reasonable to anticipate that the selected alternative will achieve the cleanup goals.

9) Comment: Please indicate how the EPA has determined that USDA's proposed alternative is not consistent with EPA's Natural Attenuation Policy.

Response: Presently there has been no evaluation to determine if the rate of natural attenuation at the site is sufficient to accomplish remedial action objectives. The efficiency of the natural attenuation rate for the contaminants of concern is accomplished by evaluating the biogeochemical system at the site. EPA suggested to USDA (correspondence dated April 11, 1997) to include biogeochemical parameters in their monitoring program to allow evaluation of the efficiency of the site's natural attenuation rate. USDA declined the suggestion (correspondence dated June 17, 1997). Until the site's natural attenuation rate can be substantiated, natural attenuation cannot be included as part of the selected remedy.

10) **Comment**: The baseline risk assessment used by the EPA is based on incorrect assumptions and inappropriate models (citing examples discussed below), and it exaggerates the potential risk at the site.

Response: The fact that the Village of Bruno still uses Supply Well #65-1 as a backup supply during times of scarcity and that it has shown detectable levels of site contaminants illustrates that risks continue to exist at the site from groundwater. The local ordinance on new well construction only requires that a permit be obtained to install a new well inside the Village of Bruno and does not prohibit the installation of new wells, as suggested elsewhere in USDA's comments, even in the most contaminated areas of the Site.

When evaluating the human health risks posed by groundwater contamination, it is appropriate to use the concentration at the highest point of contamination in the plume as the exposure point concentration. This is consistent with the Risk Assessment Guidance for Superfund (RAGS V1 A Section 6.5.2, page 6-27) which states "...it generally should be assumed that water could be drawn from anywhere in the aquifer, regardless of the location of existing wells relative to the contaminant plume." The NCP Preamble (55 FR 8713) states "For groundwater, remediation levels should generally be attained throughout the contaminated plume, or at and beyond the edge of the waste management area when waste is left in place."

One USDA comment on soil risk was addressed by a modification to the recommended remedy: According to Nebraska Department of Health's (NDOH) 1995 risk analysis, a possible future child resident of the grain bin site, exposed to CT in the soil at the location of highest soil contamination, might experience adverse health effects from exposure to chemicals evaporating from the soil. This calculation, however, assumed (in addition to the assumption that a child is playing and digging in the soil at this location on a daily basis) that the highest level in soils, 2,700 μg/kg, is spread uniformly over an area 45 meters on one side. However, USDA pointed out that nearby samples as close as 25 feet away showed non-detect values, causing EPA to reevaluate the calculation. EPA has determined as a result of this reevaluation that institutional controls to restrict residences from being built on the former USDA grain bin site are not needed as part of the remedy.

11) <u>Comment</u>: USDA commented that there is no risk evaluation for residual contamination that would remain in the aquifer if the EPA's preferred alternative is implemented.

<u>Response</u>: It is EPA's intention to remediate the aquifer to the remediation goals for the cleanup which are the drinking water standard for the contaminants of concern. If cleanup goals can be reached in the aquifer, then residual risk analysis will not be necessary. Groundwater sampling to monitor the progress/effectiveness of the system is included as part of the remedy. If future data indicates that the extraction system is having little impact on the middle silt unit, remedy adjustments can be considered. If it can be shown, after pumping the aquifer aggressively for the purpose of remediating all layers of the aquifer, that achievement of the cleanup goals for the middle silty layer is impracticable, then the EPA can consider amending the remedy or granting a technical impracticability waiver under CERCLA.

12) <u>Comment</u>: The location chosen by the NDOH for its risk assessment is not a realistic home site because it lies substantially below base flood level in a flood plain across the street from a National Priorities List site.

<u>Response</u>: Several homes already exist in the area referred to by USDA as a flood plain. Also, no institutional controls or other restrictions prevent the drilling of new wells even in the most contaminated parts of the aquifer. Therefore the exposure scenario used for groundwater is realistic for this site. The contaminated portion of this groundwater aquifer was used as a source of drinking water for the Village and could be used again in the future.

13) <u>Comment</u>: USDA's September 1995 interim study for Bruno, Nebraska, prepared for the CCC/USDA by Argonne[2], has been omitted from the administrative record provided by the EPA. Preliminary hydrogeologic models developed by Argonne in the September 1995 study demonstrated the complex nature of the Bruno groundwater flow and contaminant transport system. Argonne concluded that these preliminary hydrogeologic models could not be used to perform a quantitative evaluation of remedial needs or alternatives for the Bruno site, due to uncertain impact of (1) inferred variations in the hydraulic characteristics of the

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[2]USDA comments reference an August 1996 "interim Feasibility Study" prepared for CCC/USDA by Argonne. EPA has a September 1995 study by the same name, but does not have one dated August 1996. EPA assumes the reference in USDA comments is to the 1995 study.

middle silt aquifer unit and (2) periodic recharge events on groundwater flow and contaminant transport within the aquifer system. On the basis of these findings Argonne instituted a program of extended monitoring and hydraulic testing of the Bruno aquifer system to address these uncertainties with the EPA's approval.

The results of the extended monitoring and hydraulic testing program were reported by Argonne in the their April 1998 study, prepared for the CCC/USDA. These studies documented that the hydrogeologic properties of the middle silt aquifer unit vary both vertically and laterally across the Bruno contamination site, and that these variations strongly control the movement of contaminated groundwater within and through the aquifer system in the vicinity of the Bruno Co-op.

Response: The data collected during the extended monitoring program conducted by USDA and the models presented in USDA's September 1995 and April 1998 studies have been reviewed by EPA. The new study does not significantly change the previous understanding of the subsurface of the Bruno site. EPA will add USDA's September 1995 study to the Administrative Record File. (The April 1998 study is already included in the Administrative Record File.)

14) Comment: Revised groundwater flow and contaminant transport models incorporating these data (USDA's April 1998 study) were developed for the site by Argonne. These models demonstrate that the contaminated groundwater within the middle silt unit is relatively immobile and will be impossible to effectively remediate by using conventional or innovative technologies such as horizontal extraction wells or in-well vapor stripping technologies.

Response: Even though significant efforts have been exerted in preparation of the models, we feel that the revised model has not significantly decreased the uncertainties which existed in the initial model. EPA believes that USDA's model has not been sufficiently tested and calibrated to be used as proof that remediation of the middle silty layer is impossible (For instance the model has not been calibrated to USDA's own pump test data). The most significant factors causing uncertainty include: 1) the hydraulic interaction between the upper sand and middle silt units and between the middle silt and lower sand units, 2) the variability of hydraulic conductivity in the middle silt. The model parameter with the most uncertainty which has the most significant impact on remediation simulations effectiveness in the middle silt unit are the hydraulic interaction values assigned to the top and bottom of layers representing the middle silty layer. Sufficient testing has not been performed to prove that the middle silty layer is hydraulically isolated from the upper and lower sand layers. In fact, the most reliable pump test performed at the site, pump test #3 (USDA's interim study, Argonne, September 1995) indicates that there is good hydraulic connection between the upper and lower sand layers.

Based on current data, it is not sufficiently demonstrated that remediation of the middle silty layer is "impossible". Review of the grain size analysis data presented in USDA's April 1998 study prepared by Argonne indicates that, in general, the middle silty layer contains more silt than the upper sand and the lower sand layers; however, the middle silty layer is actually fairly sandy with many samples from this layer containing greater than 50 percent sand. Additionally, samples collected from this layer generally contain only a very small percentage of clay. The grain size data indicates that, in general, the middle silty layer can be expected to be fairly permeable with only small portions of this unit being clay rich and impermeable. If the grain size data is representative of the middle silt unit then it is reasonable to anticipate that the preferred alternative presented in the Proposed Plan will achieve PRGs.

15) Comment: In reviewing the EPA's Superfund Proposed Plan, Argonne can find no technical justification for the EPA's assertion that proposed Remedial Alternative 3, employing four fully penetrating groundwater extraction wells pumping at a combined flow of 200 gpm, will be capable of reducing carbon tetrachloride concentrations within the aquifer system to the specified PRG of 5 ppb within 18 years of operations.

Response: As discussed above, it is premature to accept the model results as proof that the middle silty layer is impossible to be remediated as was concluded in USDA's April 1998 study (Argonne 1998). In fact, data presented in USDA's September 1995 interim study suggests that the middle silt should be capable of remediation. Data suggesting this includes, the grain size data collected from the middle silty layer indicates that a good deal of the middle silty layer contains significant percentages of sand. Additionally, pump test #3 (Argonne 1995) proves that (at least in some locations) there is good hydraulic connection between the upper and lower sand units suggesting that the middle silt unit is not a hydraulic barrier between the upper and lower sand units. Because remediation of the middle silty layer may be possible, an alternative was selected that included remediation of this layer as a goal. The EPA proposes to evaluate the progress of the system and take a look at the effectiveness of the remedy every two years after system operation begins.

16) Comment: The EPA states in its Proposed Plan that "the modeling of groundwater contamination described within the FS report was performed by Argonne, and by Black & Veatch, an EPA contractor," and that "the analysis of

remedial alternatives within the FS report, and their conceptual design cost estimates were performed by Black & Veatch." These statements imply that only one Feasibility Study report, that generated by BVSPC (July 1998), was considered directly by the EPA in its analysis of remedial alternatives.

Response: EPA considers the Feasibility Study report it issued in July 1998 as the Feasibility Study for the Site under the NCP. However, EPA considered each report prepared by USDA carefully and has placed or will place the pertinent documents in the Administrative Record File.

17) Comment: Appendix A of the EPA Feasibility Study (July 1998) prepared by BVSPC states that the preliminary groundwater flow and solute transport models presented by Argonne in the USDA's interim study (September 1995) were recreated by Black & Veatch and used without modification for Black & Veatch's evaluation of remedial options. Argonne specifically concluded that these preliminary hydrogeologic models could not be used to perform a quantitative evaluation of remedial needs or alternatives for the Bruno site. Argonne can find no evidence that BVSPC or the EPA incorporated any of the data obtained from Argonne's extended monitoring program or USDA's/Argonne's April 1998 study in their modeling of the remedial alternatives.

Response: Black & Veatch recreated the earlier modeling effort and reviewed the later ones. Based on this work, EPA concluded that data and models presented in USDA's April 1998 study did not significantly alter the previous understanding of the subsurface conditions. Review showed that sufficient hydraulic testing combined with extensive calibration of the updated model has not been performed that would adequately support Argonne's view, which is that the model results show that the middle silty layer will not respond to a pump-and-treat remedial system. EPA believes that Argonne's preliminary model and their updated model, as applied, have significant uncertainties regarding the analysis of the effectiveness of remedial pump and treat.

18) Comment: BVSPC provided no documentation supporting their modeling of remedial options in EPA's Feasibility Study (July 1998) that would permit a critical analysis by Argonne and the CCC/USDA of this activity and the resulting conclusions. BVSPC cited the supporting document titled Draft Data Evaluation and Environmental Fate and Transport Modeling, Technical Memorandum (March 1997); this report has not been made available to Argonne or the CCC/USDA for review and was not placed in the administrative record by the EPA.

Response: The March 1997 document mentioned in the comment will be placed in the Administrative Record File.

19) Comment: Argonne employed two distinctly different, alternative hydrogeologic models of the middle silt aquifer unit in considering each groundwater flow and contaminant transport scenario addressed for the Bruno aquifer system in USDA's interim study (September 1995), reflecting Argonne's uncertainty (at that time) about the detailed character of the middle silt unit. BVSPC provided no indication of which (if in fact either) of these aquifer system models was adopted by BVSPC for its analysis of remedial options, or the justification for this model selection.

Response: The 4 layer model in USDA's September 1995 study was reproduced by Black & Veatch. USDA in this and subsequent reports, developed three groundwater models of the Bruno site. In EPA's evaluation of those modeling runs, we found that they provide a somewhat more detailed picture of the aquifer, but no significant additional knowledge was gained regarding groundwater behavior. In particular, no significant additional information was gained concerning the practicability of remediating the middle silty layer.

20) Comment: The EPA indicated that their preferred remedial alternative should employ four wells that are "fully screened from the top of the upper sand unit to the base of the lower sand unit." This scenario cannot be simulated by using the groundwater modeling software indicated (MODFLOW), without a prior assigning of a specific groundwater extraction rate to each aquifer zone (model layer) at the location of each well. BVSPC provided no information on how modeled groundwater extraction rates were apportioned to the individual aquifer units in their simulations. To achieve predetermined flow rates from the individual aquifer units in the actual aquifer system, a cluster of multiple wells, screened at different depths, would be required at each location in lieu of the single fully screened well called for in the Proposed Plan, increasing both the complexity and costs of the proposed extraction system.

Response: The BVSPC model simulated pumping 50 percent of the volume from the upper sand layer and 50 percent of the volume from the lower sand layer at each well location. The number of wells, their design, and pumping rates presented in the Feasibility Study is a conceptual design for use in the Feasibility Study phase of this project. The Remedial Design will need to include performance of a pump test and reevaluation of the number of extraction wells, extraction rates, and their design.

21) Comment: Appendix A of EPA's July 1998 Feasibility Study states that modeling of the preferred four-well extraction system "predicts that this pumping scenario will decrease the concentration of contaminants within the upper and lower sand units to the cleanup goal of 5 ppb in 18 years." Elsewhere within this

report and the Proposed Plan, it is stated that this alternative would achieve remediation of the aquifer within 18 years. Argonne has modeled the four-well extraction scenario proposed by EPA, requiring eight wells to achieve a flow rate of 25 gpm each from the upper and lower sands at the proposed well locations and using the updated aquifer system models presented in Argonne's April 1998 study. The results of this simulation indicate that the EPA's preferred Alternative 3 will not achieve the stated cleanup goal of 5 ppb within the upper sand unit after 60 years of continuous pumping or within the middle silt unit after 100 years of continuous pumping.

Response: It is EPA's cleanup goal to contain the spread of the contaminant plume and to actively restore the contaminated aquifer to its use as a source of drinking water. Multiple model runs were performed to determine the number of wells, their locations and pump rates to restore all layers of the aquifer to drinking water standards. It is understood that different values assigned to model parameters will significantly impact model predictions. The four-well and 200-gallon per minute pump rate are a result of modeling and could be modified as more information on the aquifer is gathered during design investigations. EPA acknowledges that achievement of MCL concentrations in the groundwater is not a certainty using the modeled recommended alternative. Furthermore, during active restoration, groundwater sampling and treatment system monitoring is to be performed to evaluate the performance and effectiveness of the extraction system in each aquifer layer. Decisions regarding the effectiveness of the extraction system will be based on actual data accumulated over time, and not just on model predictions. System performance reports will be prepared every two years and system adjustments or improvements or other changes will be considered on a regular basis to improve system effectiveness and efficiency.

22) **Comment**: The NCP specifies that the EPA is expected to return groundwater to their beneficial uses wherever practicable within a time frame that is reasonable given the particular circumstances of the site. When restoration of groundwater to beneficial uses is not practicable, the EPA is expected to prevent further migration of the plume, prevent exposure to the contaminated groundwater, and evaluate further risk reduction.

The NCP states that during the Feasibility Study the EPA is to establish PRGs, or acceptable exposure levels that are protective of human health and the environment. In establishing PRGs, the EPA is to consider applicable or relevant and appropriate requirements and other factors to determine acceptable exposure levels. These preliminary goals are to be modified "as more information becomes available during the Remedial Investigation/Feasibility Study (RI/FS)." Therefore, we request that the EPA Proposed Plan specifically address how these goals will be met or modify them on the basis of the additional significant information not used in setting the PRGs.

__Response:__ The EPA does not view the data collected as part of USDA's extended monitoring program or the additional modeling results as "significant" information which proves that remediation of the middle silty layer is impossible. The grain size data indicates that a good percentage of the middle unit should be fairly amenable to pump-and-treat remediation and pump test #3 (referenced above) indicates that the middle silt unit is not hydraulically isolated from the upper and lower sand units (at least in some locations). Therefore, it is premature to assume that it is impossible to remediate the middle silty layer.

23) __Comment__: The NCP requires the EPA to evaluate each alternative to determine such factors as effectiveness, technical feasibility, and cost in achieving the PRGs. Neither the EPA's Proposed Plan nor its Feasibility Study indicates how any of identified alternatives will effectively address remediation of the middle silt unit.

__Response:__ EPA acknowledges that there is uncertainty about whether hydraulic properties of the middle silty layer could inhibit the success of the proposed alternative; however, EPA is not convinced that it is impossible to remediate the middle silty layer. The final design should take into account all data currently known regarding the subsurface. During operation of the system, groundwater sampling will be performed to evaluate the performance and effectiveness of the extraction system in each aquifer layer. Decisions regarding the effectiveness of the extraction system will be based on field data from active remediation pumping and not on model predictions alone.

24) __Comment__: The NCP provides that alternatives determined to be technically or administratively infeasible may be eliminated from further consideration. It states that "the alternatives shall be assessed to determine whether they attain applicable or relevant and appropriate requirements under federal environmental laws and state environmental or facility siting laws or provide grounds for invoking one of the waivers under paragraph (f)(1)(ii)(C) of the section." One of the grounds under which the EPA may invoke a waiver is that "compliance with the requirement is technically impracticable from an engineering perspective."

USDA requested that the EPA issue modified PRGs that are protective of human health and the environment and are technically feasible, as specified in CERCLA Section 121 and the NCP. In addition, the NCP provides EPA with additional authority in selecting an alternative when other circumstances besides technical impracticability apply, as in cases where "compliance with such requirement at the facility will result in greater risk to human health and the environment than alternative options." This provision may apply to the Bruno site because as is indicated on page 5-17 of USDA's April 1998 study, the modeling of direct extraction of the middle silt unit demonstrated that increased contamination of the upper sand unit would result. The NCP also states that the EPA is expected to use treatment wherever practicable and where contaminants are highly mobile. As has been stated in this document and the April 1998 USDA study, the contamination in the middle silt unit is not highly mobile.

Response: It has not been demonstrated that it is technically impracticable to remediate the middle silty layer, and therefore modification of the PRGs is not warranted. The observations discussed on page 5-17 of USDA's April 1998 study regarding the predicted increase in contamination in the upper sand caused by pumping of the middle silty layer is not sufficient to show pumping in the middle silty layer causes greater risk. This observation is unexplained in USDA's April 1998 study and seems infeasible. It may also show that pumping in the middle silt will mobilize contaminants into the more conductive zones of the aquifer where the contaminants can be more readily removed from the aquifer. EPA's preferred alternative pumps from all three aquifer layers and not just form the middle silty layer. Contaminants drawn into the upper and lower sands by pumping would be extracted by the wells pumping in those layers.

25) Comment: The cost comparisons provided in the EPA's Feasibility Study do not specifically provide the detailed breakdown needed to determine their accuracy. Therefore, please provide a more detailed itemized accounting of these costs particularly for Alternative 3. On the basis of previous experience with the Waverly, Nebraska, site we believe that the estimated costs of implementation are underestimated.

Response: A detailed breakdown of the costs for the alternatives presented in the Feasibility Study (BVSPC 1998) are provided in Appendix C of the report. The cost estimates provided are within the +50/-30 range dictated by RI/FS guidance, and are fairly detailed.

26) Comment: We find that the Remedial Action Objectives (RAOs) in the Proposed Plan are not consistent with the PRGs cited in the EPA's Feasibility Study. The PRGs in the Proposed Plan indicate that the EPA considers a cleanup that would restore the groundwater to drinking water quality. The RAOs in the EPA's Feasibility Study state an objective of preventing ingestion of groundwater that exceeds MCLs. The EPA needs to explain the inconsistencies between these two very different objectives.

Response: There is no inconsistency between the RAOs described in the Feasibility Study and the Proposed Plan. The RAOs in the FS are to prevent ingestion, inhalation, or direct contact with groundwater having concentrations of the chemicals of concern above current regulatory drinking water standards. MCLs are specifically identified in the FS as regulatory standards which were carried forward as PRGs in the Proposed Plan. Also, the Village's continued use of Supply Well #65-1 during times of scarcity indicates that the use of the aquifer as a drinking water source continues and the lack of institutional controls that would prevent the drilling of new wells both make MCLs appropriate standards for the aquifer.

27) Comment: The EPA stated in the Proposed Plan that it evaluated USDA's April 1998 submitted on behalf of CCC/USDA. The Proposed Plan briefly describes the CCC/USDA's proposed alternative and says that it would include six extraction wells pumping the aquifer for two years at a rate of 150 gpm. After two years of treating the hot spots of the aquifer this alternative would provide for natural attenuation of the lower concentrations remaining in the aquifer. The EPA then stated in its Proposed Plan that its policy on natural attenuation is that "it should normally be used in conjunction with or to supplement active remediation measures. For example, natural attenuation could be employed in lower concentration areas of the dissolved plume and as a follow-up to active remediation in areas of higher concentration." This example is a totally accurate description of the CCC/USDA proposed alternative. Please indicate how the EPA has determined that our proposed alternative is not consistent with this EPA policy.

Response: Presently, although USDA has done much work at the Site, there has been no evaluation to determine if the rate of natural attenuation at the site is sufficient to accomplish remedial action objectives. The efficiency of the natural attenuation rate of the contaminants of concern is accomplished by evaluating the biogeochemical system of the site. EPA suggested to USDA (correspondence dated April 11, 1997) to include biogeochemical parameters to their monitoring program to allow evaluation of the efficiency of the site's natural attenuation rate. USDA declined the suggestion (correspondence dated June 17, 1997). Until the site's natural attenuation rate can be substantiated, natural attenuation can not be included as part of the selected remedy.

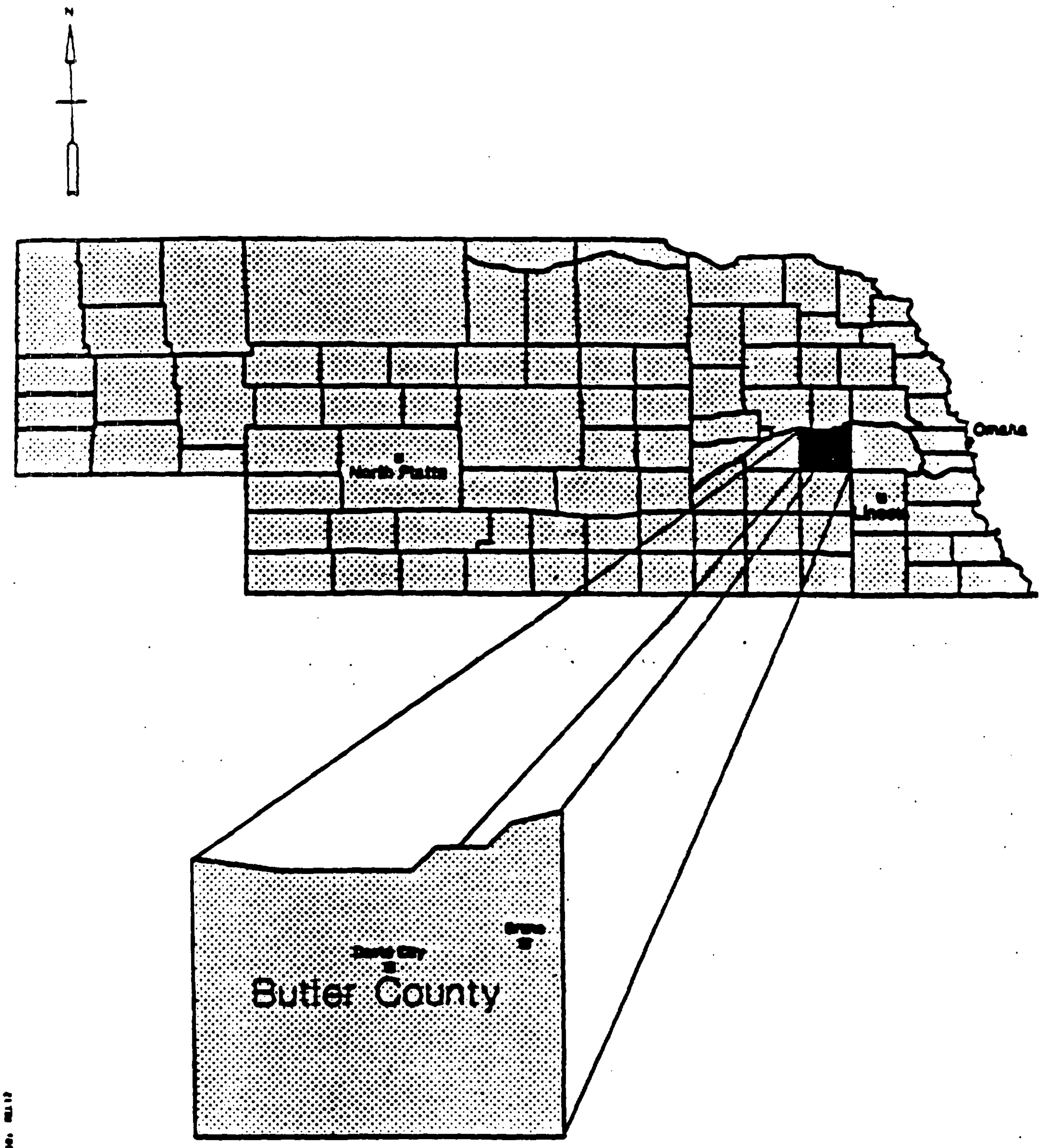
28) Comment: The EPA Feasibility Study provides no risk evaluation for the different remedial alternatives. This is not consistent with the EPA's guidance in RAGS, Volume I, Parts A and C. The Proposed Plan does not indicate how the middle silt unit will be cleaned of contaminant to a level below the MCL, but the middle silt unit was used in the baseline risk assessment as a potential source of

contaminated water. As a result, if the middle silt is not actually to be cleaned a risk assessment of the residual contamination should be performed. Please provide this risk analysis for the alternatives.

Response: As described previously, it has not been demonstrated that remediation of the middle silty layer is unlikely. Therefore, part of the remediation goal is restoration of the middle silty layer. As part of the Nine-Criteria analysis in the FS, EPA has examined possible risks posed by any of the evaluated alternatives. EPA normally develops remediation goals based on existing site risks and has followed the guidance cited in this comment. Under the NCP, MCLs promulgated under the Safe Drinking Water Act are to be relevant and appropriate in most instances as cleanup levels for drinking water aquifers.

29) Comment: Calculated models for pumping of public well 65-1 to supplement the water supply of the community demonstrate that this activity can be undertaken now in a safe manner. Please detail why EPA chose to ignore this possibility.

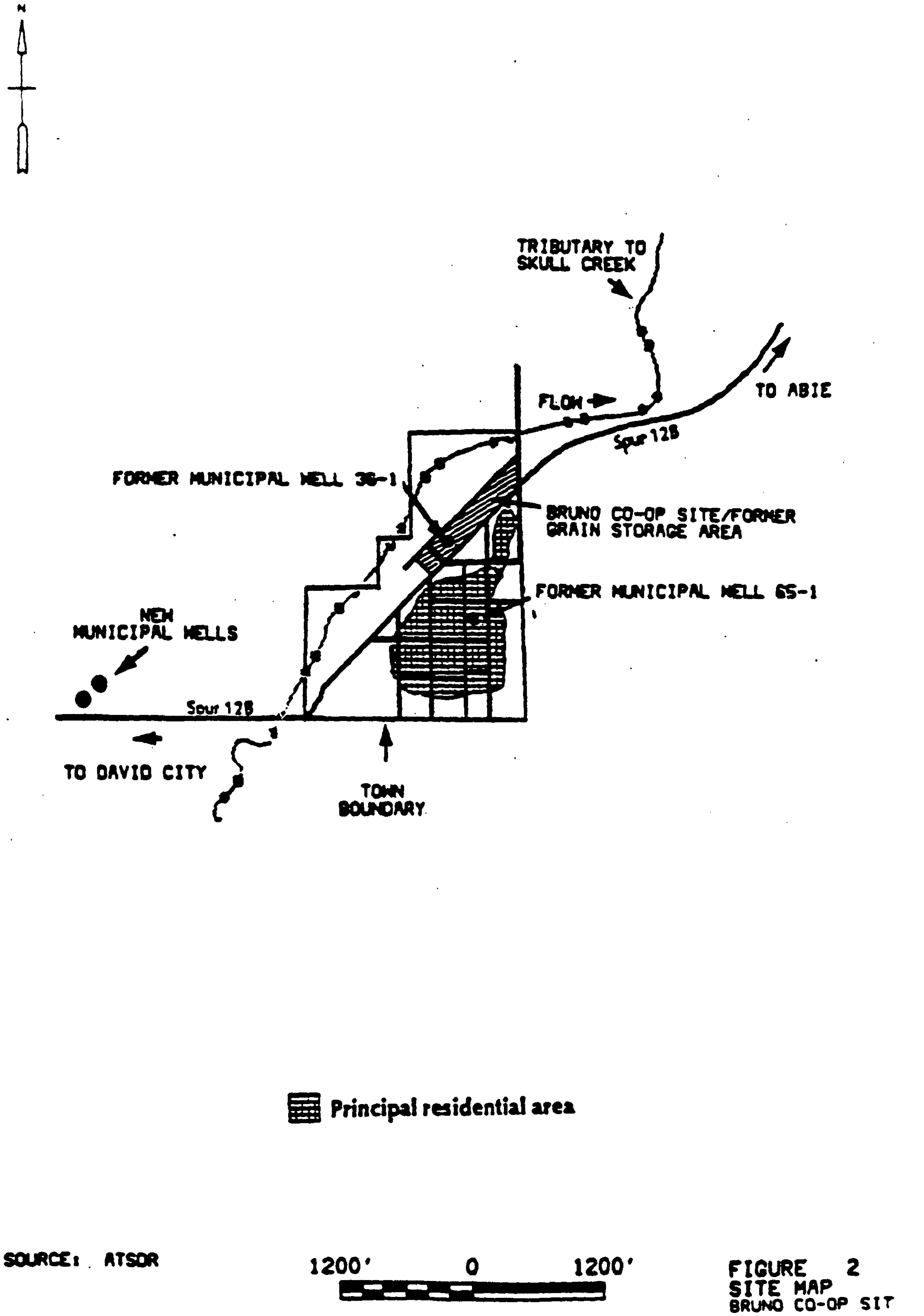
Response: Well 65-1 has been shown to be contaminated in the past. It is unreasonable to believe that the model can sufficiently demonstrate that no contaminants will enter public well 65-1 in the future. The ROD includes treatment to allow utilization of Well 65-1 as a backup supply for the Village of Bruno.



SOURCE: NDH

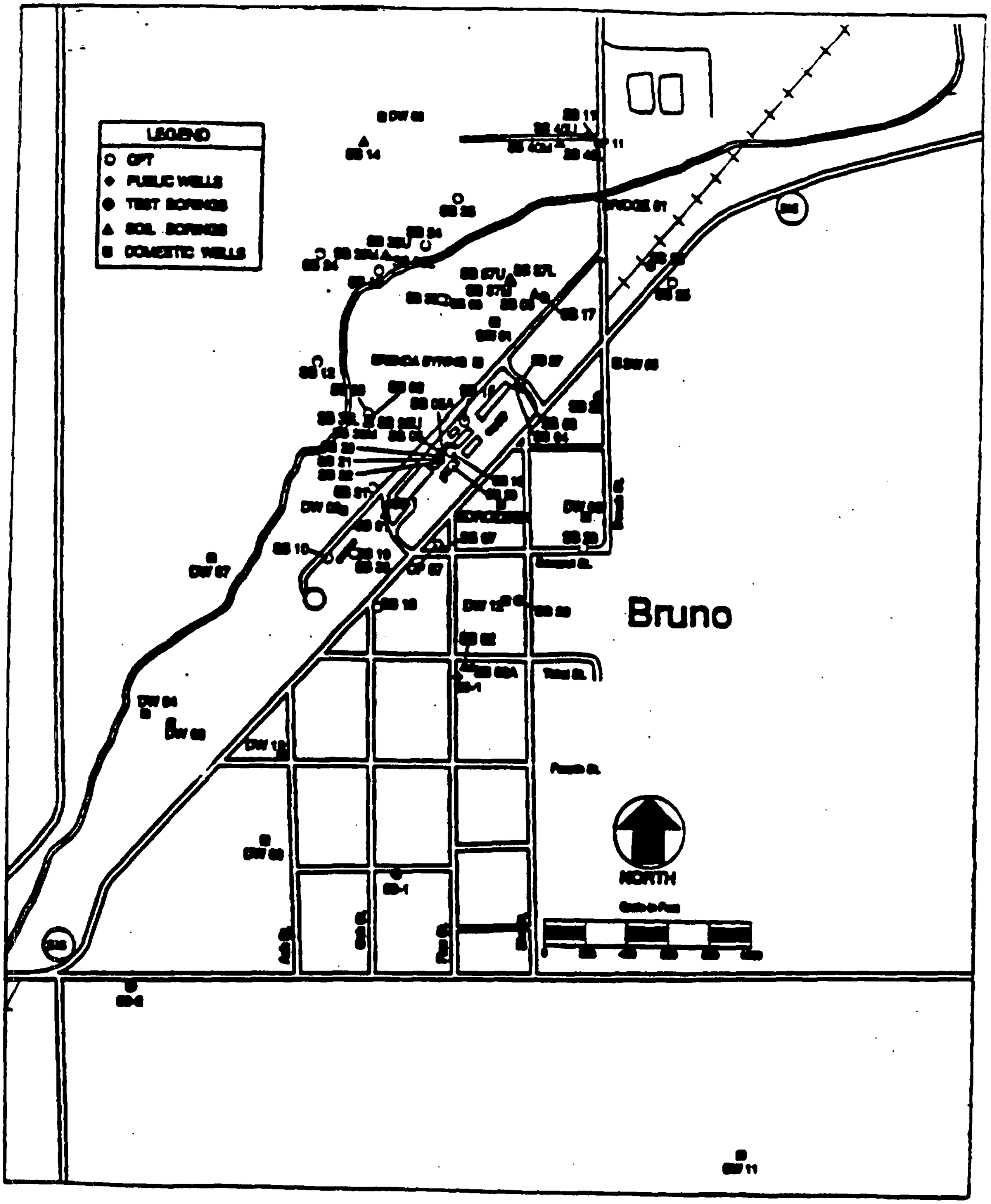
NOT TO SCALE

FIGURE 1
SITE LOCATION



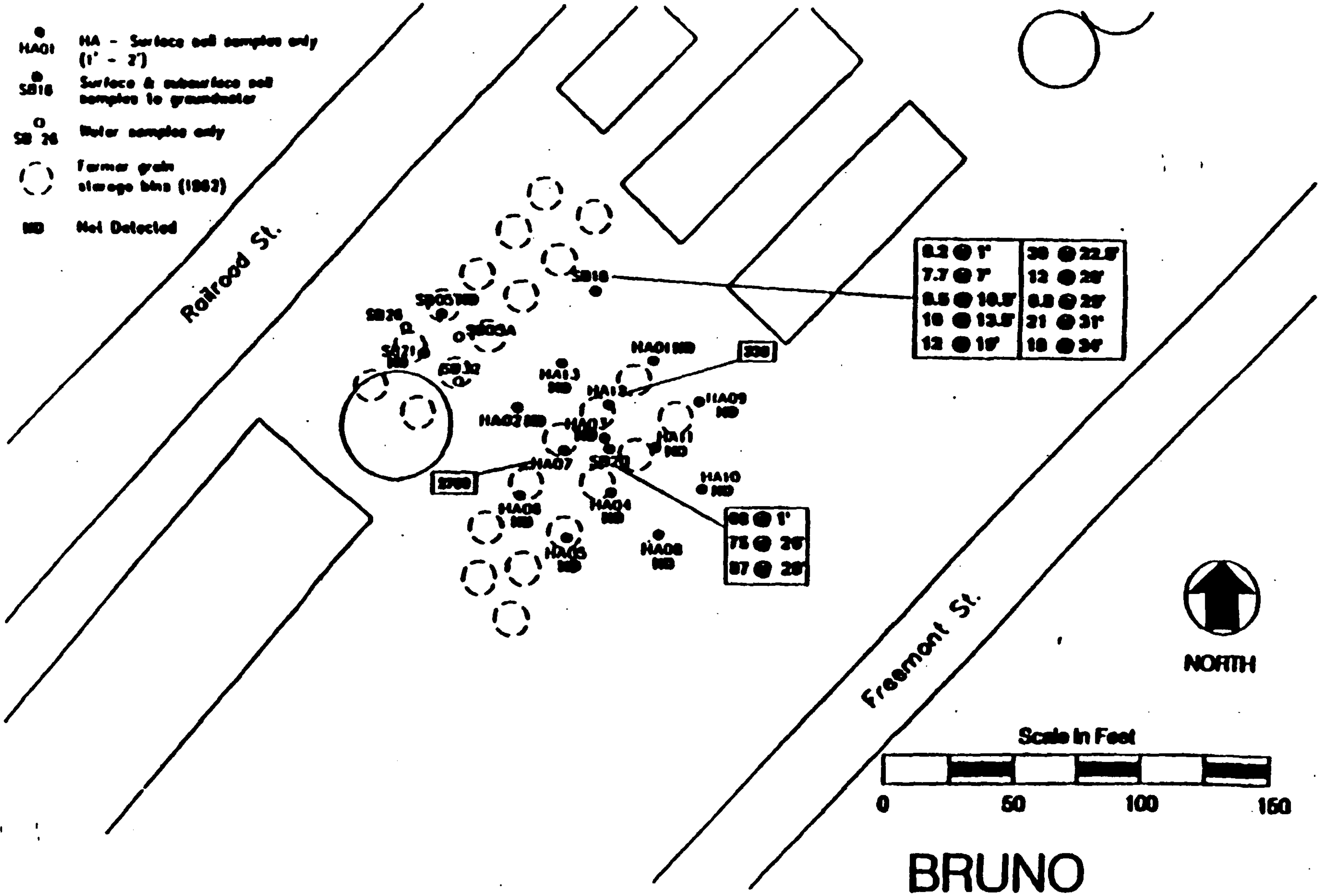
SOURCE: ATSDR

FIGURE 2
SITE MAP
BRUNO CO-OP SIT



SOURCE: ARGONNE

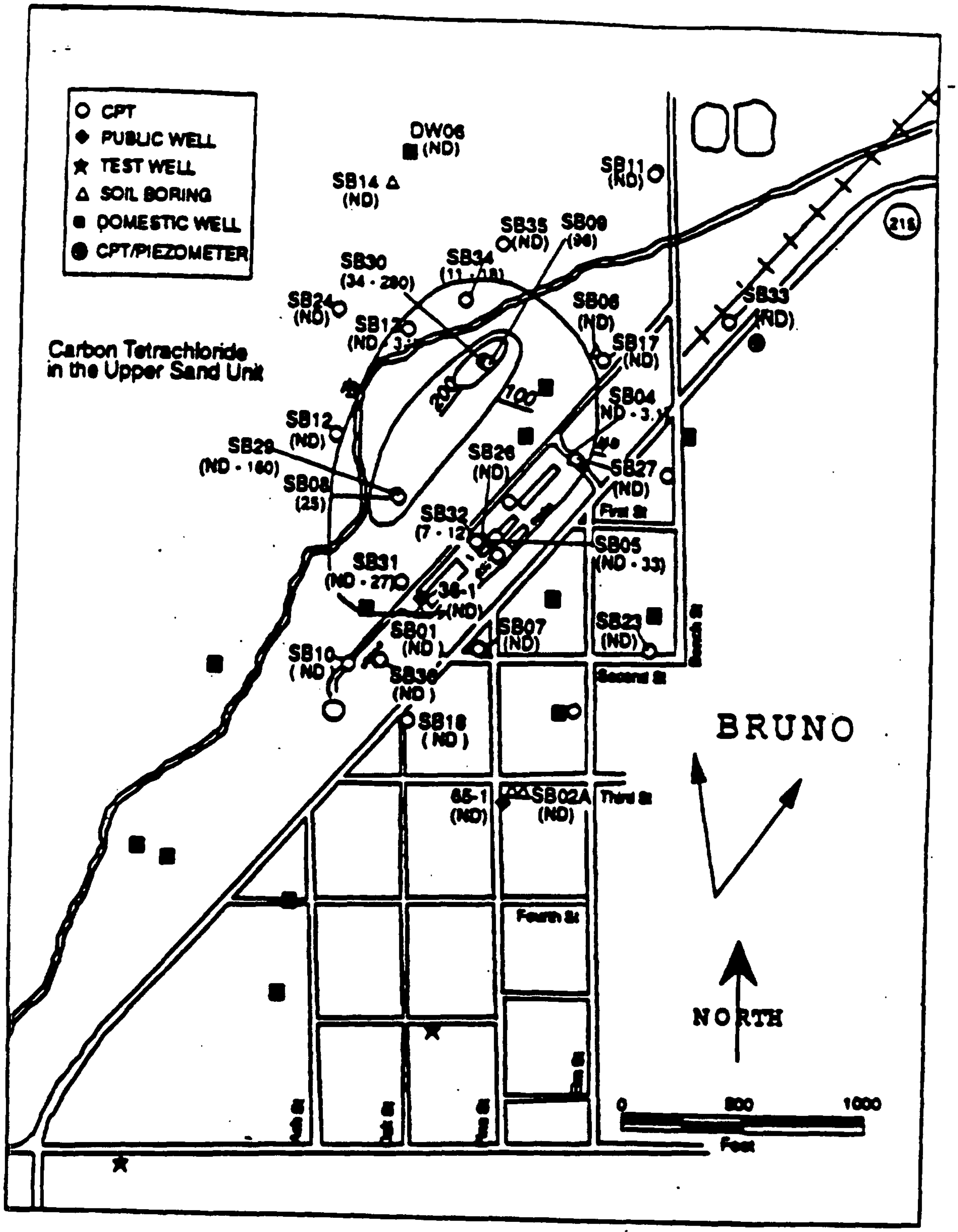
FIGURE 3
SAMPLING LOCATI(
BRUNO CO-OP SITE



BRUNO

SOURCE: ARGONNE

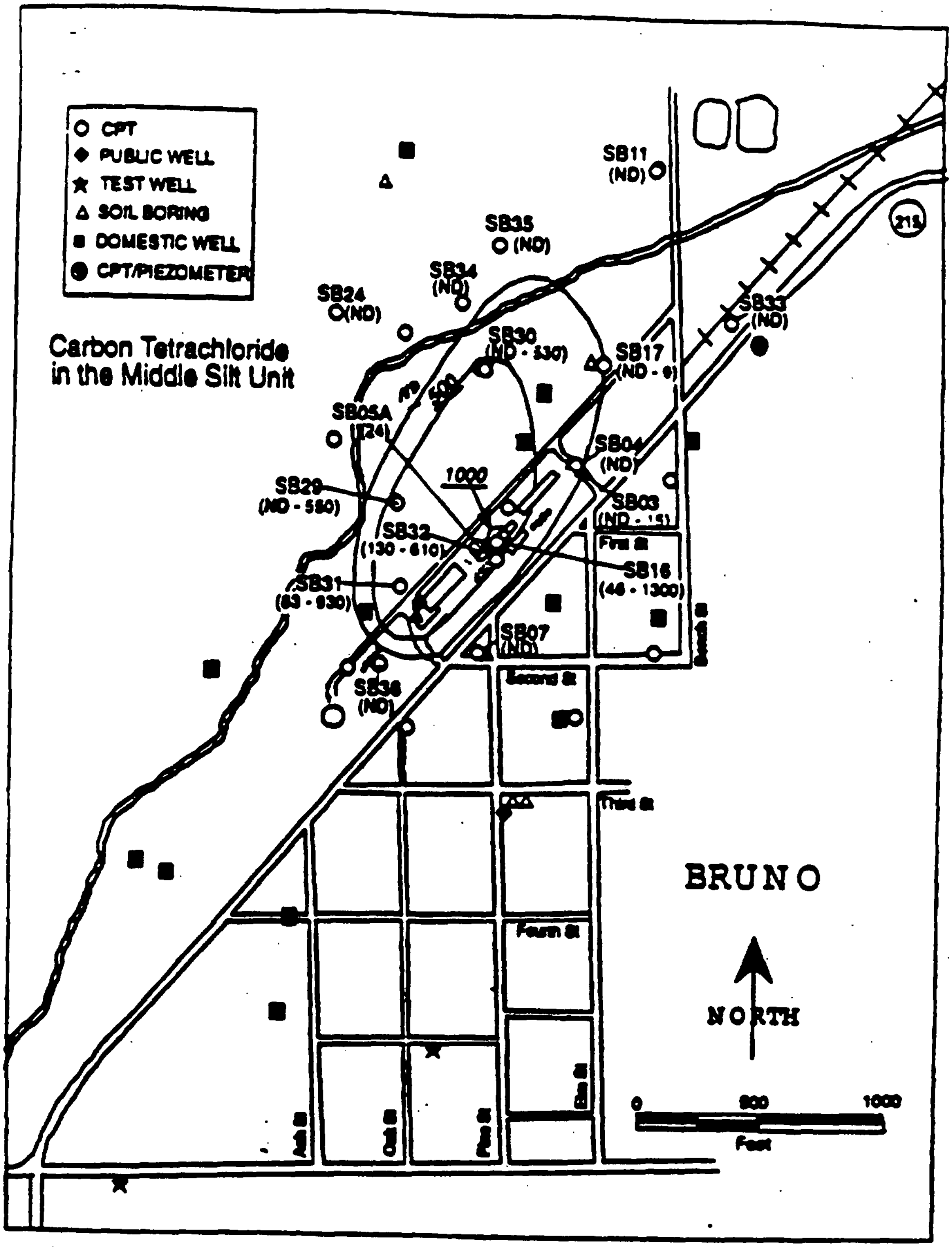
FIGURE 4
SOIL SAMPLE RESULTS
CARBON TETRACHLORIDE (μg/kg)
BRUNO CO-OP SITE



CONCENTRATIONS µg/L

SOURCE: ARGONNE

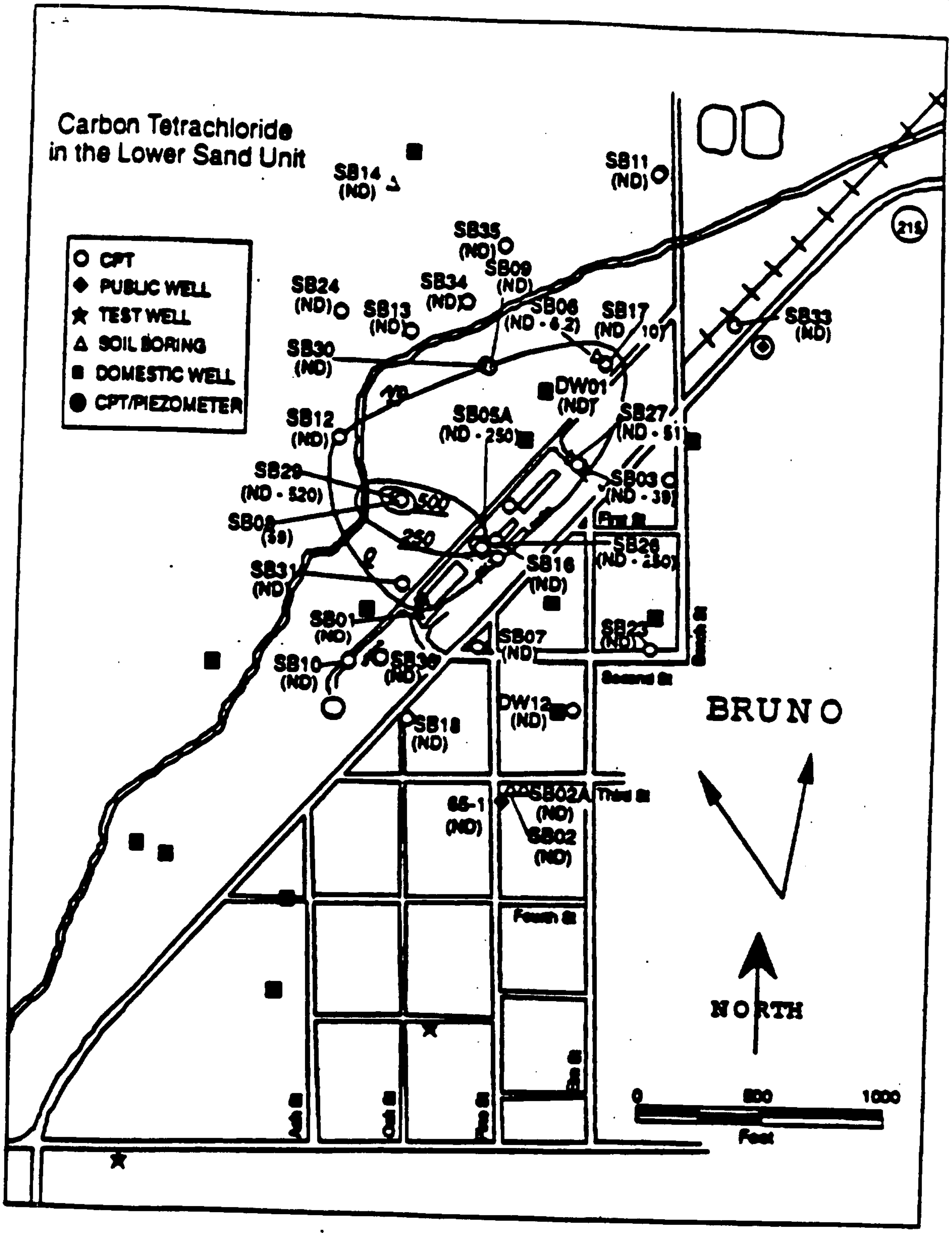
FIGURE 5
AREAL EXTENT OF CARBON TETRACHLORIDE IN THE UPPER SAND UNIT
BRUNO CO-OP SITE



CONCENTRATIONS µg/L

SOURCE: ARGONNE

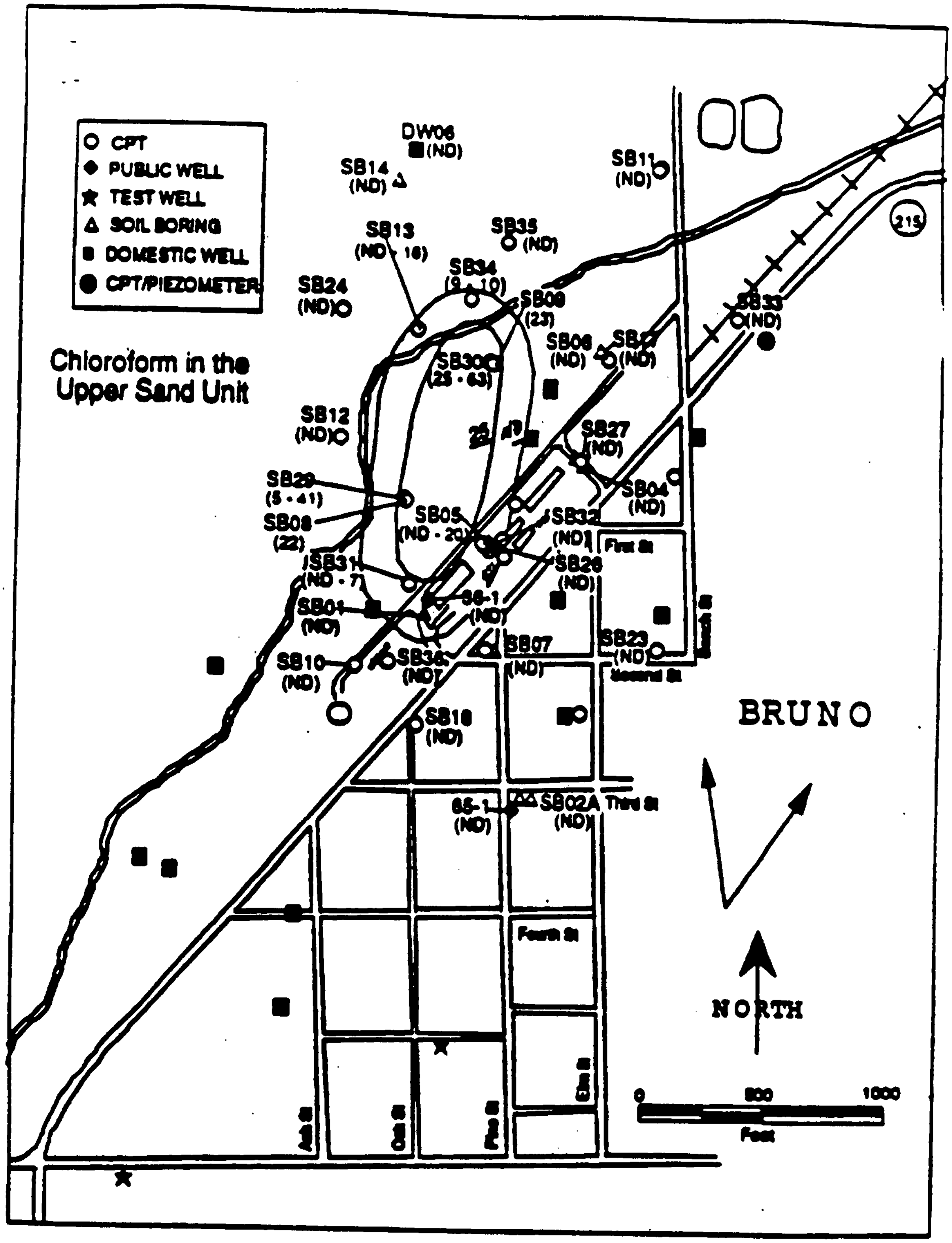
FIGURE 6
AREAL EXTENT OF CARBON TETRACHLORIDE IN THE MIDDLE SILT UNIT
BRUNO CO-OP SITE



CONCENTRATIONS µg/L

SOURCE: ARGONNE

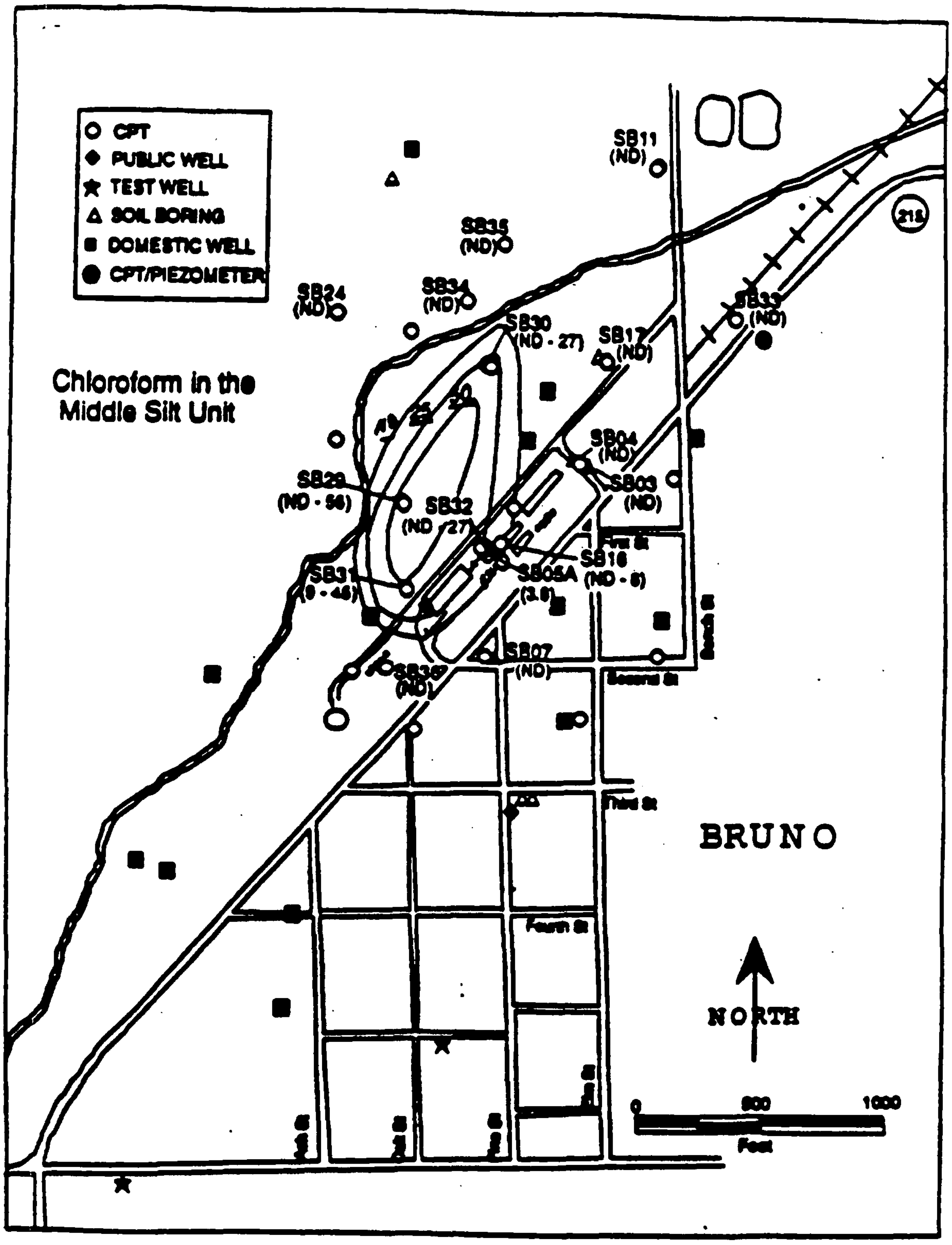
FIGURE 7
AREAL EXTENT OF CARBO
TETRACHLORIDE IN THE
LOWER SAND UNIT



CONCENTRATIONS µg/L

SOURCE: ARGONNE

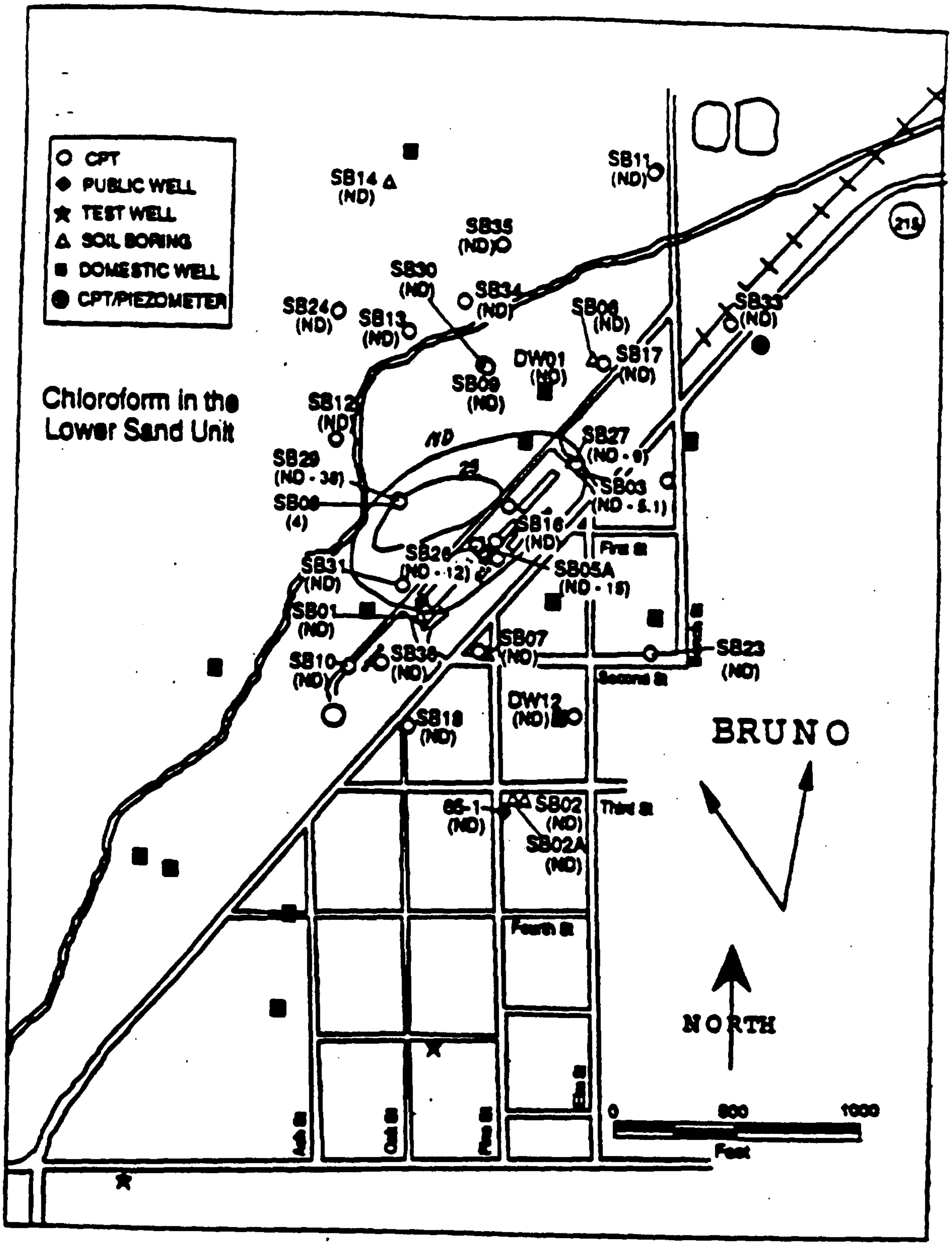
FIGURE 8
AREAL EXTENT OF CHLOROFORM
IN THE UPPER SAND UNIT
BRUNO CO-OP SITE



CONCENTRATIONS µG/L

SOURCE: ARGONNE

FIGURE 9
AREAL EXTENT OF CHLOROFORM
IN THE MIDDLE SILT UNIT
BRUNO CO-OP SITE



CONCENTRATIONS µg/L

SOURCE: ARGONNE

FIGURE 10
AREAL EXTENT OF CHLOROFORM IN THE LOWER SAND UNIT
BRUNO CO-OP SITE

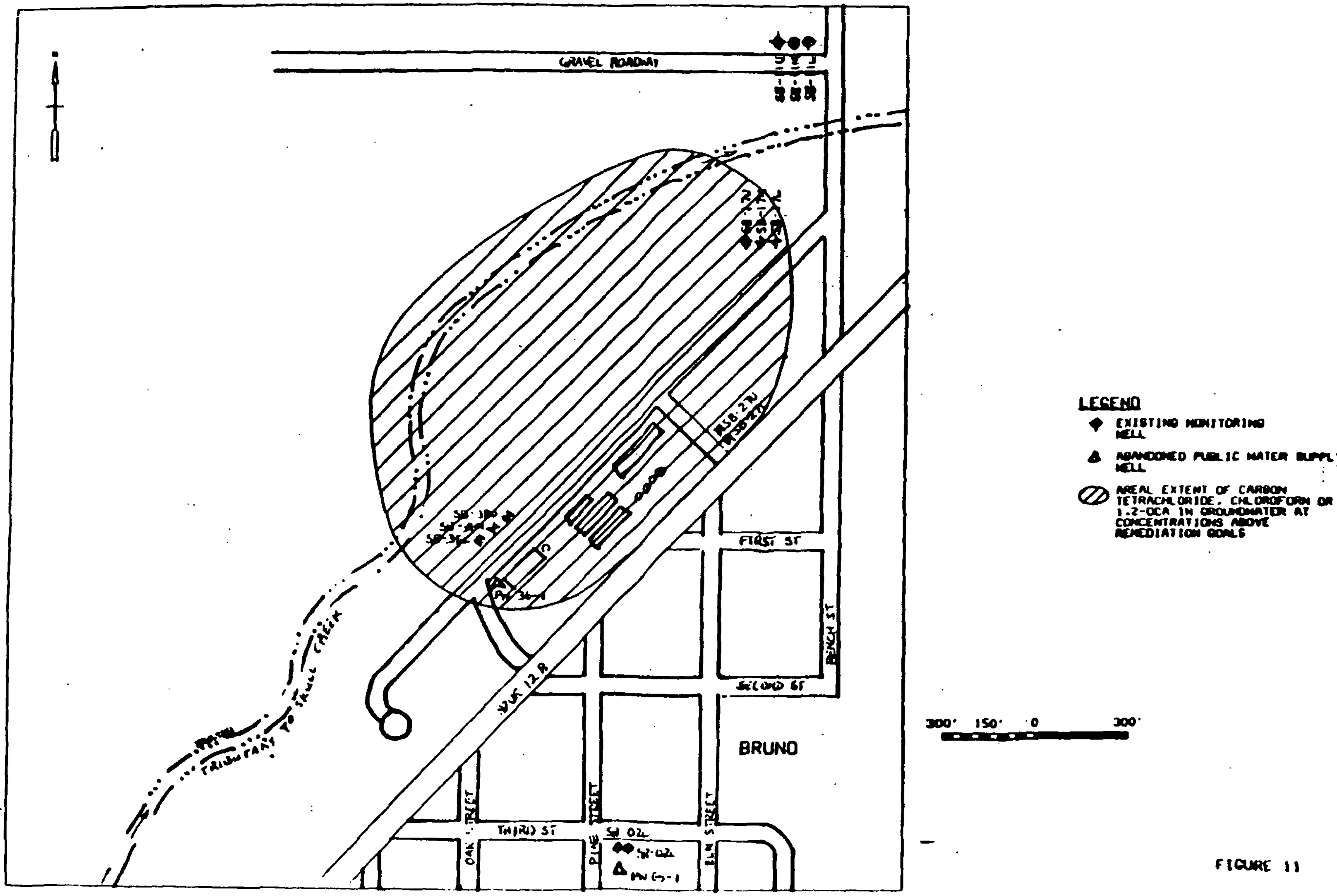

GRAVEL ROADWAY
TRIBUTARY TO SMALL CREEK
FIRST ST
SECOND ST
THIRD ST
BENCH ST
OAK STREET
PINE STREET
ELM STREET
BRUNO
LEGEND
EXISTING MONITORING WELL
ABANDONED PUBLIC WATER SUPPLY WELL
AREAL EXTENT OF CARBON TETRACHLORIDE, CHLOROFORM OR 1,2-DCA IN GROUNDWATER AT CONCENTRATIONS ABOVE REMEDIATION GOALS
300' 150' 0 300'

FIGURE 11

Table 1
Present Worth Cost Analysis
Selected Alternative (Alternative 3)
Bruno Co-op Site

Cost Estimate Component	Quantity	Units	Unit Cost	Capital Cost	Annual Cost
CAPITAL COSTS					
Extraction Wells (4, 8" PVC wells installed to a depth of 105 ft)	420	VLF	$60	$25,200	
3 HP Submersible Pump (wire flow and control devices)	4	EA	$3,500	$14,000	
Groundwater Collection Double Containment Piping (2" inside 4" PVC installed, includes bedding and trenching)	380	LF	$21.84	$8,300	
Groundwater Collection Double Containment Piping (4" inside 6" PVC installed, includes bedding and trenching)	990	LF	$33.43	$33,100	
Chain-Link Fencing (6 ft high)	60	LF	$13.53	$800	
Swing Gate (6 ft high, 12 ft opening)	1	EA	$400	$400	
Concrete Well Vaults	4	EA	$1,100	$4,400	
Prefabricated Structure	1	EA	$2,000	$2,000	
Purchased Packaged (Air Stripper)	1	LS	$36,600	$36,600	
Other Direct Costs for Packaged System	1	LS	$90,036	$90,000	
Discharge Piping to Drainage Ditch (6" PVC installed, includes bedding and trenching)	200	LF	$12	$2,400	
Monitoring Wells (2 sets of 3, 2" PVC wells installed to depths of 45, 75, and 105 ft)	450	VLF	$25	$11,300	
Treatability Study	1	LS	$30,000	$30,000	
DIRECT CAPITAL COST SUBTOTAL				$258,500	
Bid Contingency (15%)				$38,800	
Scope Contingency (15%)				$38,800	
TOTAL DIRECT CAPITAL COST				$336,100	
Permitting and Legal (5%)				$16,800	
Construction Services (10%)				$33,600	
CONSTRUCTION COSTS TOTAL				$386,500	
Engineering Design (8%)				$30,900	
TOTAL CAPITAL COST				$417,400	
ANNUAL O&M COSTS					
Electrical Costs (483 KWh/day)	176300	KWh	$0.08		$14,100
Groundwater Monitoring (Analysis only)					
Year 1 Monthly sampling of 19 monitoring wells for CCl4, CHCl3 and 1,2-DCA (standard turnaround)	228	EA	$100		$22,800
Years 2 through 6 Quarterly sampling of 19 monitoring wells for CCl4, CHCl3 and 1,2-DCA (standard turnaround)	76	EA	$100		$7,600
Years 7 through 18 Semi-annual sampling of 19 monitoring wells for CCl4, CHCl3 and 1,2-DCA (standard turnaround)	38	EA	$100		$3,800

Table 1 (Continued)
Present Worth Cost Analysis
Selected Alternative (Alternative 3)
Bruno Co-op Site

Cost Estimate Component	Quantity	Units	Unit Cost	Capital Cost	Annual Cost
Groundwater Monitoring (Labor only)					
Year 1 2 Level P1 persons for 2-8 hour days per sampling event	384	HR	$60		$23,000
Years 2 through 6 2 Level P1 persons for 2-8 hour days per sampling event	128	HR	$60		$7,700
Years 7 through 18 2 Level P1 persons for 2-8 hour days per sampling event	64	HR	$60		$3,800
Treatment Plant Effluent Monitoring (Monthly monitoring for CCl3, CHCl4, and 1,2-DCA, standard turnaround)	12	EA	$100		$1,200
Preparation of Health and Safety Plan (Year 1 only)	40	HR	$60		$2,400
Preparation of O&M Manual (Year 1 only)	80	HR	$60		$4,800
Preparation of QA/Sampling Plan (Year 1 only)	60	HR	$60		$3,600
Five-Year Review @ 5, 10, and 15 yrs	1	LS	$15,000		$15,000
Maintenance Allowance (12% of purchased equipment delivered)	1	LS	$4,392		$4,400
Operator Requirement (2 hour/day)	730	HR	$25		$18,300
TOTAL PRESENT WORTH O&M COST				$639,600	
TOTAL PRESENT WORTH				$1,057,000	

5 percent discount rate used to calculate present worth.

Table 1 (Continued)
Present Worth Cost Analysis
Selected Alternative (Alternative 3)
Bruno Co-op Site

Year	Yearly O&M Cost*	Intermittent O&M Costs	Total Annual O&M Costs	Intermittent O&M Costs Include:
1	$38,000	$56,600	$94,600	Year 1 (plans and monitoring)
2	$38,000	$15,300	$53,300	Years 2-6
3	$38,000	$15,300	$53,300	Years 2-6
4	$38,000	$15,300	$53,300	Years 2-6
5	$38,000	$30,300	$68,300	Years 2-6 and 5 yr review
6	$38,000	$15,300	$53,300	Years 2-6
7	$38,000	$7,600	$45,600	Years 7-18
8	$38,000	$7,600	$45,600	Years 7-18
9	$38,000	$7,600	$45,600	Years 7-18
10	$38,000	$22,600	$60,600	Years 7-18 and 5 yr review
11	$38,000	$7,600	$45,600	Years 7-18
12	$38,000	$7,600	$45,600	Years 7-18
13	$38,000	$7,600	$45,600	Years 7-18
14	$38,000	$7,600	$45,600	Years 7-18
15	$38,000	$22,600	$60,600	Years 7-18 and 5 yr review
16	$38,000	$7,600	$45,600	Years 7-18
17	$38,000	$7,600	$45,600	Years 7-18
18	$38,000	$7,600	$45,600	Years 7-18
Present Worth of Annual O&M			$639,638	

* Yearly O&M costs include: electricity, treatment plant effluent monitoring, maintenance, and operator.

Table 2
Cost for well abandonment of well 36-1 and the Treatment of well 65-1
Bruno Co-op Site
Bruno, Nebraska

Capital Costs			
Two 2,000 lb Carbon Vessels			$42,000
20 X 20 Ft. Building			$33,000
Well Abandonment			$5,000
Shipping			$2,000
Total Capital Costs			**$82,000**
Operation & Maint. Costs			
Monthly Sampling	150	12	$1,800
Annual Regeneration of Carbon			$6,000
Biannual backwashing of carbon units			
Annual O&M Costs			**$7,800**

Assumptions:

1) Well will need to be used in winter months. Thus, a heated building is necessary. Building is on concrete slab, heated, and is a wood frame construction.
2) Monthly sampling and analytical work will be necessary to insure breakthrough is not Occurring.
3) Regeneration and disposal of old carbon will be performed annually.
4) City employees will perform general operation and maintenance of system including sampling and backwashing.