

**PB95-964601
EPA/ROD/R10-95/086
January 1995**

**EPA Superfund
Record of Decision:**

**U.S. DOE Idaho National Engineering
Laboratory, Operable Unit 15, ID
12/2/1994**





IDAHO DEPARTMENT
OF HEALTH AND WELFARE

DIVISION OF
ENVIRONMENTAL QUALITY

Record of Decision

Declaration for Organic Contamination in the Vadose Zone

Operable Unit 7-08

Idaho National Engineering Laboratory
Radioactive Waste Management Complex
Subsurface Disposal Area

DECLARATION OF THE RECORD OF DECISION

SITE NAME AND LOCATION

**Organic Contamination in the Vadose Zone (OCVZ)
Subsurface Disposal Area
Radioactive Waste Management Complex
Idaho National Engineering Laboratory
Idaho Falls, Idaho**

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Organic Contamination in the Vadose Zone (OCVZ) site located at the Idaho National Engineering Laboratory (INEL). The remedial action was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA), and is consistent, to the extent practicable, with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, 40 CFR Part 300). Information supporting the selection of the remedy is contained in the Administrative Record for the OCVZ Remedial Action.

The lead agency of this decision is the U.S. Department of Energy (DOE). The U.S. Environmental Protection Agency (EPA) approves of this decision and, along with the Idaho Department of Health and Welfare (IDHW), has participated in the evaluation of final action alternatives. The IDHW concurs with the selection of the preferred remedy for the OCVZ.

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. Implementation of the remedial action selected in this ROD will provide extraction of the organic contaminants present in the most significant concentrations in the vadose zone beneath and within the immediate vicinity of the Radioactive Waste Management Complex (RWMC). These extracted contaminants will be destroyed through treatment at the surface of the RWMC. Extraction and destruction of the organic contaminants will prevent the long-term contamination of the Snake River Plain Aquifer (SRPA) above acceptable levels. The selected remedial action is not intended to address potential contaminants such as radionuclides and metals. These contaminants will be investigated as part of a comprehensive remedial investigation and feasibility study scheduled to begin in 1996.

DESCRIPTION OF THE SELECTED REMEDY

This ROD addresses the OCVZ at the RWMC of the INEL. The RWMC has been designated as Waste Area Group (WAG) 7 of the 10 WAGs currently under investigation at the INEL pursuant to the Federal Facility Agreement and Consent Order (FFA/CO) between the IDHW, the EPA, and the U.S. Department of Energy Idaho Operations Office (DOE-ID). OCVZ, designated as Operable Unit (OU) 7-08, is part of WAG 7.

The vadose zone extends from the ground surface to the top of the SRPA, approximately 580 ft below the surface. The vadose zone contains volatile organic compounds, primarily in the form of organic vapors, which have migrated from organic wastes disposed of in pits at the Subsurface Disposal Area (SDA) of the RWMC. Organic wastes remaining in the pits are not addressed with the selected remedy described in this ROD. Instead, risks to human health and the environment associated with these wastes will be evaluated as part of the remedial investigation and feasibility study which is to begin in 1994 for the disposal pits.

The selected remedy for OCVZ will provide extraction/destruction of organic contaminant vapors present in the vadose zone beneath and within the immediate vicinity of the RWMC. In addition, the selected remedy will include monitoring of vadose zone vapor and the SRPA. The objective of this selected remedy will be to reduce the risks to human health and the environment associated with the organic contaminants present in the vadose zone and to prevent Federal and state safe drinking water standards from being exceeded in the future.

The major components of the selected remedy include:

- The installation and operation of five vapor extraction wells (in addition to an existing vapor extraction well) at the RWMC as part of a first phase effort to extract organic contaminant vapors from the vadose zone. The selected remedy includes options to expand the number of vapor extraction wells for potential second and third phases. Additional system modifications will be evaluated with each phase transition.
- The installation and operation of off-gas treatment systems to destroy the organic contaminants present in the vapor removed by the extraction wells. Off-gas treatment will be in the form of catalytic oxidation or an equally effective organic contaminant destruction technology.
- The addition of soil vapor monitoring wells to monitor the performance of the vapor extraction wells and verify the attainment of remedial action objectives. Soil vapor monitoring will also provide information used to evaluate potential modifications to the selected remedy to continue it beyond the first phase. The expected duration of the first phase is approximately two years; potential second and third phases would operate for approximately two years each. The actual duration of each phase is dependent on elements such as equipment procurement and installation that may be involved with each potential phase transition.

- The maintenance of institutional controls, which includes: using signs, restricting access, maintaining fences/barriers, and monitoring the existing production well supplying water to workers at the RWMC. It is presumed that this level of institutional control will be maintained at the RWMC through the year 2091.

Organic wastes remaining in the pits could extend the timeframe required to achieve remedial action objectives using the selected remedy since the remaining organic wastes could act as a "long-term" source of organic contamination in the vadose zone.

STATUTORY DETERMINATION

The selected remedy is protective of human health and the environment, complies with Federal and state applicable or relevant and appropriate requirements (ARARs), and is cost-effective. This remedy uses permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. The most concentrated areas of organic contaminants present in the vadose zone will be extracted and destroyed. As such, the selected remedy satisfies the statutory preference for treatment as a principal element of the remedy.

For those remedial actions that allow hazardous substances to remain on-site, Section 121 (c) of CERCLA requires that a review of the remedy be conducted within five years after initiation of the remedial action and at least once every five years thereafter. The purpose of this review is to evaluate the remedy's performance—to ensure that the remedy has achieved, or will achieve, the remedial action objectives set forth in the ROD and that it continues to be protective of human health and the environment. Reviews for the OCVZ selected remedy will be conducted as described below.

The potential progression of the selected remedy to a second and third phase is dependent on the ability of the vapor extraction system to achieve the remedial action objectives, i.e., ensure that risks to future groundwater users are within acceptable guidelines and that future contaminant concentrations in the aquifer remain below Federal and state safe drinking water standards. During implementation of the selected remedy at OCVZ, the remedy's performance will be reviewed on a two year (24 month) cycle, with each phase of operation under the selected remedy expected to last at least two years. The actual duration of each phase is dependent on elements such as equipment procurement and installation that may be involved with each transition. The following description of the review cycle assumes that transitions will occur in a timely fashion every 24 months.

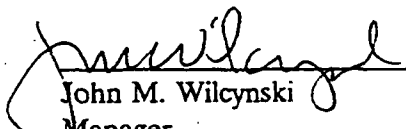
The first review will commence after 18 months of operation under the first phase. Data accumulated over these 18 months will be analyzed and a decision made by DOE, EPA, and the IDHW as to what will comprise the second phase of the selected remedy (if a second phase is necessary to attain remedial action objectives). The selected remedy will continue under first phase operations up to 24 months, at which time, after the data analysis period, a transition to the second phase will occur. Data analyzed will be relevant to the attainment of remedial action objectives (e.g., contaminant recovery rates, equilibrium contaminant concentrations in the vadose zone, etc.).

Considerable engineering judgement will be used in deciding what modifications to the first phase will be made to continue the selected remedy into a second phase in order to achieve remedial action objectives. Potential options for continuing the selected remedy into a second phase include:

(1) continuing operation with no changes to the first phase of operation; (2) adding more vapor extraction wells; (3) extracting from different depths within existing extraction wells; (4) converting monitoring wells into extraction wells; and (5) adding and/or converting existing wells to passive venting wells. These options and others not currently identified may be carried out singly or in combinations, with the intent being to ensure that the selected remedy achieves remedial action objectives.

The need for additional phases beyond a second phase will be evaluated using the same general approach as outlined above for the transition between the first and possible second phase. If a second phase is implemented, then the data evaluation and decision regarding a possible third phase will begin 18 months into the second phase (i.e., 42 months from the start of the selected remedy) with the third phase beginning, if necessary, approximately 48 months from the start of the selected remedy. Potential options for continuing the selected remedy into a third phase would be similar to those listed above. This type of phased operation will continue through phases lasting 24 months each until remedial action objectives are achieved. In addition to the 2 year reviews associated with the potential phases under the selected remedy, a review will be conducted five years after remedial action objectives have been achieved, and extraction/treatment operations have been discontinued.

Signature sheet for the foregoing OCVZ located in the Subsurface Disposal Area of the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory Record of Decision between the U.S. Department of Energy and the Environmental Protection Agency, with concurrence by the Idaho Department of Health and Welfare.


John M. Wilcynski
Manager

11/14/94
Date

U.S. Department of Energy, Idaho Operations Office

Signature sheet for the foregoing OCVZ located in the Subsurface Disposal Area of the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory Record of Decision between the U.S. Department of Energy and the Environmental Protection Agency, with concurrence by the Idaho Department of Health and Welfare.



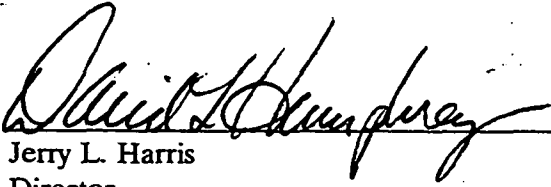
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Chuck Clarke

Date

Regional Administrator, Region 10
U.S. Environmental Protection Agency

Signature sheet for the foregoing OCVZ located in the Subsurface Disposal Area of the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory Record of Decision between the U.S. Department of Energy and the Environmental Protection Agency, with concurrence by the Idaho Department of Health and Welfare.



 Jerry L. Harris

Director

Idaho Department of Health and Welfare

11/28/94
Date

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ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
AT	Averaging Time
BW	Body Weight
CCl ₄	carbon tetrachloride
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Contaminant of Concern
COCA	Consent Order and Compliance Agreement
CFM	cubic feet per minute
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
ECU	Environmental Chemistry Unit
ED	Exposure Duration
EF	Exposure Frequency
EPA	Environmental Protection Agency
FFA/CO	Federal Facility Agreement and Consent Order
FR	Federal Register
ft	feet
HEAST	Health Effects Assessment Summary Tables
IDHW	Idaho Department of Health and Welfare
in.	inch
INEL	Idaho National Engineering Laboratory
IR	Ingestion Rate
IRIS	Integrated Risk Information System

kg	kilogram
l	liter
lbs	pounds
m	meter
MCL	Maximum Contaminant Level
mi	mile
min	minute
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
OCVZ	Organic Contamination in the Vadose Zone
OU	Operable Unit
PCE	tetrachloroethylene
PRG	preliminary remediation goal
PPB	parts per billion
PPMV	parts per million volume
RAG	Risk Assessment Guidance
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RR	Respiration Rate
RWMC	Radioactive Waste Management Complex
SARA	Superfund Amendments and Reauthorization Act
SDA	Subsurface Disposal Area
SRPA	Snake River Plain Aquifer

TCA	trichloroethane
TCE	trichloroethylene
TRU	Transuranic
TSA	Transuranic Storage Area
VOC	volatile organic compound
VVE	Vapor Vacuum Extraction
WAG	Waste Area Group
yr	year
μg	microgram

Decision Summary

1. SITE NAME, LOCATION, AND DESCRIPTION

The Idaho National Engineering Laboratory (INEL) is a government facility managed by the U.S. Department of Energy (DOE) located 32 miles (mi) west of Idaho Falls, Idaho, and occupies 890 mi² of the northeastern portion of the Eastern Snake River Plain. The Radioactive Waste Management Complex (RWMC) is located in the southwestern portion of the INEL (Figure 1). The majority of the organic contamination associated with the Organic Contamination in the Vadose Zone (OCVZ) operable unit (OU) is within the subsurface of the area outlined in Figure 1, and the highest contaminant concentrations are found immediately beneath the Subsurface Disposal Area (SDA), an area with several disposal pits and trenches previously used for the disposal of organic wastes. The SDA is a 88-acre area located within the RWMC. The RWMC encompasses 144 acres (approximately 0.23 mi²) and consists of both the SDA and the Transuranic (TRU) Storage Area.

Current land use at the INEL is primarily nuclear research and development and waste management. Surrounding areas are managed by the Bureau of Land Management for multipurpose use. The developed area within the INEL is surrounded by a 500 mi² buffer zone used for cattle and sheep grazing.

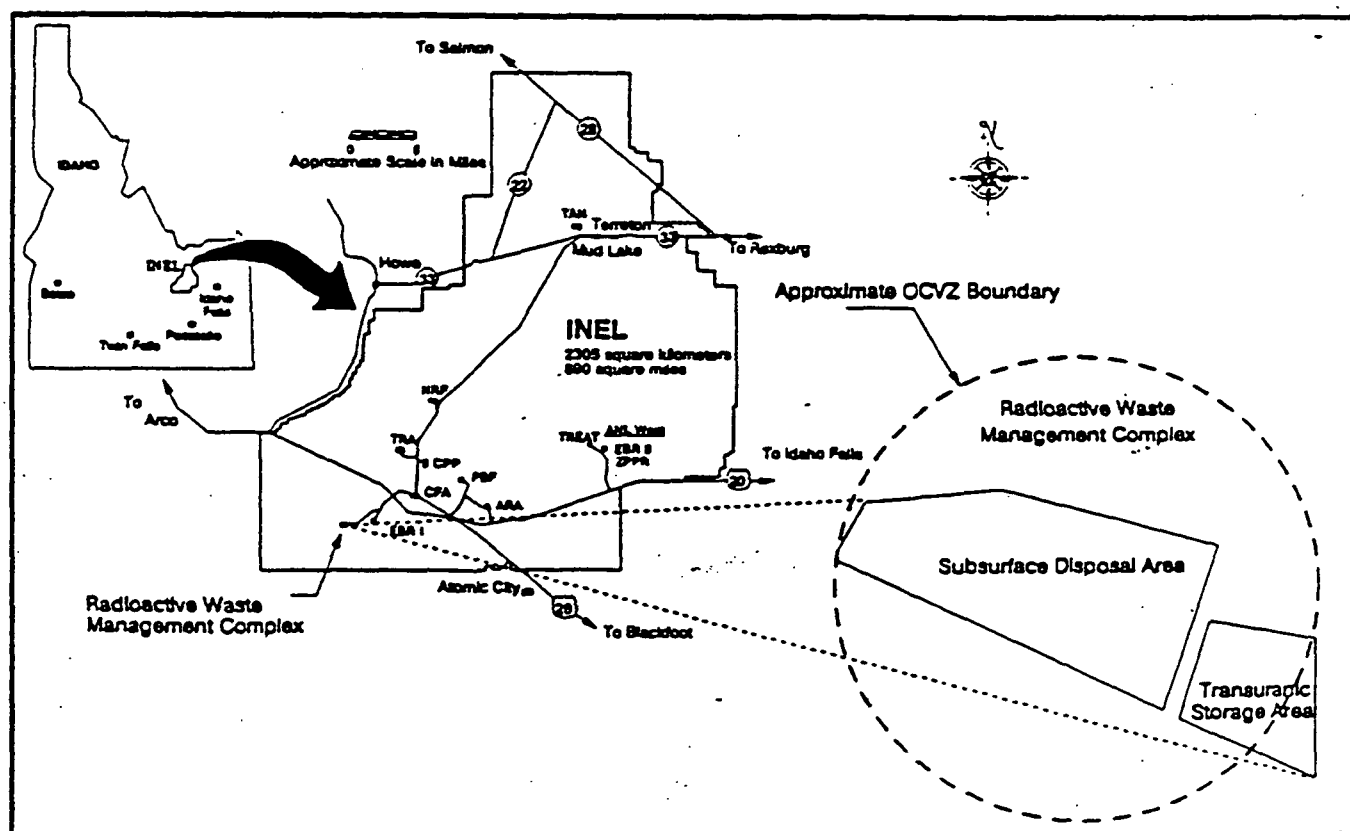


Figure 1. The Radioactive Waste Management Complex at the INEL.

Of the 11,700 people employed at the INEL, approximately 100 are located at the RWMC. The nearest off-site populations are in Atomic City (12 mi southeast of RWMC), Arco (16 mi northwest of RWMC), Howe (19 mi north of RWMC), Mud Lake (36 mi northeast of RWMC), and Terreton (37 mi northeast of RWMC).

The INEL property is located on the northeastern edge of the Eastern Snake River Plain, a volcanic plateau that is primarily composed of volcanic rocks and relatively minor amounts of sedimentary interbeds. The basalts immediately beneath the RWMC are relatively flat and covered by 20 to 30 feet (ft) of alluvium.

The depth to the Snake River Plain Aquifer (SRPA) underlying the INEL varies from 200 ft in the northern portion to 900 ft in the southern portion. The depth to the SRPA at the RWMC is about 580 ft. Flow of the aquifer in this region is generally to the south-southwest. Organic contaminants beneath the RWMC are currently migrating toward the aquifer. Some contaminants have already reached the aquifer, but they are at concentrations that are below Federal and state safe drinking water standards [i.e., Maximum Contaminant Levels (MCLs)]. Contaminants that reach the aquifer are carried by the flow of the groundwater in the southwest direction, potentially beyond the southern boundary of the INEL.

The INEL has semi-desert characteristics with hot summers and cold winters. Normal annual precipitation is 9.1 inches per year (in/yr), with estimated evapotranspiration of 6 to 9 in/yr. The only surface water present in the southern portion of the INEL is the Big Lost River, which is approximately 1.5 mi northwest of the RWMC; however, due to irrigation diversions upstream, this river is typically dry. Surface water is present at the RWMC only during and following periods of heavy rainfall and snowmelt, which generally occur in January through April.

To minimize the potential for surface water to flow onto the RWMC during periods of high surface water runoff at the INEL, water is diverted from the RWMC via spreading areas and associated dikes, located to the west and south of the RWMC. To further enhance surface water diversion from disposal pits and trenches, berms have also been constructed immediately around the SDA.

Twenty distinctive vegetative cover types have been identified at the INEL. Big sagebrush is the dominant species, covering approximately 80 percent of the ground surface. The variety of habitats on the INEL support numerous species of reptiles, birds, and mammals. Several bird species at the INEL warrant special concern because of sensitivity to disturbance or their threatened status include the ferruginous hawk (*Buteo regalis*), bald eagle (*Haliaeetus leucocephalus*), long-billed curlew (*Numenius americanus*), and the loggerhead shrike (*Lanius ludovicianus*). In addition, the Townsend's big-eared bat (*Plecotus townsendii*) and pygmy rabbit (*Brachylagus idahoensis*) are listed by the U.S. Fish and Wildlife Service as candidate species for consideration as threatened or endangered species. The ringneck snake, whose occurrence is considered to be INEL-wide, is listed by the Idaho Department of Fish and Game as a Category C sensitive species.

The OCVZ operable unit is defined as that part of the vadose zone beneath and within the immediate vicinity of the RWMC where there are organic contaminants in the vapor state. Their presence is a result of the burial at the SDA disposal pits of organic wastes from the Rocky Flats Plant in Colorado. OCVZ does not include the wastes remaining in the disposal pits

(i.e., contaminated solids, drums, etc.). It only includes those organic compounds that have migrated from the wastes. The organic compounds are primarily carbon tetrachloride, 1,1,1-trichloroethane, trichloroethylene, and tetrachloroethylene.

2. SITE HISTORY AND ENFORCEMENT ACTIVITIES

The RWMC was established in the early 1950s as a disposal site for solid, low level waste generated by INEL operations. Within the RWMC is the SDA, where hazardous substances, including radioactive wastes and organic wastes, have been disposed of in underground pits, trenches, soil vault rows, and Pad A—an aboveground pad. TRU waste was disposed of in the SDA from 1952 to 1970 and was received from the Rocky Flats Plant for disposal in the SDA from 1954 to 1970. The Rocky Flats Plant is a DOE-owned facility located west of Denver, Colorado. The Rocky Flats Plant is used primarily for the production of plutonium components for nuclear weapons. Also located at the RWMC is the Transuranic Storage Area (TSA), where interim storage of TRU waste occurs in containers on asphalt pads. The TSA accepted TRU waste from off-site generators for storage from 1970 through 1988. TRU waste generated at the INEL is still stored at the TSA.

Organic contaminants that are part of the OCVZ operable unit are present in the subsurface fractured basalt and sedimentary interbeds (i.e., the vadose zone) beneath and within the immediate vicinity of the RWMC, above the SRPA. The presence of organic contaminants in the vadose zone is a result of the burial, and breach, at the SDA of containerized organic wastes from the Rocky Flats Plant. From 1966 to 1970, approximately 88,400 gallons of organic wastes were mixed with calcium silicate to reduce free liquids and form a grease- or paste-like material prior to being placed in containers and sent to the INEL for disposal in several pits at the SDA. Pits 4, 5, 6, 9, and 10 have been identified as receiving the organic wastes. Also, Pit 2 received an unknown quantity of organic waste before 1966, and the acid pit may have received organic wastes during past operations. The locations of these pits are shown in Figure 2. Section 11 of this record of decision (ROD) provides additional information on the waste inventory at the disposal pits of the SDA.

A Consent Order and Compliance Agreement (COCA) was entered into between DOE and the U.S. Environmental Protection Agency (EPA) pursuant to the Resource Conservation and Recovery Act (RCRA) Section 3008(h) in August 1987. The COCA required DOE to conduct an initial assessment and screening of all solid waste and/or hazardous waste disposal units at the INEL, and set up a process for conducting any necessary corrective actions.

On July 14, 1989, the INEL was proposed for listing on the National Priorities List (NPL) [54 Federal Register (FR) 29820]. The listing was proposed by the EPA under the authorities granted EPA by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). The INEL was listed on the NPL on November 21, 1989 (54 FR 44184).

As a result of the INEL's listing on the NPL in November 1989, DOE, EPA, and the Idaho Department of Health and Welfare (IDHW) entered into a Federal Facility Agreement and Consent Order (FFA/CO) on December 9, 1991. Under the FFA/CO, OCVZ was identified for a Remedial Investigation/Feasibility Study (RI/FS). This ROD documents the results of the RI/FS and the remedy selected. The entire RWMC will be evaluated in the Waste Area Group (WAG) 7 Comprehensive RI/FS which is scheduled to begin no later than July 1996.

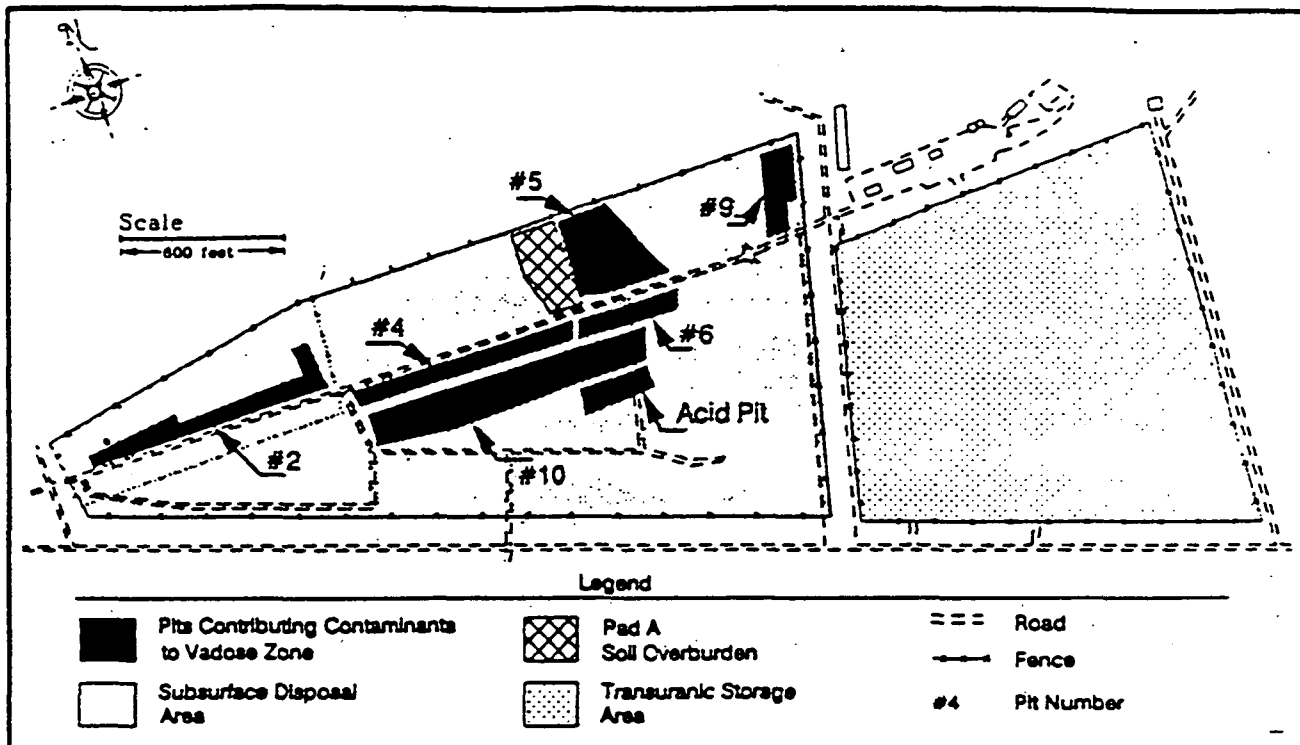


Figure 2. The RWMC with pits contributing organic contamination to the vadose zone.

3. HIGHLIGHTS OF COMMUNITY PARTICIPATION

In accordance with CERCLA § 113(k)(2)(B)(i-v) and 117, a series of opportunities for public information and participation in the remedial investigation and decision process for OCVZ were provided over the course of 29 months beginning in November 1991 and continuing through April 1994. For the public, the activities ranged from receiving a fact sheet that briefly discussed the OCVZ investigation to date, *INEL Reporter* articles and updates, and a proposed plan, to having a telephone briefing, four public scoping meetings, three public meetings, and two open houses to offer verbal or written comments during two separate 30-day public comment periods.

On November 19, 1991, a fact sheet concerning OCVZ was conveyed through a "Dear Citizen" letter to a mailing list of 5,600 individuals of the general public and 11,700 INEL employees in advance of the public scoping meetings scheduled on December 9, 10, 11, and 12, 1991. On November 20, the DOE issued a news release to more than 40 news media contacts concerning the beginning of a 30-day public scoping comment period, which ended January 3, 1992, on the OCVZ remedial investigation. Both the letter and release gave notice to the public that OCVZ documents would be available before the beginning of the comment period in the Administrative Record section of the INEL Information Repositories located in the INEL Technical Library of Idaho Falls, as well as in city libraries in Idaho Falls, Pocatello, Twin Falls, Boise, and Moscow. Display ads announcing the same information appeared in eight major Idaho newspapers. Large ads appeared in the following newspapers from November 22 to the 27: *Post Register* (Idaho Falls); *Idaho State Journal* (Pocatello); *South Idaho Press* (Burley); *Times News* (Twin Falls); *Idaho Statesman* (Boise); *Idaho Press Tribune* (Nampa); *Lewiston Morning Tribune* (Lewiston); and *Idahonian* (Moscow).

Similar display ads concerning upcoming meetings appeared in seven of these newspapers several days preceding each local meeting to encourage citizens to attend and provide verbal or written comments. All three media—the Dear Citizen letter, news release, and newspaper ads—gave public notice of four scoping meetings concerning the beginning of the investigation of OCVZ and the beginning of a 30-day public comment period that was to begin December 4, 1991. Additionally, two radio stations in Idaho Falls and newspapers in Idaho Falls and other communities repeated announcements from the news release to the public at large. A total of seven radio advertisements were made by local stations where meetings were scheduled several days before and the day of the meetings.

Personal phone calls concerning the availability of OCVZ documents and public meetings were made to individuals, environmental groups and organizations by INEL Outreach Office staff in Pocatello, Twin Falls, and Boise. The Community Relations Plan Coordinator made calls in Idaho Falls and Moscow.

Scoping meetings on OCVZ were held December 9, 10, 11, 12, 1991 in Boise, Moscow, Twin Falls, and Idaho Falls, respectively. An informal open house was held one hour prior to each of the meetings to allow the public to visit with State and Federal representatives about OCVZ. During these meetings, representatives from DOE and INEL discussed the project, answered both written and verbal questions, and received public comments. Written comment forms were distributed at the meetings. Comments from the scoping meetings were evaluated and considered as part of the RI/FS process.

Regular reports concerning the status of the OCVZ project were included in the *INEL Reporter* and mailed to those who attended the meetings and who were on the mailing list. Reports appeared in the March, May, July, and November 1992; and the January, March, and July 1993 issues of the *INEL Reporter*. During this time the number of individuals on the mailing list increased to 7,000. Individuals on the mailing list, those who attended the meetings, and all INEL employees received issues of the *INEL Reporter*.

Opportunities for public involvement in the decision process for OCVZ were provided beginning in March 1994. For the public, the activities ranged from receiving the proposed plan, conducting one teleconference call, and attending open houses and public meetings to informally discuss issues and offer verbal and written comments to the agencies during the 30-day public comment period.

On March 18, 1994, the Department of Energy Idaho Operations Office (DOE-ID) issued a news release to more than 40 news media contacts concerning the beginning of a 30-day public comment period on the OCVZ proposed plan. The release also gave notice to the public that OCVZ documents would be available before the beginning of the comment period in the Administrative Record section of the INEL Information Repositories located in the INEL Technical Library in Idaho Falls, the Shoshone-Bannock Library at Fort Hall, the University of Idaho Library in Moscow, the Idaho State Library in Boise; as well as city libraries in Idaho Falls, Pocatello, Twin Falls, Boise, and Moscow.

Copies of the proposed plan for OCVZ were mailed to 7,000 members of the public and 400 INEL employees on the INEL Community Relations Plan mailing list on March 28, 1994 urging citizens to comment on the plan and to attend public meetings. Display ads announcing the same

information and the location of open houses in Pocatello and Twin Falls, and public meetings in Idaho Falls, Boise, and Moscow appeared in seven major Idaho newspapers. Large ads appeared in the following newspapers from March 15 to 20: *Post Register* (Idaho Falls), *Idaho State Journal* (Pocatello), *South Idaho Press* (Burley), *Times News* (Twin Falls), *Idaho Statesman* (Boise), *Lewiston Morning Tribune* (Lewiston), and *The Daily News* (Moscow).

Similar display ads concerning upcoming meetings appeared in each of these newspapers several days preceding each local open house or meeting to encourage citizens to attend and provide verbal or written comments. Both media, the news release and newspaper ads, gave public notice of public involvement activities and offerings for briefings, and the beginning of a 30-day public comment period that was to begin March 31 and run through April 30, 1994. Additionally, radio stations in Idaho Falls, Blackfoot, Pocatello, Burley, and Twin Falls ran advertisements during the three days prior to the open houses in Pocatello and Twin Falls.

The open houses were held in Pocatello and Twin Falls on April 12 and April 14, respectively, and the public meetings were held in Idaho Falls, Boise, and Moscow on April 18, 20, and 21, 1993, respectively. Written comment forms, including a postage-paid business reply form, were made available to those attending the meetings. The forms were used to turn in written comments at the meeting, and by some, to mail in comments later. The reverse side of the meeting agenda contained a form for the public to evaluate the effectiveness of the meetings. A court reporter was present at each meeting to keep a verbatim transcript of discussions and public comments. The meeting transcripts were placed in the Administrative Record section for OCVZ, OU 7-08, in eight INEL Information Repositories.

On April 13, 1994, a teleconference call between the League of Woman Voters of Moscow and the Environmental Defense Institute, DOE-ID, EPA, and the IDHW concerning INEL environmental restoration issues was conducted at the request of Moscow area residents. The call consisted of an overview of the proposed plan, questions and answers, and general discussion of OCVZ issues.

Personal phone calls concerning the availability of the proposed plan and the public meetings were made to individuals, environmental groups, and organizations by INEL Community Relations Plan staff in Idaho Falls and Boise. Outreach Office staff made calls to citizens in northern, southwestern, and southeastern Idaho.

Another series of ads were placed in the same local papers several days before the public meetings to encourage citizens to attend and comment on the plan. Additionally, a special feature article in the July issue of the *INEL Reporter* was mailed to individuals on the INEL Community Relations Plan mailing list as a reminder of the meetings and the opportunity to comment on the proposed plan.

A Responsiveness Summary has been prepared as part of the ROD. All formal verbal comments, as given at the public meetings, and all written comments, as submitted, are repeated verbatim in the Administrative Record for the ROD. Those comments are annotated to indicate which response in the Responsiveness Summary addresses each comment.

A total of about 83 people attended the OCVZ public meetings. Overall, 27 provided formal comments; of these 27 people, 12 people provided oral comments and 15 people provided written comments. DOE further divided the oral and written comments into 91 separate comments. All comments received on the proposed plan were considered during the development of this ROD. The decision for this action is based on the information in the Administrative Record for this OU.

4. SCOPE AND ROLE OF OPERABLE UNIT AND RESPONSE ACTION

Under the FFA/CO, the INEL is divided into 10 WAGs. The WAGs are further divided into OUs. The RWMC has been designated WAG 7 and consists of 14 OUs. Data from shipping records, along with process knowledge, written correspondence, and existing monitoring data, were available to allow OCVZ, OU 7-08, to be evaluated in an expeditious manner. OCVZ consists of the organic contaminants present in the vadose zone beneath and within the immediate vicinity of the RWMC, but does not include the waste materials disposed of in the pits of the SDA. Potentially, organic wastes remaining in the pits could impact alternatives considered for remediation of the vadose zone. However, given the current level of information available on the organic wastes present within the pits, it is impossible to predict with any certainty whether these wastes will impact remediation at all.

A complete evaluation of all cumulative risks associated with CERCLA actions at WAG 7 will be conducted as part of the WAG 7 Comprehensive RI/FS (OU 7-14) to ensure all risks have been adequately evaluated. Conducting a remedial action at OCVZ is part of the overall WAG strategy and is expected to be consistent with any planned future actions.

5. SUMMARY OF SITE CHARACTERISTICS

The following sections provide a summary of the physical characteristics of the site as well as a summary of the contaminants present in various media at the site. Much information on the characteristics of the vadose zone (including contaminant behavior in the vadose zone) was obtained during a treatability study using vapor vacuum extraction (VVE); therefore, a summary of the treatability study is included as Section 5.3.

5.1 Geology and Hydrology

The INEL is located along the northern edge of the Eastern Snake River Plain, a 50- to 70-mi wide northeastern trending geologic basin extending from the vicinity of Twin Falls on the southwest part of the plain to the Yellowstone Plateau on the northeast. The Eastern Snake River Plain is underlain by a substantial volume of volcanic rocks with relatively minor amounts of sediment, except along its margins where drainages emerge from the nearby mountain ranges.

The RWMC is underlain by a thick sequence of basaltic lava flows interbedded with thin layers of sediments termed "interbeds." A layer of surficial sediments ranging from 0 to 22 ft thick directly underlies the RWMC. It is within these sediments that the organic wastes were buried at the RWMC. The basalts range from highly fractured and vesicular along the margins of the flows to more dense and less fractured in the interior portions of the flows. The interbeds consist of silt, sand, clay, and fine gravel and are generally less permeable than the fractured basalt.

The RWMC is located in the Pioneer Basin, a topographically closed basin which includes most of the INEL. The Pioneer Basin receives intermittent surface water flow from three drainages that flow onto the INEL from the northwest: The Big Lost River, Little Lost River, and Birch Creek. These drainages usually only flow onto the INEL following wet winters. Precipitation at the INEL averages only 9.1 in (approximately 23 centimeters) per year, but the mountain ranges in the upper reaches of The Big Lost and Little Lost River Basins to the north and west of INEL receive up to 50 in (approximately 125 centimeters) of precipitation per year. Annual average infiltration rates at the RWMC are on the order of a few centimeters per year.

During periods of high runoff in the Big Lost River, water is diverted from the river to spreading basins located to the west of the RWMC. Except for a few hours in the Spring of 1993, water has not been diverted to the spreading areas since 1985. The SDA has flooded three times (1962, 1969, and 1982) prior to completion of the extensive dike system surrounding the SDA. Flooding was a result of local runoff from rain or rapidly melting snow in the spring. Because the SDA is located in a basin, water entered the SDA on each occasion and flooded some pits and trenches. Each of these flooding events may have resulted in recharge to perched water zones and to the SRPA.

The SRPA is present beneath the RWMC at a depth of about 580 ft and, as in the vadose zone, consists of a series of basalt flows with interbedded sedimentary deposits. The EPA designated the SRPA a sole source aquifer under the Safe Drinking Water Act on October 7, 1991 (194 FR 50634). The aquifer is relatively permeable due to the presence of fractures, fissures, and voids such as lava tubes within the basalt. Groundwater flow in the SRPA is to the south-southwest at rates on the order of 5 to 20 ft/day. Infiltration of surface water from the spreading basins to the aquifer has in the past temporarily changed the local gradient beneath the SRPA to the east.

Perched water has been detected in 7 of 45 groundwater monitoring wells drilled at the RWMC. Perched water occurs where infiltrating water accumulates above relatively less permeable zones in the subsurface such as the sedimentary interbeds. Limited zones of perched water have been identified above interbeds located at both 110 and 240 ft. The perched water bodies appear to be laterally discontinuous and are generally only a few feet thick. As such, they are not a viable source of water in the site area.

5.2 Nature and Extent of Contamination

The presence of organic contaminants in the vadose zone is a result of the burial, and presumed breach, at the SDA of containerized organic wastes from the Rocky Flats Plant in Colorado. According to Kudera (*Estimate of Rocky Flats Plant Organic Wastes Shipped to the RWMC*, internal note, EG&G Idaho, Inc., July 24, 1987), from 1966 to 1970, approximately 88,400 gallons of containerized organic wastes were disposed of in the SDA. The organic wastes were mixed with calcium silicate to reduce free liquids and form a grease- or paste-like material which was usually double-bagged and placed in drums prior to disposal in several pits at the SDA. In addition, small amounts of absorbent, such as Oil-Dri, were normally mixed with the waste to bind free liquids. The organic wastes consisted of lathe coolant (Texaco Regal Oil and carbon tetrachloride), used oils, and degreasing agents (i.e., chlorinated hydrocarbons) such as 1,1,1-trichloroethane, trichloroethylene, and tetrachloroethylene. Hereinafter, carbon tetrachloride, 1,1,1-trichloroethane, trichloroethylene, and

tetrachloroethylene will be referred to using their common abbreviations of CCl_4 , 1,1,1-TCA, TCE, and PCE, respectively. Specific components of the organic wastes were estimated by Kudera to include 24,000 gallons of CCl_4 and 25,000 gallons of other chlorinated hydrocarbons. The balance of the 88,400 gallons was primarily Texaco Regal Oil. Pits 2, 4, 5, 6, 9, and 10 have been identified as receiving the organic wastes, and the acid pit may have received organic wastes. These pits, shown in Figure 2, are suspected of being the source of organic contamination in the vadose zone. Section 11 of this record of decision (ROD) provides additional information on the waste inventory at the disposal pits of the SDA.

CCl_4 , 1,1,1-TCA, and PCE are considered spent solvents, meeting the definition under IDAPA § 16.01.050.05 (40 CFR 261.31). However, the spent solvents were disposed of in the pits at INEL prior to the promulgation of the RCRA regulations in 1980. The RCRA regulations are relevant and appropriate to these spent solvent wastes according to the criteria of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) regulations.

Sampling conducted for the remedial investigation (RI) has documented that volatile organic compounds (VOCs) have migrated from the disposal pits into the vadose zone. In the vadose zone, VOCs are migrating both vertically (primarily downward) and laterally away from the disposal pits. Vertical migration of contaminants occurs both by vapor diffusion and infiltration of moisture through the vadose zone. Lateral migration occurs primarily by diffusion of VOC vapors. VOCs have been detected in soil vapor, surficial soils, perched water, and in the SRPA. The occurrence of VOCs in each of these media is discussed in the following paragraphs.

Shallow Soil Vapor

VOC concentrations in shallow soil vapor were evaluated through soil-gas surveys and gas chromatography conducted in 1987 and 1992. Soil vapor samples were collected through a vapor probe driven 30 in into surficial soil. In general, both surveys yielded the highest VOC concentrations in the vicinity of the pits known to contain organic waste. Of the VOCs analyzed, CCl_4 concentrations were highest in both surveys. The results of the 1992 shallow soil-gas survey are plotted for CCl_4 on Figure 3. Elevated concentrations of CCl_4 were detected above several of the pits including Pits 2, 4, 6, 9, and 10. These results document that VOCs have migrated in the vapor phase from the source pits into shallow soils at the SDA.

The rate at which VOC vapors are being emitted from the shallow soils to the atmosphere was measured using a surface flux chamber at 12 locations at the SDA. Detectable concentrations of one or more VOCs were measured by gas chromatography at 11 of the 12 flux chamber test locations. CCl_4 was the target compound measured most frequently and at the highest concentrations. The highest calculated emission rate, 38 micrograms per square meter per minute ($\mu\text{g}/\text{m}^2/\text{min}$), occurred at a location near Pit 6. TCE and chloroform were the compounds with the next highest emission rates (up to 6.6 and 4.3 $\mu\text{g}/\text{m}^2/\text{min}$, respectively). Although there are no records indicating chloroform was one of the organic wastes placed in the disposal pits, its presence was confirmed during field investigations. Clarification on the presence of chloroform can be found in this ROD in Section 6.1.1, Identification of Contaminants of Concern. Acetone and PCE had calculated emission rates up to 3.7 and 3.1 $\mu\text{g}/\text{m}^2/\text{min}$, respectively, while none of the other compounds had emission rates above 2 $\mu\text{g}/\text{m}^2/\text{min}$.

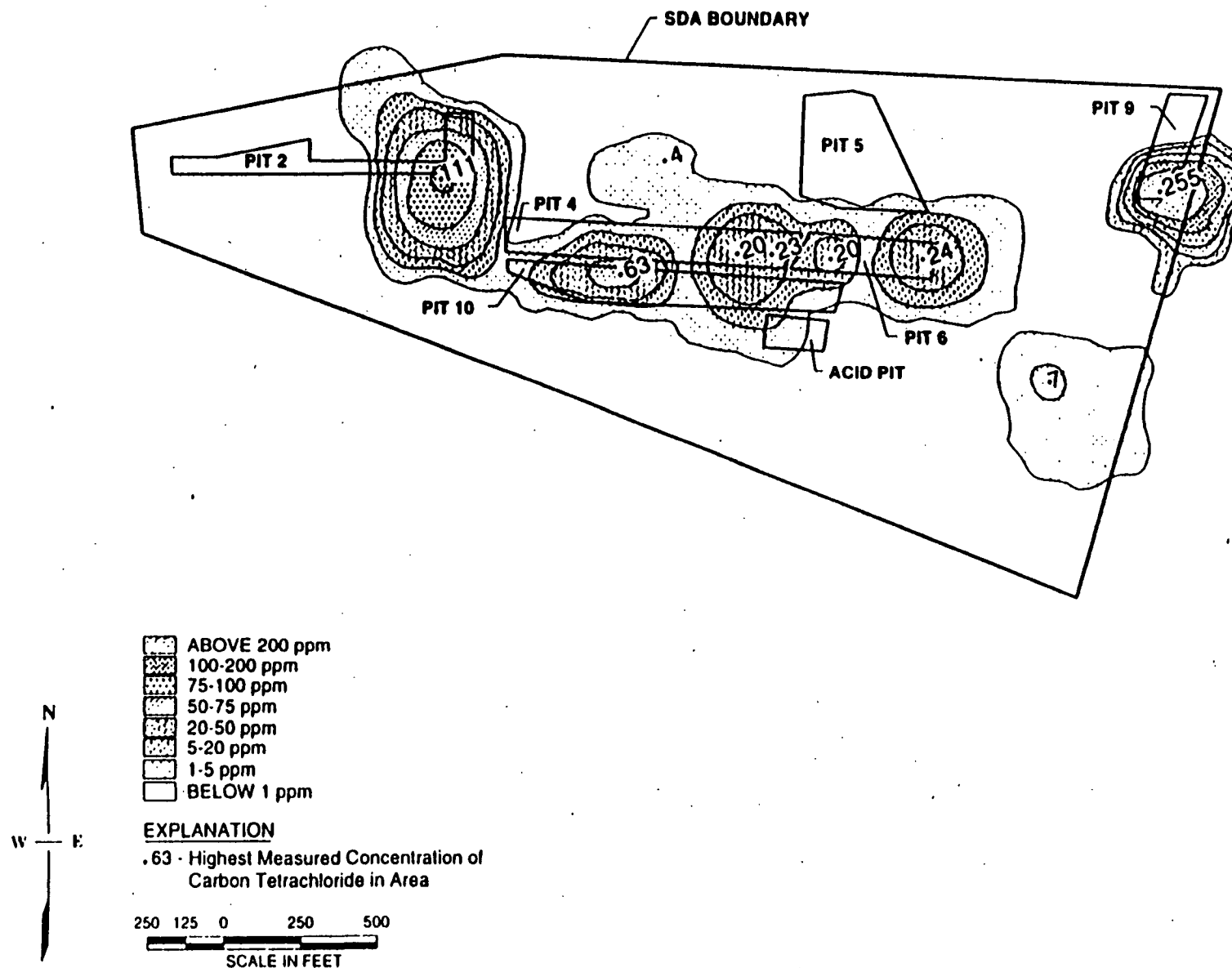


Figure 3. CCl_4 concentrations in shallow soil vapor at the SDA (1992).

Shallow Soils

Shallow borings drilled in 1990 around the perimeter of Pit 9 and the Acid Pit were sampled from depths ranging from 0-2 ft to 23 ft. Over 40 samples were analyzed for VOCs. Sampling results indicated that with a few exceptions, all of the positively identified VOC concentrations were at depths of 8 to 23 ft, indicating that VOCs are generally present in the lower portions of the surficial sediments. None of the VOC concentrations exceeded 40 micrograms/kilogram ($\mu\text{g/kg}$) and all reported concentrations were well below risk-based screening levels.

Vadose Zone Vapor

A total of 19 vapor port monitoring wells were used to evaluate the extent and concentration of VOC vapors in the vadose zone. These wells are shown on Figure 4. Samples were collected between July 1992 and March 1993 and analyzed at the Site by a portable Sentex Scentograph Gas Chromatograph Unit. The Sentex was calibrated to detect three VOCs: CCl_4 , TCE, and chloroform. Approximately 10% of the samples collected between July and September 1992 were submitted to the Environmental Chemistry Unit (ECU) laboratory at the Central Facilities Area for analysis of a more complete suite of organic compounds using a modified EPA TO-14 method. These results are summarized in Table 1.

The ECU data provide a means of comparing CCl_4 concentrations with concentrations of less prevalent VOCs. CCl_4 concentrations are generally one order of magnitude higher than TCE, chloroform, and 1,1,1-TCA concentrations. Concentrations of PCE, toluene, 1,1,2-trichloro-1,2,2-trifluoroethane, and acetone are generally two orders of magnitude less than CCl_4 concentrations. These data indicate that CCl_4 is the VOC with the highest concentrations in vadose zone vapor. CCl_4 concentrations are highest in vapor port monitoring wells located inside the SDA (8801, 8902, and D02), which are located in the central portion of the SDA around Pits 4, 5, 6, and 10.

Mean CCl_4 data from 1992 samples are plotted on cross section A-A' (Figure 5). Cross section A-A' is identified on Figure 4. The cross section illustrates that concentrations decrease laterally from the area beneath the source pits and decrease substantially with depth below the 240-foot interbed. The 240-foot interbed appears to provide a layer which impedes or delays downward vapor migration, based on VOC concentration in the deeper vapor port monitoring wells located outside the SDA. The 110-foot interbed also appears to provide a barrier, especially in the central portion of the SDA such as at Well 8801. In this area where higher VOC concentrations are present, concentrations decrease significantly below the 110-foot interbed. No vapor ports have been completed below the 240-foot interbed within the SDA so it is not possible to evaluate the VOC concentrations below the 240-foot interbed directly beneath the source pits.

Data from the new vapor port monitoring wells indicate that CCl_4 has migrated in the vapor phase laterally as far as 3,000 ft beyond the SDA boundary. However, CCl_4 concentrations in wells located greater than 500 to 1,000 ft from the SDA boundary are three to four orders of magnitude less than concentrations in the immediate source areas.

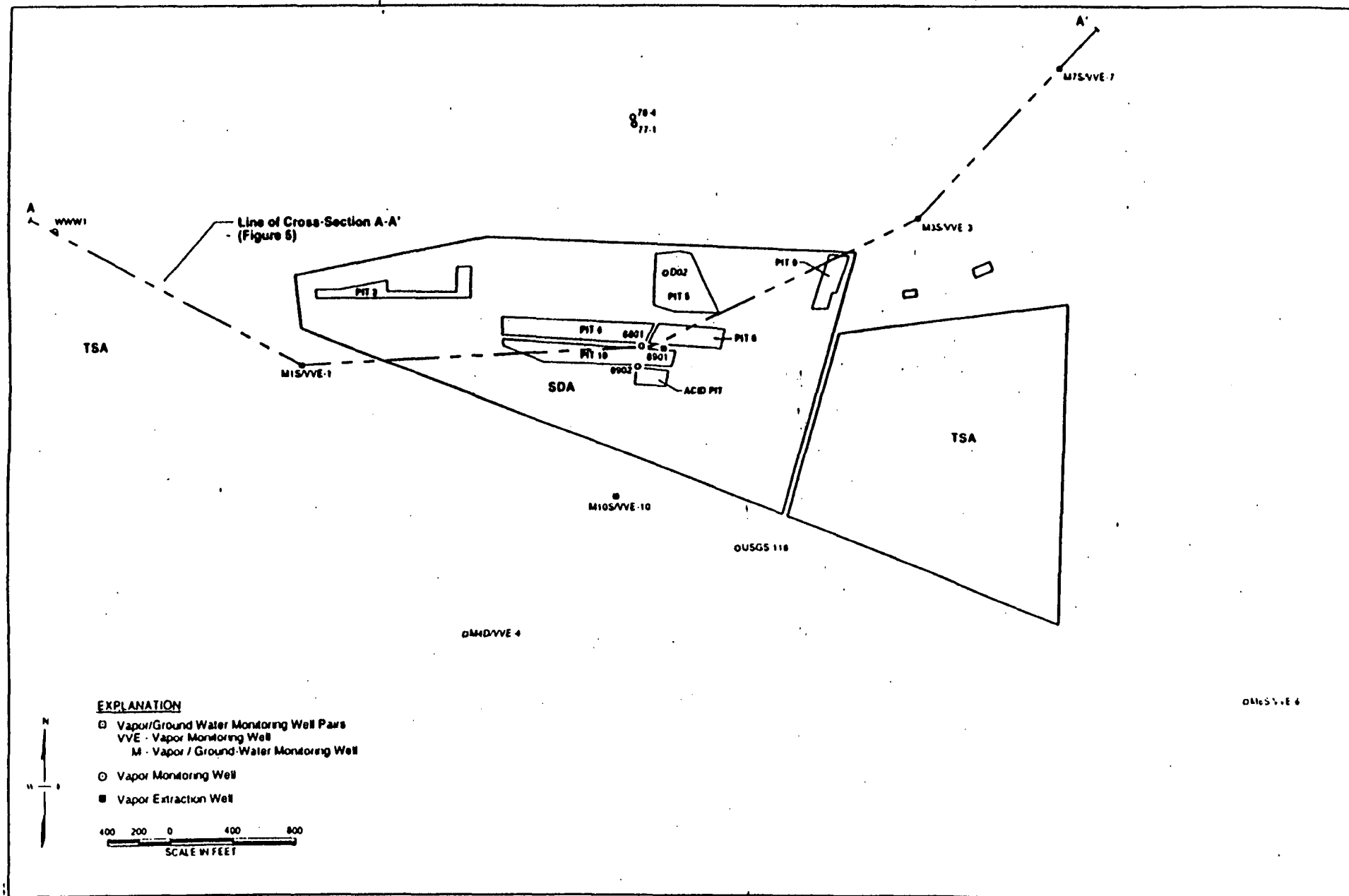


Figure 4. Vapor monitoring well locations at the RWMC.

Table 1. VOC concentrations in monitoring well vapor ports (ECU data).

Compound#	Port#	VVE-1		VVE-3		VVE-4		VVE-6	VVE-7		VVE-10	
		P1	P2	P2	P3	P2	P3	P3	P2	P3	P2	P3
		Depth (ft)#	189	127	155	92	145	75	108	133	77	138
CCl ₄		23	32	23	16	11	14	1.8	0.84 J	2.0	12	26
Chloroform		1.4	2.1	1.9	1.5	1.2	1.8	0.16 J	.080 J	0.13 J	0.63 J	4.0
PCE		0.67 J	1.0	0.55 J	0.45 J	0.39 J	0.39 J	<0.12	.043 J	.070 J	0.36 J	<0.49
Toluene		0.17 J	<0.37	<0.20	<0.14	0.28 J	2.5	<0.11	<.032	.046 J	<0.1	<0.45
1,1,1-TCA		1.8	2.1	1.6	1.3	0.76 J	1.1	0.27 J	0.13 J	0.22 J	1.1	2.1
TCE		3.8	6.2	3.8	3.2	2.6	3.1	0.46 J	0.24 J	0.38 J	2.3	4.8
1,1,2-trichloro- 1,2,2-trifluoro- ethane		0.73	0.67 J	0.50 J	0.44 J	0.19 J	0.60 J	0.13 J	.043 J	.045 J	0.33 J	1.3
Acetone		0.82	<1.2	0.80 J	<0.45	0.27 J	<0.34	0.34 J	<0.10	0.14 J	0.58 J	<1.4
Compound#	Port#	M1S		M3S		M4D	M6S	M7S	M10S			
		P1	P3	P1	P2	P1	P1	P1	P3			
		Depth (ft)#	566	319	559	505	555	588	547	357		
CCl ₄		0.36 J	0.16 J	0.83 J	1.8	0.69 J	1.3	0.81 J	2.3			
Chloroform		.064 J	.034 J	.078 J	0.11 J	.086 J	.073 J	.049 J	0.11 J			
PCE		.018 J	<.014	.038 J	.053 J	.030 J	.042 J	.038 J	0.34 J			
Toluene		.023J	<.013	.028 J	.013	0.27 J	0.93 J	.064 J	.090 J			
1,1,1-TCA		.029 J	.022 J	.066 J	0.21 J	.050 J	0.15 J	0.11 J	0.22 J			
TCE		0.14 J	.072 J	0.22 J	0.39 J	0.14 J	0.20 J	0.17 J	0.23 J			
1,1,2-trichloro- 1,2,2-trifluoroethane		<.014	<.014	.018 J	.033 J	.029 J	.045 J	.033 J	0.13 J			
Acetone		0.39 J	.062 J	<0.73	0.12 J	<.084	.087 J	0.21 J	.088 J			

Table 1. (continued).

Compound	Port	WWI		8801	8902		D02	
		P1	P3	P4	P6	P6	P2	P2
	Depth (ft)	240	135	78	71	71	60	60
CCl ₄		6.3	18	3000	1200	2500	1200	1300
Chloroform		0.93 J	1.3	640	190	470	190	190
PCE		0.16 J	0.65 J	<29	18	<22	18	18
Toluene		<.058	<0.25	<27	<11	<20	<11	<14
1,1,1-TCA		0.36 J	1.4	110	54	88	54	54
TCE		1.6	4.0	480	190	360	190	200
1,1,2-trichloro- 1,2,2-trifluoroethane		0.24 J	0.56 J	<28	14	21	14	<15
Acetone		0.64 J	<0.80	<83	<36	<163	<36	<44

Note: Port numbers are preceded by a P. All concentrations are in parts per million volume (ppmv). 8902, and D02 have duplicate data for the same port numbers; both are shown here. J indicates that value is estimated below the contract required quantitation limit. A less than symbol (<) indicates that the sample contained less than the noted detection limit.

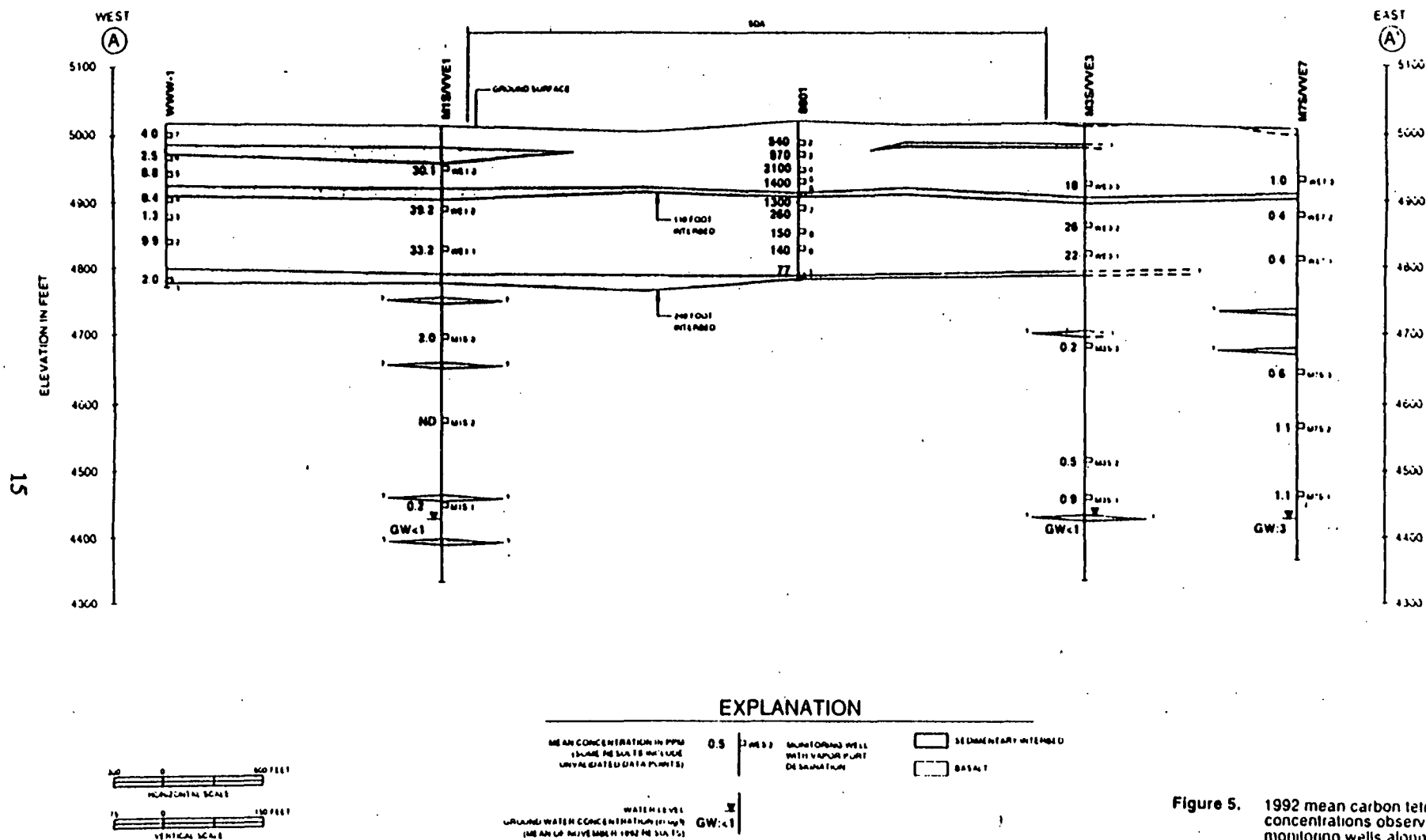


Figure 5. 1992 mean carbon tetrachloride concentrations observed in vapor port monitoring wells along cross-section A-A'.

Figure 5. Mean CCl_4 subsurface vapor concentrations along cross-section A-A'.

Perched Water

Prior to 1992, perched water had been detected in seven wells or boreholes (Figure 6). Wells known to contain perched water were sampled in 1992. Only three wells, 77-2, USGS 92, and D10, yielded enough water for samples. Results of analyses on these samples for VOCs are summarized in Table 2. The highest VOC concentrations in perched water samples were detected in Well USGS 92. CCl_4 , TCE, chloroform, and PCE were the VOCs with the highest concentrations within this well. The concentrations of these VOCs in Wells 8802D and D10 were an order of magnitude less than the concentrations found in USGS 92. The CCl_4 and TCE concentrations in all of the perched water samples exceed their respective MCLs; however, perched water is not used for any purpose in the RWMC area and is too limited in both vertical and lateral extent to provide a dependable source of water.

Groundwater

The results of sampling and analysis of groundwater in the SRPA from both USGS and new "M" series wells are illustrated on Figure 7. While no significant VOC contamination was present in monitoring wells upgradient of the SDA, VOCs were detected in all eight USGS wells and all six new "M" series monitoring wells located in the immediate vicinity of the SDA.

The most widely detected VOCs in USGS wells near the SDA were CCl_4 and TCE. The compounds detected in decreasing order of maximum historically detected concentrations are: CCl_4 [6.6 micrograms per liter ($\mu\text{g/l}$)], dichlorodifluoromethane (2.4 $\mu\text{g/l}$), TCE (1.4 $\mu\text{g/l}$), toluene (1.2 $\mu\text{g/l}$), chloroform (1.0 $\mu\text{g/l}$), and 1,1,1-TCA (0.9 $\mu\text{g/l}$). Only the CCl_4 concentration of 6.6 $\mu\text{g/l}$ in Well USGS 88 was above its MCL of 5 $\mu\text{g/l}$. This sample was collected in 1987; all subsequent samples from this well have contained less than 5 $\mu\text{g/l}$. All other results for VOCs from samples collected in USGS wells have been below MCLs.

New monitoring Wells M1S, M3S, M4D, M6S, M7S, and M10S (Figure 7) were sampled and analyzed for VOCs three times between October 1992 and May 1993. Mean VOC concentrations in these new wells are listed in Table 3. Toluene had the highest mean concentrations of any of the VOCs in the new wells. Mean toluene concentrations ranged from not detected in Wells M3S and M6S to 1.0 $\mu\text{g/l}$ in Wells M1S and M7S, 5.4 $\mu\text{g/l}$ in Well M10S and 10.8 $\mu\text{g/l}$ in Well M4D. CCl_4 concentrations of 1.7 and 3.3 $\mu\text{g/l}$ were detected in Wells M6S and M7S, respectively. TCE was detected at a mean concentration of 2.0 $\mu\text{g/l}$ in Well M7S. Methylene chloride was detected at a concentration of 2.3 $\mu\text{g/l}$ in Well M1S. None of the detected concentrations in the new groundwater monitoring wells exceeded MCLs.

5.3 Results of VVE Treatability Studies

To provide information on the viability of vapor vacuum extraction (VVE) as a remedial process for the OCVZ, a treatability study was conducted at the SDA in 1993. The treatability study used a pilot-scale VVE system consisting of a vapor extraction well (8901D), a vacuum pump, and a vapor treatment system. Two carbon bed adsorbers placed in series were used to remove the VOCs from the extracted air. In addition to providing performance information on VVE, the treatability study yielded information on the characteristics of the vadose zone. This information is noted below.

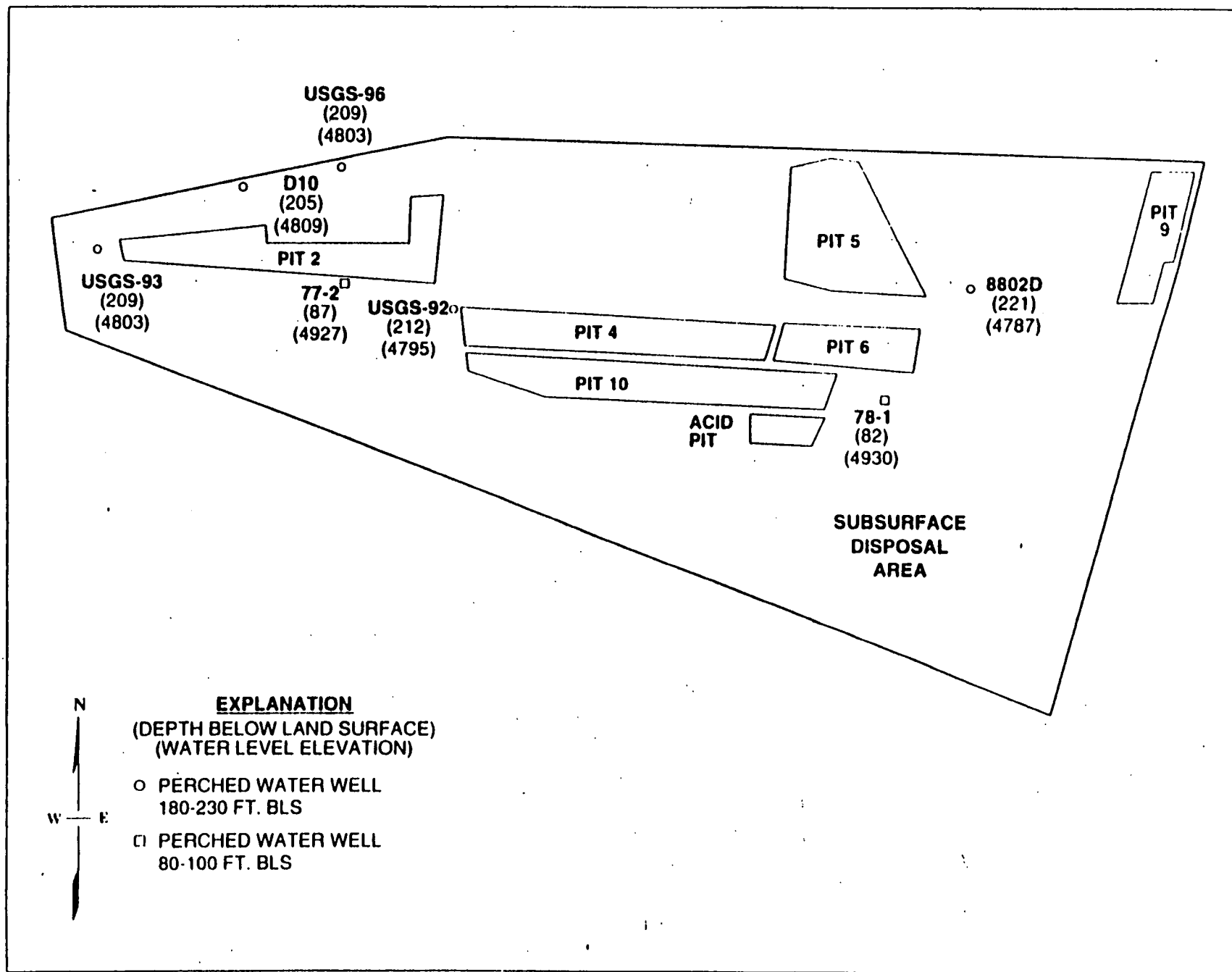


Figure 6. Location of wells that have contained perched water at the SDA.

Table 2. Concentrations of validated data for VOCs in perched water ($\mu\text{g/l}$ or ppb).

Parameter	Wells				
	USGS 92	8802D	D10 ^b	D10	Trip blank
Methylene chloride	<100	<10	ND	ND	1
1,1-dichloroethane	<100	<10	<1	0.3J	<1
Chloroform (100) ^a	1,500	ND	ND	ND	34
1,1,1-TCA (200) ^a	<100	15	3	3	<1
CCl ₄ (5) ^a	2100	190	18	21	0.4J
1,1-dichloropropane	<100	<10	<1	<1	<1
TCE (5) ^a	1600	150	13	15	<1
1,2-dichloropropane	<100	<10	1	1	<1
Bromodichloromethane	<100	<10	<1	<1	3
Toluene (1000) ^a	<100	3J	0.6J	0.7J	<1
PCE (5) ^a	230	13	4	5	<1
Dibromochloromethane	<100	<10	<1	<1	0.6J
Ethylbenzene	<100	<10	0.5J	0.7J	<1
p&m-Xylene	<100	<10	2	2	<1
Styrene	9J	<10	<1	<1	<1
1,2,4-trimethylbenzene	<100	<10	0.2J	0.2J	<1
1,2,4-trichlorobenzene	<100	<10	ND	<1	0.2
Hexachlorobutadiene	ND	<10	<1	<1	1
Napthalene	<100	<10	ND	0.3BJ	0.4
1,2,3-trichlorobenzene	<100	<10	<1	<1	<1

a. EPA Primary Drinking Water Standard 40 CR 141.61, $\mu\text{g/l}$ or ppb.

b. Duplicate analysis conducted on sample from D10.

B = Compound was also detected in a blank

J = Estimated value below contract required quantitation limit

ND = Not detected, compound detected at higher levels in a blank.

Figure 7. Summary of groundwater analyses for samples taken from the SRPA near SDA.

Table 3. Mean VOC concentrations in new groundwater monitoring wells (µg/l or ppb).

VOCs	MCL	Detection limit	Wells					
			M1S	M3S	M4D	M6S	M7S	M10S
Methylene chloride	—	1	23	ND	ND	ND	ND	ND
Chloroform	100	1	ND	ND	ND	ND	ND	ND
1,1,1-TCA	200	1	ND	ND	ND	ND	ND	ND
CCl ₄	5	1	ND	ND	ND	1.7	3.3	ND
TCE	5	1	ND	ND	ND	ND	2.0	ND
Bromo-dichloromethane	100	1	ND	ND	ND	ND	ND	ND
Toluene	1,000	1	1.0	ND	10.8	ND	1.0	5.4
PCE	5	1	ND	ND	ND	ND	ND	ND
1,2-dichloroethane	—	1	ND	ND	ND	ND	ND	ND

Note: Mean concentrations calculated by taking the mean of the mean concentrations for each of the three quarters of monitoring data. Mean concentrations below the detection limit of 1 µg/l reported as not detected.

ND = Not Detected.

Several tests were conducted during the 1993 treatability study to optimize VVE performance and to evaluate hydraulic characteristics of the vadose zone. During extraction well testing, a straddle packer was used to isolate various intervals to define zones of high permeability that could sustain high flowrates. These tests showed that a zone adjacent to the 110-ft interbed had the highest calculated permeability (15 darcies) and, therefore, the highest sustainable pumping rate. Extraction rate tests, in conjunction with vertical permeability study results, indicate that horizontal permeability varies considerably, ranging from less than 0.01 to 15 darcies, while vertical permeability ranges from 0.5 to 4 darcies.

When the treatability study began in April 1993, the total VOC concentration was approximately 1,000 parts per million volume (ppmv) in the extraction stream at a flowrate of about 170 cubic feet per minute (cfm). By June 3, 1993, the total VOC concentration dropped to 300 to 500 ppmv at the same flowrate. From June 3 to July 20, the system was not operated due to the need to replace spent carbon beds. After carbon bed replacement, the system was restarted on July 21 and the total VOC concentration had rebounded to approximately 600 ppmv in the extraction stream. The total VOC concentration stabilized and remained between 400 and 500 ppmv for the remainder of the treatability study. The 1993 treatability study operation recovered approximately 1,340 kg (2,900 lbs) of VOCs.

Long-term VVE testing showed that continued operation of the VVE system influenced VOC concentrations in vapor monitoring wells as far away as 450 ft from the extraction well. Concentrations in nearby vapor monitoring wells showed the greatest decreases in the 110-ft interbed but also decreased above and below the 110-ft interbed.

VOCs extracted during the treatability study were captured effectively from extracted vapor using carbon adsorption beds. These beds were shipped to an approved facility in Texas for final disposal at the completion of the treatability study.

6. SUMMARY OF SITE RISKS

The human health risk assessment for OCVZ evaluated both present and future potential exposures to contaminants. The risk assessments were conducted in accordance with the EPA *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual* and *Volume II: Environmental Assessment Manual* and other EPA guidance. The risk assessment methods and results are summarized in the following sections.

6.1 Human Health Risks

The risk assessment consisted of contaminant identification, exposure assessment, toxicity assessment, and human health risk characterization. The organic contaminants identified for OCVZ were based on existing inventory records and site characterization data. The exposure assessment detailed the exposure pathways that exist at the site for workers, off-site residents and potential future on-site residents. The toxicity assessment documented the adverse effects that may be caused in an individual as a result of exposure to a contaminant associated with OCVZ.

The human health risk assessment evaluated current and future potential noncarcinogenic health effects and carcinogenic risks associated with exposure to organic contaminants identified in the waste inventory. The human health evaluation used both the exposure concentrations and the toxicity data to determine a hazard index for potential noncarcinogenic effects and an excess cancer risk level for potential carcinogenic contaminants. In general, when a hazard index exceeds one, there may be a concern for potential noncarcinogenic health effects. The excess cancer risk level is the increase in the probability of contracting cancer. The NCP acceptable risk range is 1 in 10,000 to 1 in 1,000,000 (i.e., 1×10^{-4} to 1×10^{-6}). An excess lifetime cancer risk of 1 in 10,000 indicates that an individual has up to one chance in ten thousand of developing cancer over a lifetime of exposure to a site-related contaminant.

6.1.1 Identification of Contaminants of Concern

Organic contaminants of concern (COCs) evaluated in the baseline risk assessment were selected based on historical waste records and on the nature and extent of these contaminants in vadose zone media. The COCs selected for OCVZ are CCl_4 , PCE, TCE, and 1,1,1-TCA. These compounds have been identified as known waste constituents.

Chloroform was not identified in the waste history for the SDA; however, it was detected in site monitoring samples. Investigations pertaining to this contaminant indicate that the chloroform may

have two sources, both of which are difficult to quantify. Dose reconstruction activities for the Rocky Flats Plant in Colorado have identified chloroform usage associated with weapons component production; however, the presence of chloroform in the INEL waste is not documented. Chloroform may also have resulted from anaerobic degradation of CCl_4 , a known contaminant at the SDA. Therefore, chloroform may have either been initially present in the waste as a source term (but not reported), or it may have been produced by degradation of CCl_4 . Since estimates from these potential sources have not been quantified, it is impossible to quantitatively evaluate the risk to human receptors from the migration of chloroform. Similarly, no data are available which document the presence of acetone or toluene in the waste. As such, chloroform, acetone, and toluene were not identified as COCs. The uncertainty associated with not including these contaminants in the risk assessment is discussed in Section 6.1.5.

6.1.2 Exposure Assessment

An exposure assessment was performed to estimate the magnitude, frequency, duration, and routes of human exposure to the organic contaminants present in the vadose zone.

Exposed Populations

Only exposure pathways deemed to be complete (i.e., where a plausible route of exposure can be demonstrated from the site to an individual) were quantitatively evaluated in the risk assessment. The populations at risk due to exposure to organic COCs present in the vadose zone were identified by considering both current and future land use scenarios.

The human health risk assessment evaluated carcinogenic risks and noncarcinogenic health effects for the period from 1992 through 2121. This window of time for evaluating risks was selected because it is during this time that peak contaminant concentrations occur in the SRPA. The period was further divided into three current and future use time periods:

1. Current period (1992–2021). Control of the RWMC will be maintained by the DOE during this period of time. Potential exposures to on-site workers or visitors and residents adjacent to the INEL were evaluated. Institutional control of the RWMC is defined in an Institutional Control Plan for the INEL per DOE Order 5820.2a.
2. Institutional control period (2022–2091). Control of the RWMC will be maintained by the DOE during this period of time. Institutional controls would be implemented to control the facility and may include, but are not limited to, restricting land use, controlling public access, and the posting of signs, fencing, or other barriers. Potential exposures to on-site workers or visitors and residents adjacent to the INEL were evaluated.
3. Post-institutional control period (2092–2121). Only potential exposures on residents were evaluated for this time period. Hypothetical residents were evaluated at 200 meters (which is approximately the distance from the center of the SDA to its boundary), 500 meters, and 5,200 meters from the center of the SDA. Each of these three locations is southwest of the SDA—the normal direction of flow for the SRPA. Note that the 5,200 meter location is the southern INEL boundary.

Exposure Pathways

The following exposure pathways were evaluated in the risk assessment for the current, institutional, and post-institutional control periods. In order to complete the pathways evaluation, contaminant fate and transport modeling was performed. The use of modeling is discussed in the following section.

- Outdoor inhalation of organic vapors
- Indoor inhalation of organic vapors
- Indoor inhalation of organic vapors released from indoor use of groundwater
- Dermal contact with groundwater
- Ingestion of groundwater (by hypothetical residents only).

Ingestion of contaminated groundwater by workers during the current and institutional control periods was not considered a viable pathway because the water supplied to workers from the RWMC production well is tested for contaminants. If contaminants in this well were to exceed MCLs, the water would be treated, or water from an uncontaminated source would be supplied to the workers.

The estimated risks and potential health effects associated with the pathway of dermal contact with groundwater turned out to be very low relative to the pathways of inhalation and ingestion. As such, for purposes of summarizing risk in this ROD, following discussions focus on inhalation and ingestion. Details for all of the pathways considered can be found in Sections 5 and 6 of *Remedial Investigation/Feasibility Study Report for the Organic Contamination in the Vadose Zone—Operable Unit 7-08* (EGG-ER-10684).

Contaminant Fate and Transport Modeling

A two-dimensional numerical transport model was developed to characterize the migration of contaminants from the disposal pits, through the vadose zone to the SRPA and to the atmosphere. Two additional models used the results of the vadose zone modeling to subsequently simulate the transport of contaminants in the SRPA and in the atmosphere. Also, the vadose zone model results were used to calculate COC concentrations in hypothetical building basements.

The computer code PORFLOW Version 2.39 was used to simulate transport of contaminants in the vadose zone. The source term of the model was based on Kudera's estimates which are described in Section 5.2. The model was calibrated using 1992 vapor concentration measurements of CCl_4 from wells instrumented with vapor sampling ports. The model was then used to predict the mass flux of each COC to the atmosphere and the SRPA from 1966 to the year 2193. The material properties used in the model are based on data collected during the RI, historical data, and calibration of the model.

The vadose zone model results provide mass fluxes to the air and groundwater pathways as a function of time and provide the basis for COC concentrations at receptor locations. As expected,

the CCl_4 flux is higher than the other COCs. The peak flux to the atmosphere for each COC occurs shortly after disposal ceased in 1970. CCl_4 flux to groundwater is predicted to peak in 2071, with flux to groundwater of the other COCs peaking in 2074.

A two dimensional transient analytical model, AT123D, was used to simulate the migration of COCs in the SRPA from beneath the SDA and predict concentrations of the four COCs through time (1966 through 2193) at three receptor locations downgradient. ISCLT Version 2.0 was used to model airborne contaminant transport to predict maximum average concentrations of COCs in air at specified receptor locations. The predicted groundwater and air concentrations were then used in the baseline risk assessment.

Results of the vadose zone model were also used to estimate COC vapor concentrations in hypothetical building basements at the 200 and 500 meter receptor locations for use in the baseline risk assessment. Estimates of building concentrations were made with a simple mixing equation for each exposure period. This equation assumes instantaneous mixing and steady state conditions for each time period. The results of this model are building concentrations for 1966 through 2193 for each COC for the 200 and 500 meter receptor locations. These concentrations were then used in the baseline risk assessment.

Exposure Point Concentrations

COC concentrations at points where the potential for human exposure is expected to occur are necessary to evaluate the intake of potentially exposed individuals. The contaminant fate and transport models described above provided COC concentrations in both air and groundwater at selected exposure point locations.

COC transport modeling indicated that the flux of COCs from the vadose zone to the atmosphere and the resultant airborne COC concentrations have peaked and will continue to decrease through the current, institutional, and post-institutional control periods. As such, exposure to airborne COCs will be greatest during the current control period. Figure 8 shows total COC emission to the atmosphere over time. The emission of COCs to the atmosphere results in an airborne COC concentration during the current period that ranges from approximately $15 \mu\text{g}/\text{m}^3$ at the WAG 7 boundary (200 m from center of SDA) to $0.00637 \mu\text{g}/\text{m}^3$ at the southern INEL boundary (5,200 m from center of SDA).

Unlike the airborne COC concentrations, the COC concentrations in groundwater will not peak until around the year 2071, which is during the latter part of the institutional control period. As shown in Figure 9, each COC peaks at a different concentration, with CCl_4 peaking the highest at approximately 125 $\mu\text{g}/\text{l}$ or ppb. Three of the COCs, CCl_4 , TCE, and PCE are predicted to remain above MCLs beginning early in the current period and extending beyond the institutional control period. The concentrations shown on Figure 9 are predicted for groundwater at the SDA boundary.

Detailed discussions on exposure point concentrations can be found in Volume I, Section 5 of the *Remedial Investigation/Feasibility Study Report for the Organic Contamination in the Vadose Zone—Operable Unit 7-08* (EGG-ER-10684).

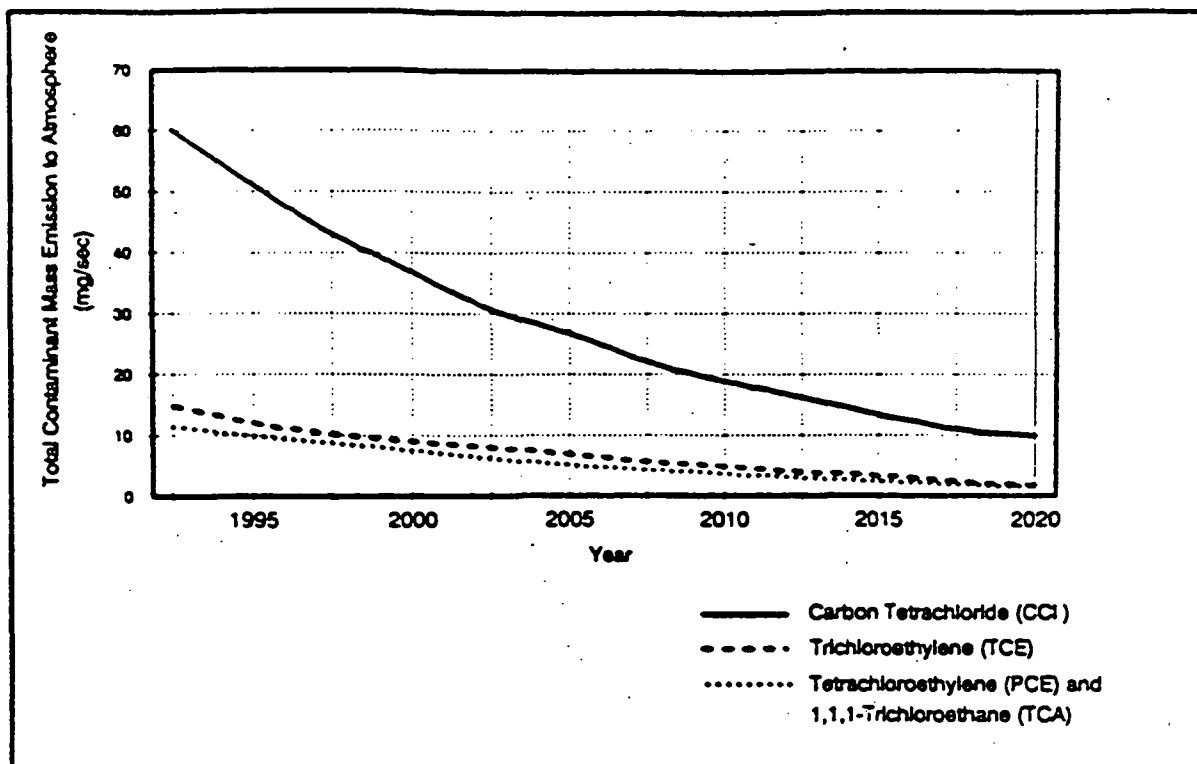


Figure 8. Total COC emission to the atmosphere over time.

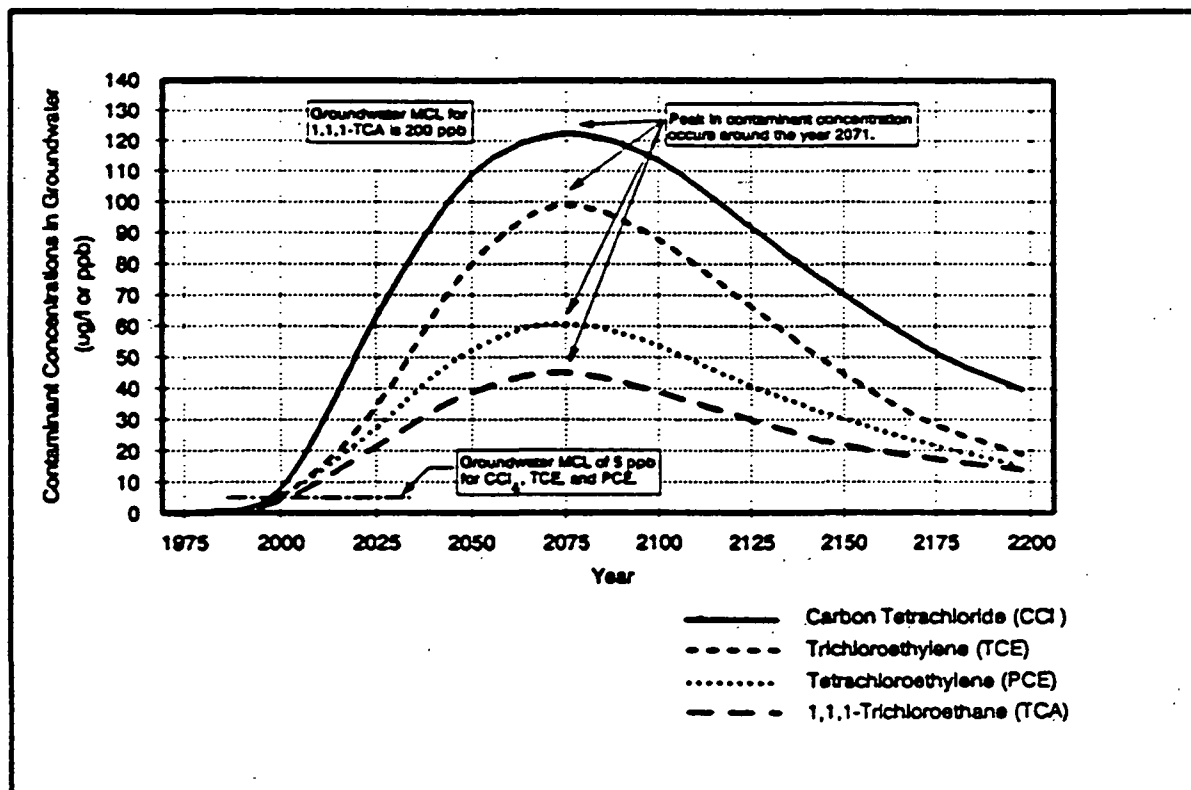


Figure 9. COC concentrations in the SRPA at the SDA boundary over time.

6.1.3 Toxicity Assessment

The toxicity assessment addresses the potential for a contaminant to cause adverse effects in exposed populations and estimates the relationship between extent of exposure and extent of toxic injury (i.e., dose response relationship).

Two types of toxicity values were used in the risk assessment: chronic reference doses, which are used to evaluate noncarcinogenic effects; and slope factors, which are used to evaluate carcinogenic effects. The Integrated Risk Information System (IRIS) database, an EPA online computer database, and the EPA Health Effects Assessment Summary Tables (HEAST) provided toxicity values and slope factors for the COCs present at OCVZ. These reference doses and slope factors are listed in Tables 4 and 5, respectively. Reference doses and slope factors are "pathway specific;" that is, they are dependent on the means of contaminant exposure.

The COCs, except for 1,1,1-TCA, are known carcinogens that target the liver and lungs. The potential carcinogenic effects of 1,1,1-TCA cannot be evaluated due to insufficient data on the carcinogenic effects of this compound. Each of the contaminants has harmful noncarcinogenic effects (both acute and chronic) on the central nervous system, liver, and lungs.

6.1.4 Risk Characterization

Risk characterization is the process of combining the results of the exposure and toxicity assessments. This process provides numerical quantification relative to the existence and magnitude of potential public health concerns related to the potential release of contaminants from the site. Exposure parameters, such as exposure frequency and duration, used in the risk assessment were obtained from Standard Default Exposure Factors guidance (EPA *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors*, OSWER Directive 9285.6-03, 1991). The exposure parameters used are shown in Table 6. As noted earlier, the summary format of this ROD focuses on inhalation and ingestion because, relative to these pathways, dermal absorption contributed very little health risks or effects.

Risk calculations are divided into carcinogenic and noncarcinogenic categories. The calculation of health risks from potential exposure to carcinogenic compounds involves the multiplication of cancer slope factors for each carcinogen and the estimated intake values for that contaminant. Noncarcinogenic health effects are assessed by comparison of an estimated daily intake of a contaminant to its applicable reference dose. A reference dose is a provisional estimate of the daily exposure to the human population that is likely to be without an appreciable risk of deleterious effects during a portion of an individual's lifetime. The estimated daily intake of each contaminant by an individual route of exposure is divided by its reference dose and the resulting quotients are added to provide a hazard index.

Carcinogenic risk and noncarcinogenic health effects associated with OCVZ are summarized in Table 7. As shown in this table, carcinogenic risks are estimated to be below or within the acceptable risk range of 1×10^{-4} to 1×10^{-6} for all receptors under the current period and for the worker receptors under the institutional control period. An estimated two additional residential receptors out of 10,000 (2×10^{-4}) are at risk of developing cancer as a result of the use of contaminated

Table 4. Constants for evaluating noncarcinogenic health effects from exposure to COCs.

Chemical	Chronic reference doses			Subchronic RfD (mg/kg/day)	Total organ
	Oral (mg/kg/day)	Inhalation			
		(mg/kg/day)	($\mu\text{g}/\text{m}^3$)		
CCl_4	7×10^{-4} ^a	1.8×10^{-3} ^b	6.1^b	7×10^{-3} ^c	Liver
PCE	1×10^{-2} ^d	1×10^{-2} ^e	35^e	1×10^{-1} ^f	Liver
TCE	NA	NA	NA	NA	Lung/Liver
1,1,1-TCA ^g	9×10^{-2} ^h	3×10^{-1}	1×10^0	9×10^{-1}	Liver

a. IRIS (2/93). Last update 10/7/92.

b. Calculated from oral RfD assuming inhalation: oral absorption ratio of 0.4 (see carcinogenicity data table).

c. HEAST (1992).

d. IRIS (2/93). Last update 4/6/92.

e. Calculated from oral RfD assuming an inhalation volume of $20 \text{ m}^3/\text{day}$ for a 70-kg adult. No correction for relative absorption efficiency.

f. HEAST (1991).

g. Information from HEAST (1991). Last IRIS update 10/7/92.

h. Notes in HEAST (1991) indicate that this value is based on extrapolation from inhalation data. The assumed relative absorption efficiency (inhalation: oral) appears to be 0.3.

Table 5. Constants for evaluating carcinogenic effects associated with exposure to the COCs.

Chemical	Weight of evidence classification	Target organ	Slope factors		
			Oral (mg/kg/day) ⁻¹	Inhalation unit risks	
				(mg/kg/day) ⁻¹	($\mu\text{g}/\text{m}^3$) ⁻¹
CCl_4 ^a	B2	Liver	0.13	5.3×10^{-2} ^b	1.5×10^{-5} ^c
PCE ^d	B2	Liver	5.1×10^{-2}	1.8×10^{-3} ^e	5.2×10^{-7}
TCE ^f	B2	Lung, liver	1.1×10^{-2}	1.7×10^{-2}	1.7×10^{-6}

a. Information from IRIS (accessed 2/93); last update 10/7/92.

b. Calculated from inhalation unit risk assuming inhalation rate of $20 \text{ m}^3/\text{day}$ by a 70-kg adult.

c. As described in IRIS (2/93), this value is calculated from the oral slope factor assuming that absorption efficiency via inhalation is 40% of absorption efficiency via the oral route.

d. Information from HEAST (1991). Last IRIS update 4/6/92.

e. Calculated from inhalation unit risk. No correction for inhalation absorption efficiency has been made.

f. Information from HEAST (1991). Last IRIS update 8/7/92.

Table 6. Parameters used to model inhalation and ingestion exposures by current and future receptors.

Parameter	Receptor group	RME value	Reference
<u>Inhalation</u>			
Respiration Rate (RR)	Adult/child	20 m ³ /day (total) 15 m ³ /day (indoor)	EPA RAGS ^a
Exposure Frequency (EF)	Adult/child	350 days/year	EPA RAGS
	Worker	250 days/year	
Exposure Duration (ED)	Adult	24 years	EPA RAGS
	Child	6 years	
	Worker	25 years	
Body Weight (BW)	Adult/worker	70 kilogram (kg)	EPA RAGS
	Child	15 kg	
Averaging Time (AT)	Adult	8,760 days (noncarcinogens)	EPA RAGS
	Child	2,190 days (noncarcinogens)	
	Worker	9125 days (noncarcinogens)	
	Adult/worker	25,550 days (carcinogens)	
<u>Ingestion</u>			
Ingestion Rate (IR)	Adult	2.0 l/day	EPA RAGS
	infant (0-3 years)	0.53 l/day	EPA ^b
	child (3-6 years)	0.74 l/day	EPA ^b
Exposure Frequency (EF)	Adult/child	350 days/year	EPA RAGS
Exposure Duration (ED)	Adult	24 years	EPA RAGS
	Child	6 years	
Body Weight (BW)	Adult	70 kg	EPA RAGS
	Child	15 kg	
Average Time (AT)	Adult	8,760 days (noncarcinogens)	EPA RAGS
	Child	2,190 days (noncarcinogens)	
	Adult	25,550 days (carcinogens)	

a. Risk Assessment Guidance for Superfund (RAGS), U.S. EPA, 1991.

b. Statement of Work RI/FS Risk Assessment Deliverables, EPA Region 10, U.S. EPA, 1990.

Table 7. Summary of baseline risk assessment results.

Receptor ^a	Exposure timeframe	Carcinogenic risk ^b	Noncarcinogenic risk (hazard index) ^c	Primary contributing exposure route
Current Scenario (1992 to 2021)				
Worker—200 meters	1992–2016	6 in 100,000 (6×10^{-5})	2	Air
Worker—500 meters	1992–2016	4 in 1,000,000 (4×10^{-6})	0.1	Air
Resident adult—5,200 meters	1992–2021	1 in 100,000 (1×10^{-5})	0.3	Groundwater
Resident child—5,200	1992–2021	— ^d	0.3	Groundwater
Institutional Control Scenario (2022 to 2091)				
Worker—200 meters ^e	2062–2086	9 in 10,000,000 (9×10^{-7})	0.03	Air
Worker—500 meters ^e	2062–2086	2 in 1,000,000 (2×10^{-6})	0.07	Air
Resident adult—5,200 meters	2062–2091	2 in 10,000 (2×10^{-4})	5	Groundwater
Resident child—5,200 meters	2062–2091	— ^d	6	Groundwater
Post-Institutional Control Scenario (2092 to 2121)				
Resident adult—200 meters	2092–2121	2 in 10,000 (2×10^{-4})	6	Groundwater
Resident child—200 meters	2092–2121	— ^d	5	Groundwater
Resident adult—500 meters	2092–2121	2 in 10,000 (2×10^{-4})	3	Groundwater
Resident child—500 meters	2092–2121	— ^d	7	Groundwater
Resident adult—5,200 meters	2092–2121	2 in 10,000 (2×10^{-4})	5	Groundwater
Resident child—5,200 meters	2092–2221	— ^d	5	Groundwater

a. Risks are calculated for three different distances from receptor to center of SDA. 200 meters = 656 ft, 500 meters = 1,640 ft, 5,200 meters = 17,060 ft.

b. The NCP defines an acceptable level of carcinogenic risk as less than 1 additional incidence of cancer in 10,000 to 1,000,000 individuals (i.e., 1×10^{-4} to 1×10^{-6}).

c. A hazard index (the ratio of the level of exposure to an acceptable level) greater than 1 indicates that there may be concern for noncarcinogenic effects. Hazard indices listed are cumulative across all exposure pathways.

d. Carcinogenic risks are calculated for the population exposed over a period of time to contaminant concentrations for which cancer is typically observed.

e. Concentration of CCl_4 in the SRPA beneath the SDA is predicted by the model to peak in the year 2071 at a concentration of about 125 mg/m^3 (ppb). However, ingestion of groundwater by workers during the institutional control scenario was not considered in the risk assessment due to institutional controls preventing the use of SRPA water above MCLs by workers.

groundwater during the latter part of the institutional control period and the post-institutional control period. The risk increases with increasing concentrations of contaminants in groundwater. Therefore, organic contamination in the vadose zone, if not addressed by a remediation alternative, could migrate to the SRPA and contaminate the groundwater to a degree that results in risks to human health of 2×10^{-4} , which is slightly greater than the acceptable risk range. In addition, concentrations of CCl_4 , TCE, and PCE in groundwater are predicted to peak above their respective MCLs (see Figure 9).

The hazard indices estimated for the current period are less than 1 except for the worker at the SDA boundary. The estimated hazard index of 2 for the current worker is related to outdoor inhalation of organic contaminants. This estimate is based on conservative assumptions associated with exposure duration and the air model used to predict outdoor concentrations of organic contaminants. Due to the conservative nature of these assumptions, the actual hazard index for this receptor is expected to be less than 1. Generally, hazard indices greater than 1 indicate that the potential exists for noncarcinogenic effects to be seen in exposed individuals. For the institutional and post-institutional control periods, hazard indices greater than 1 were calculated for each of the residential receptors. The primary exposure routes for these hazard indices are ingestion of groundwater and inhalation of organic vapors released from indoor use of groundwater.

6.1.5 Uncertainty

Risk assessments are subject to uncertainty from inventory records, sampling and analysis, fate and transport estimation, exposure estimation, and toxicological data. Uncertainty was addressed by using health protective assumptions that systematically overstate the magnitude of health risks. This process is intended to bound the plausible upper limits of risk and to facilitate an informed risk management decision. Table 8 is a summary of risk assessment uncertainty factors and their effects on the modeling results.

6.2 Environmental Concerns

In order for organic contaminants to elicit adverse ecological impacts, credible pathways of ecological exposure must be identified. Three potential pathways of exposure are:

- Absorption or inhalation of vapors through the airborne route
- Uptake or ingestion of groundwater containing COCs which have migrated from the vadose zone to the saturated zone
- Direct exposure or uptake from burrowing or root penetration of the vadose zone contamination.

Modeling suggests that the peak concentration of volatilized COCs measured at the ground surface has already occurred and will continue to decrease with time. The groundwater pathway is not currently a complete pathway because groundwater is not being developed for irrigation at the Site. The concentration of COCs in groundwater are expected to peak and begin to decline during the institutional control period. Lastly, because COC concentrations in soil were extremely low or

Table 8. Uncertainty factors, OU7-08, INEL.

Uncertainty factor	Effect of uncertainty	Comment
Sampling and analysis		
Vapor plume extent	May slightly over- or under-estimate risk	Since the source term is static, a larger vapor plume would affect a larger exposure area, but result in reduced concentrations.
Detection limits/COC screening	May slightly over- or under-estimate risk	Measurements used in COC screening had different detection limits in the laboratory equipment than in the field equipment. However, since maximum concentrations are used in screening, the effect is expected to be small.
Exclusion of surface soil from the sampling and analysis program	May slightly under-estimate risk	Since the COCs are volatile, they would volatilize from surface soils. Therefore, sampling and analysis was not conducted for this medium. Surface soil is the subject of OU7-05.
Fate and transport estimation		
Assumed house volume and ventilation rate	May slightly over- or under-estimate risk	The indoor concentration of soil gas penetrating the foundation depends on indoor ventilation.
Near field indoor soil-gas concentrations	May over- or under-estimate risk	Indoor soil-gas concentrations at 200 m were assumed equal to modeled concentrations at 500 m, since the model assumptions do not facilitate near-field resolution.
Source term assumptions	May over- or under-estimate risk	The heterogeneous sources (pits) were assumed to be a homogeneous disk of 200 m in radius. Chloroform may have been present in the source term, but not recorded.
Natural infiltration rate	May over-estimate risk	A conservative value was used for this parameter.
Moisture content	May over- or under-estimate risk	This varies seasonally in the upper vadose zone and may be subject to measurement error.

Table 8. (continued).

Uncertainty factor	Effect of uncertainty	Comment
Fate and transport estimation (continued)		
Modeling use of a 100 foot screen interval	May over- or under-estimate risk	Active thickness of SRPA is 250 ft.
Volume of theoretical mixing space in near-field air dispersion model	May over-estimate risk	The initial source term area for the vadose zone model was used, although the surface flux will be emitted over a larger area.
Exposure estimation		
Receptor locations	May over- or under-estimate risk	Receptors were located in the direction of highest contaminant concentrations which would tend to overestimate actual exposure. However, if a resident lives on top of the SDA, the calculated exposure is an underestimation of actual exposure.
Exposure duration	May over-estimate risk	The assumption that an individual will work at the RWMC or reside at the INEL boundary for 25 or 30 years is conservative.
Exclusion of food pathway	May under-estimate risk	VOC uptake by homegrown vegetables is considered a negligible exposure route.
Non chemical-specific constants (e.g., exposure parameters such as inhalation rates, exposure duration, etc.)	May over-estimate risk	Conservative or upper bound values were used for all parameters incorporated into intake calculations
Contaminant concentrations	May over-estimate risk	Assumptions regarding contaminant concentrations as averages centered around peak concentrations may not characterize actual exposures.
Assumed aquifer mixing depth of 100 ft.	May over- or under-estimate risk	Wood (1991) indicates that the active depth of the aquifer is estimated to be 250 ft. However, for receptors close to the source, mixing depth is mostly dependent on the screened interval of the well.

Table 8. (continued).

Uncertainty factor	Effect of uncertainty	Comment
Exposure estimation (continued)		
Assumed hydraulic conductivity of 700 ft/day	May over- or under-estimate risk	Higher hydraulic conductivities may send the plume to receptors faster, but may disperse contaminants faster as well.
Model does not consider biotic decay	May over-estimate risk	Biotic decay would tend to reduce contamination over time. However, the modeling effort did not account for this process.
Exclusion of chloroform	May under-estimate risk	Chloroform may be either a source or transformation product. Its detection is sporadic and was not modeled.
Exclusion of transformation products	May under-estimate risk	Not all transformation products of the identified organic compounds were evaluated.
Toxicological data		
Use of cancer slope factors	May over-estimate risk	Potencies are upper 95th percentile confidence limits. Considered unlikely to underestimate true risk.
Critical toxicity values derived primarily from animal studies	May over- or under-estimate risk	Extrapolation from animal to humans may induce error due to differences in absorption, pharmacokinetics, target organs, enzymes, and population variability.
Critical toxicity values derived primarily from high doses, most exposures are at low doses	May over- or under-estimate risk	Assumes linear at low doses. Tend to have conservative exposure assumptions.
Critical toxicity values and classification of carcinogens	May over- or under-estimate risk	Not all values represent the same degree of certainty. All are subject to change as new evidence becomes available.

Table 8. (continued).

Uncertainty factor	Effect of uncertainty	Comment
Toxicological data (continued)		
Lack of RfDs	May under-estimate risk	Inhalation RfDs are not available for TCE.
Effect of absorption	May over- or under-estimate risk	The assumption that absorption is equivalent across species is implicit in the derivation of the critical toxicity values. Absorption may actually vary with chemical.
Dermal absorption toxicity values	May slightly under-estimate risk	The unavailability of consensus absorption values does not facilitate comparison of absorbed dose to toxicity constants based on administered dose.

not detected, plants and burrowing animals are not expected to be adversely affected by COCs at the Site. Therefore, while it is acknowledged that potential ecological receptors are currently present on-Site, contact with COCs is unlikely under current Site conditions.

Consequently, an ecological risk assessment was not conducted for the OCVZ RI/FS. The ecological impacts from OCVZ COCs will be evaluated in the comprehensive WAG 7 RI/FS (OU 7-14).

6.3 Basis for Response

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

7. DESCRIPTION OF ALTERNATIVES

Remedial action alternatives were developed and analyzed in detail for the OCVZ operable unit. Prior to developing alternatives, remedial action objectives were established. These objectives and descriptions of the developed alternatives are included in the following sections.

7.1 Remedial Action Objectives

The intent of the remedial action objectives is to set measurable goals for protection of human health and the environment. The goals are designed specifically to mitigate the potential adverse effects that could result from the continued migration of the vadose zone COCs to the air or groundwater.

The risk assessment indicates that there is a current and future risk to workers and a future risk to the public due to the organic contaminants present in the vadose zone beneath and within the immediate vicinity of the RWMC. For workers, the primary contributing exposure route is inhalation of air contaminated with organic vapors that migrate upward from the vadose zone to the atmosphere. Exposure to contaminated groundwater was not considered a complete exposure pathway for current and future on-site workers due to the fact that if contaminant concentrations in the RWMC production well exceed permissible standards, the water would be treated or water would be supplied to workers from an uncontaminated source. For public receptors, the primary contributing exposure route was the use of groundwater. The baseline risk assessment concluded that future residential exposure to groundwater both on- and off-site would result in carcinogenic risks and noncarcinogenic hazards that are unacceptable. In addition, modeling of contaminant migration through the vadose zone and into the SRPA indicated that contaminant concentrations in the aquifer would continue to increase until sometime around the year 2071, at which time they would begin to decrease (see Figure 9 in Section 6). The resultant contaminant concentrations in groundwater could continue to remain above Federal and state MCLs for a period of several hundred years.

The results of the RI and baseline risk assessment indicated that the contamination of groundwater due to the migration of the vadose zone organic contaminants to the SRPA will present the most significant future risk to human health if no action is taken. Specifically, the baseline risk assessment indicated that the highest risk to a human receptor from the inhalation of contaminants emanating from the vadose zone is on the order of 10^{-5} , while the highest risk from the future ingestion of contaminated groundwater is on the order of 10^{-4} . The baseline risk assessment also shows that the risk from the inhalation of vapors emanating from the subsurface is at or below the 10^{-6} level for all of the future risk scenarios. That is, contaminant flux to the atmosphere has already peaked and will continue to decrease naturally. These results suggest that the primary objective of the FS should be to develop alternatives that would prevent vapor-phase organic contaminants in the vadose zone from reaching groundwater in concentrations that would result in future groundwater contaminant concentrations that exceed Federal and state MCLs. The MCLs result in an overall risk value within the acceptable range of 10^{-4} to 10^{-6} . As such, the primary remedial action objective, and the focus of remedial action alternative development, is to ensure that risks to future groundwater users are within acceptable guidelines and that future contaminant concentrations in the aquifer remain below Federal and state MCLs. To ensure that this remedial action objective is met and maintained, a long-term groundwater and soil vapor monitoring program would be conducted. The monitoring program would be designed to provide an early indication of the possibility of future groundwater contamination above acceptable levels.

Remedial action objectives also include the identification of preliminary remediation goals (PRGs) that are established based on both risk and frequently used standards referred to as Applicable or Relevant and Appropriate Requirements (ARARs). PRGs are typically expressed as contaminant concentrations (i.e., cleanup levels) desired after a remedial action for various contaminated media. Contaminants associated with OCVZ are primarily organic vapors of CCl_4 , TCE, PCE, 1,1,1-TCA, and chloroform present in the vadose zone. Because there are currently no ARAR-based standards available for determining cleanup levels for organic vapors in subsurface soils, an approach using groundwater MCLs to estimate PRGs for OCVZ was used. Such an approach relied on the contaminant fate and transport modeling, which was used as part of the baseline risk assessment, to estimate cleanup levels that would satisfy the primary remedial action objective. The fate and transport modeling predicts PRG levels for CCl_4 , which is the COC present in the most

significant concentrations, that may range from 30 to 200 ppmv, depending on the location within the vadose zone. The other COCs are predicted to have similar PRG levels that also vary depending on the location within the vadose zone. The PRGs only apply to alternatives that focus on removal of the COCs from the vadose zone; however, the remedial action objectives apply to any alternative.

The PRG range of 30 to 200 ppmv for CCl_4 is an estimate based on information available to date. Any alternative that removes COCs from the vadose zone would also include steps to further define characteristics (i.e., extent and concentrations) of the vadose zone COCs. Better definition of the COC characteristics will allow PRGs to be refined. The future refinement of PRGs will be agreed upon by the DOE, EPA, and the IDHW. Such a refinement will increase the three agencies' confidence that remedial action objectives can be met and maintained. It should be noted that PRGs for the OCVZ operable unit cannot be identified as discrete COC concentrations in the vadose zone.

Alternatives designed to achieve the remedial action objectives were assembled using combinations of the following general response actions.

- **Institutional Controls**—includes soil vapor and groundwater monitoring. Monitoring is effective for observing changes in vadose zone as well as groundwater contaminant concentrations and in identifying imminent hazards.
- **Containment**—only option for containment that can be implemented for the OCVZ is capping. A cap over the SDA may effectively prevent water from reaching the source pits and contributing to leaching of contaminants; thereby, minimizing the migration of contaminants to the environment. A cap would minimize migration of contaminants to the atmosphere at the surface of the SDA.
- **Vapor Extraction**—includes methods to extract vapor from the various regions of the vadose zone beneath the RWMC.
- **In-Situ Treatment of Vapors**—only reasonable option for in-situ treatment is bioremediation.
- **Ex-Situ Treatment of Vapors**—includes several options for biological, physical, thermal, and chemical treatment of vapors recovered from the vadose zone. Ex-situ treatment would attempt to reduce the toxicity, mobility, and volume of recovered contaminants.

7.2 Summary of Alternatives

In accordance with Section 121 of CERCLA, the Feasibility Study (FS) identified alternatives that (a) achieve the stated remedial action objectives, (b) provide overall protection of human health and the environment, (c) meet ARARs, and (d) are cost-effective.

The alternatives evaluated in the FS for OCVZ were Alternative 0—No Action; Alternative 1—Containment of Vadose Zone Vapors by Capping; Alternative 2—Extraction/ Treatment by Vapor Vacuum Extraction (VVE); Alternative 3—Extraction/Treatment by VVE with Vaporization Enhancement; and Alternative 4—In Situ Bioremediation. Alternatives 3 and 4 propose to use a catalytic oxidation unit to treat vapor. This technology is fairly new and may be substituted with other

technologies such as carbon adsorption, biological treatment, ultraviolet treatment, etc. if implementation of the catalytic oxidation system proves to be ineffective or difficult due to site-specific circumstances. Although Alternative 4 was developed, it was not analyzed in detail with the other alternatives since it was decided early in the FS process that in situ bioremediation would be ineffective as well as very difficult to implement in the fractured basalt region beneath the RWMC. Descriptions of Alternatives 0 through 3 are provided in the following sections.

Substantive action-specific ARARs are identified for Alternatives 1–3. These ARARs, are listed in Table 9. Note that there are no action-specific ARARs for the No Action Alternative. The majority of ARARs focus on the management of materials and waste, including the regulation of air emissions from vapor treatment and remediation activities at the OCVZ operable unit. Specific requirements are:

- Characterization of hazardous wastes that may be generated from remediation activities
- Control of emissions from vapor treatment and recovery systems
- Measures to control fugitive dust from well drilling and earth moving.

No chemical-specific ARARs are identified for the considered alternatives. Regulations have not been promulgated specific to soil cleanup levels for vapor-phase contaminants. Also, no location-specific ARARs are identified as there are no known threatened and endangered species, wetlands, rivers, or floodplains located in the area of potential remedial activities under the considered alternatives.

Conservative calculations of organics in or contacting equipment demonstrate that concentrations by weight of hazardous air pollutants are well below the threshold criteria of applicability for the National Emission Standards for Hazardous Air Pollutants (NESHAP) program involving equipment leaks (40 CFR 61.240).

7.3 Alternative 0—No Action

Under this alternative, no attempt would be made to contain, treat in place, or extract and treat the organic contaminants present within the vadose zone. Instead, only long-term groundwater and soil vapor monitoring would be implemented. Groundwater monitoring is necessary to detect contaminant concentrations in the SRPA. Soil vapor monitoring is necessary to track the migration of contaminant vapors in the vadose zone. Changes in contaminant concentrations in groundwater and soil vapor would be evaluated to determine whether measures must be taken to minimize potential risks to public health and the environment. It was assumed that monitoring would continue for a period of 30 years under the No Action Alternative. This alternative was a "baseline" case against which the other alternatives were compared.

There are no ARARs identified for the No Action Alternative. Net present value costs for implementing groundwater and soil vapor monitoring under this alternative for the next 30 years are estimated to be \$4.1 million.

Table 9. Summary of ARARs and TBC criteria for OCVZ alternatives.

Statute	Regulation	Alternative 0 no action	Alternative 1 containment	Alternative 2 extraction/ treatment by VVE	Alternative 3 extraction/treatment by VVE with enhancement
RCRA	IDAPA § 16.01.050.5005, (40 CFR 261.10, 261.20-261.24) "Idaho Rules, Regulations and Standards for Hazardous Waste"	Not ARAR	Not ARAR	R/Yes	R/Yes
	40 CFR 264.600 Subpart X, Miscellaneous Units	Not ARAR	Not ARAR	R/Yes	R/Yes
Clean Air Act	40 CFR 61.92, "National Emission Standards for Radionuclide Emission from DOE Facilities"	Not ARAR	Not ARAR	A/Yes	A/Yes
	IDAPA §16.01.01.577, "Ambient Air Quality Standards for Specific Air Pollutants"	Not ARAR	Not ARAR	A/Yes	A/Yes
Idaho Toxic Air Pollutants Non-Carcinogenic Increments	IDAPA §16.01.015.85	Not ARAR	Not ARAR	A/Yes	A/Yes
Idaho Toxic Air Pollutants Carcinogenic Increments	IDAPA § 16.01.015.86	Not ARAR	Not ARAR	A/Yes	A/Yes

Table 9. (continued).

Statute	Regulation	Alternative 0 no action	Alternative 1 containment	Alternative 2 extraction/ treatment by VVE	Alternative 3 extraction/treatment by VVE with enhancement
Idaho Rules for Control of Fugitive Dust	IDAPA § 16.01.01.651	Not ARAR	A/Yes	A/Yes	A/Yes
Idaho Demonstration of Preconstruction Compliance with Toxic Standards	IDAPA § 16.01.01.210.10	Not ARAR	Not ARAR	R/Yes	R/Yes
DOE Order	DOE 5820.2A, "Radioactive Waste Management"	TBC	TBC	TBC	TBC

A = Applicable

R = Relevant and Appropriate

TBC = To Be Considered.

7.4 Alternative 1—Containment of Vadose Zone Vapors by Capping

Alternative 1 consists of the installation of a cap over the SDA to minimize infiltration of rainwater, surface water, and snowmelt into the subsurface. Capping would reduce the amount of infiltrating moisture that reaches the waste buried in the SDA and contributes to downward migration of organic contaminants in the vadose zone. Capping is the systematic covering of an area with layers of soil, clay, and/or synthetic material that would be used, in this case, to provide a relatively impermeable barrier to surface water. Typical applications of capping are municipal landfills where contaminated water (i.e., leachate) is formed via infiltrating surface water. A cap of the SDA would consist of three layers of earthen fill over the entire 88-acre surface of the SDA.

Under Alternative 1, removal and treatment of organic contaminants would not occur. By minimizing the infiltration of water, capping would decrease the contact of water with organic contaminants at shallow depths directly beneath the disposal area; thus, migration of organic contaminants dissolved in infiltrating moisture would be reduced. However, even with capping, contaminants would continue to migrate both vertically and laterally in the vadose zone, primarily in the vapor phase.

The only ARAR identified for this alternative is Idaho Rules for Control of Fugitive Dust (IDAPA § 16.01.01.651). This ARAR would be met during the construction of a cap through appropriate engineering controls to minimize dust generation.

The net present value cost of Alternative 1 is estimated to be \$43.3 million, including a nine million dollar contingency to cover unanticipated costs associated with capping materials acquisition. It is expected that it would take no more than 20 workers five years to construct the cap. As such, there are no significant socio-economic impacts associated with this alternative. Periodic maintenance of the cap would be needed to maintain its integrity. In addition, soil vapor and groundwater monitoring would be conducted to monitor the migration of organic contaminants in the vadose zone and SRPA.

7.5 Alternative 2—Extraction/Treatment by VVE

Alternative 2 would use VVE to remove organic vapors from the vadose zone. Extracted vapors would subsequently be treated at the surface. This alternative would utilize the existing VVE extraction well and several additional extraction wells which would be located in areas of the SDA known to have significant levels of organic vapors in the vadose zone. The existing VVE system was installed to determine the viability of VVE as a technology for the recovery and treatment of the vadose zone contaminants. The system consists of one vapor extraction well, a blower, and a carbon adsorption vapor treatment system. The extraction well is configured to draw vapors at a flowrate of approximately 200 cubic feet per minute from the 110-foot sedimentary interbed. This configuration recovers vapor organic contaminants from above and below the interbed. Figure 10 shows a conceptual cross-sectional view of the existing VVE system with geological features of the vadose zone and a conceptual representation of the vapor contaminant plume included.

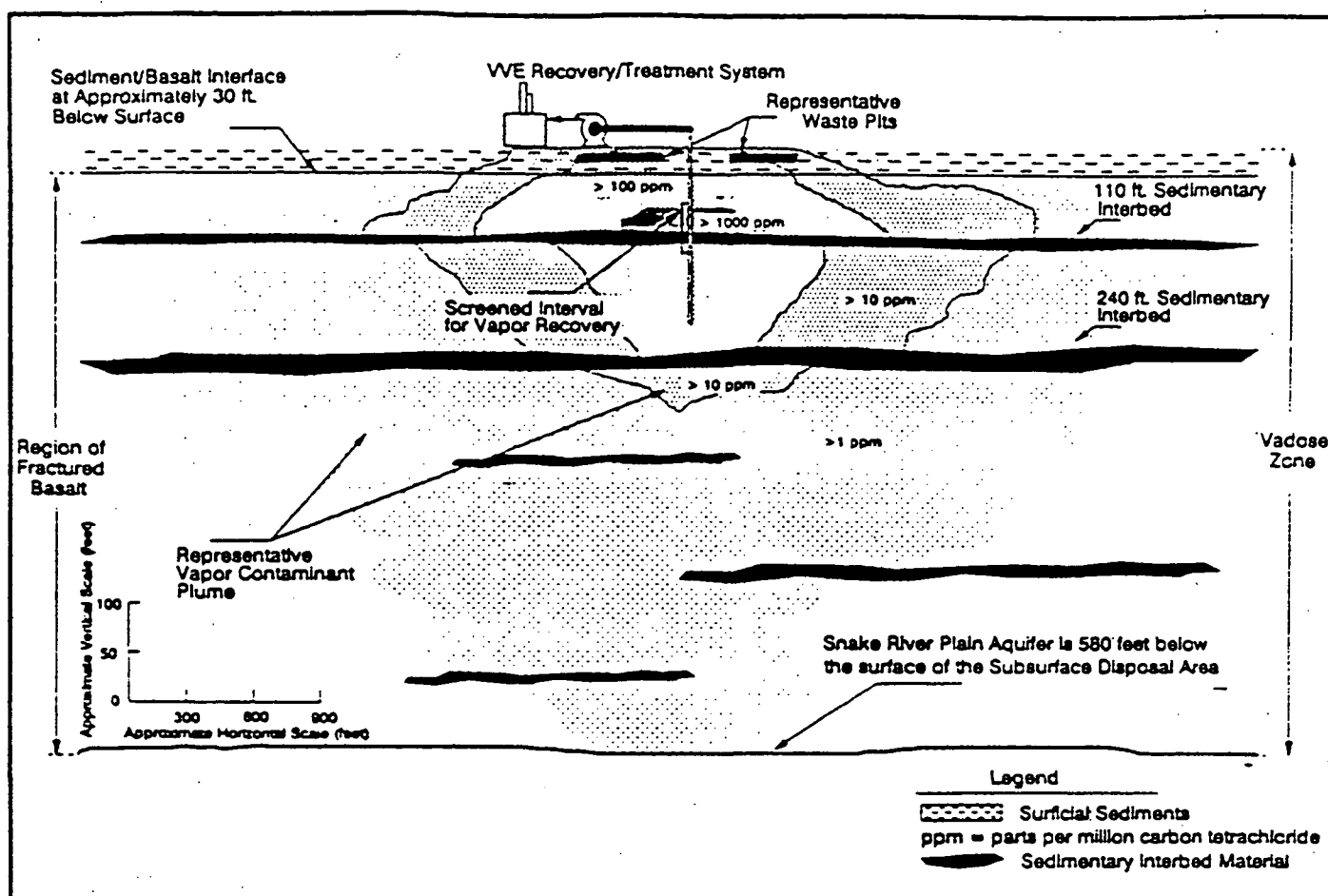


Figure 10. Schematic cross section of VVE system showing approximate extent of vapor plume and vapor extraction well.

Under a phased approach to Alternative 2, the existing VVE system would be augmented with additional vapor extraction wells, monitoring wells, and vapor treatment equipment. The first phase would include the installation of five additional vapor extraction wells (see Figure 11) to augment the contaminant recovery capability of the existing vapor extraction well. Additional vapor treatment units and vapor monitoring wells would support these five wells. Subsequent phases may also include more vapor extraction wells, monitoring wells, passive venting wells, and vapor treatment units. In order to clarify the range of cost for Alternative 2, it was assumed that a second phase would involve the installation of four additional vapor extraction wells and accompanying support equipment, for a total of 10 wells (including those installed under the first phase). A maximum number of fourteen vapor extraction wells and accompanying support equipment would be expected under a third and final phase of Alternative 2. A more detailed discussion on the use of phases under Alternative 2 is included below. In addition to contaminant recovery and treatment, Alternative 2 would include long-term soil vapor and groundwater monitoring.

Each vapor extraction well would be linked to a catalytic oxidation unit or equivalent vapor treatment system. Such a treatment system could typically achieve a sufficient contaminant destruction efficiency for the extracted vapors, and be capable of maintaining an airflow that would

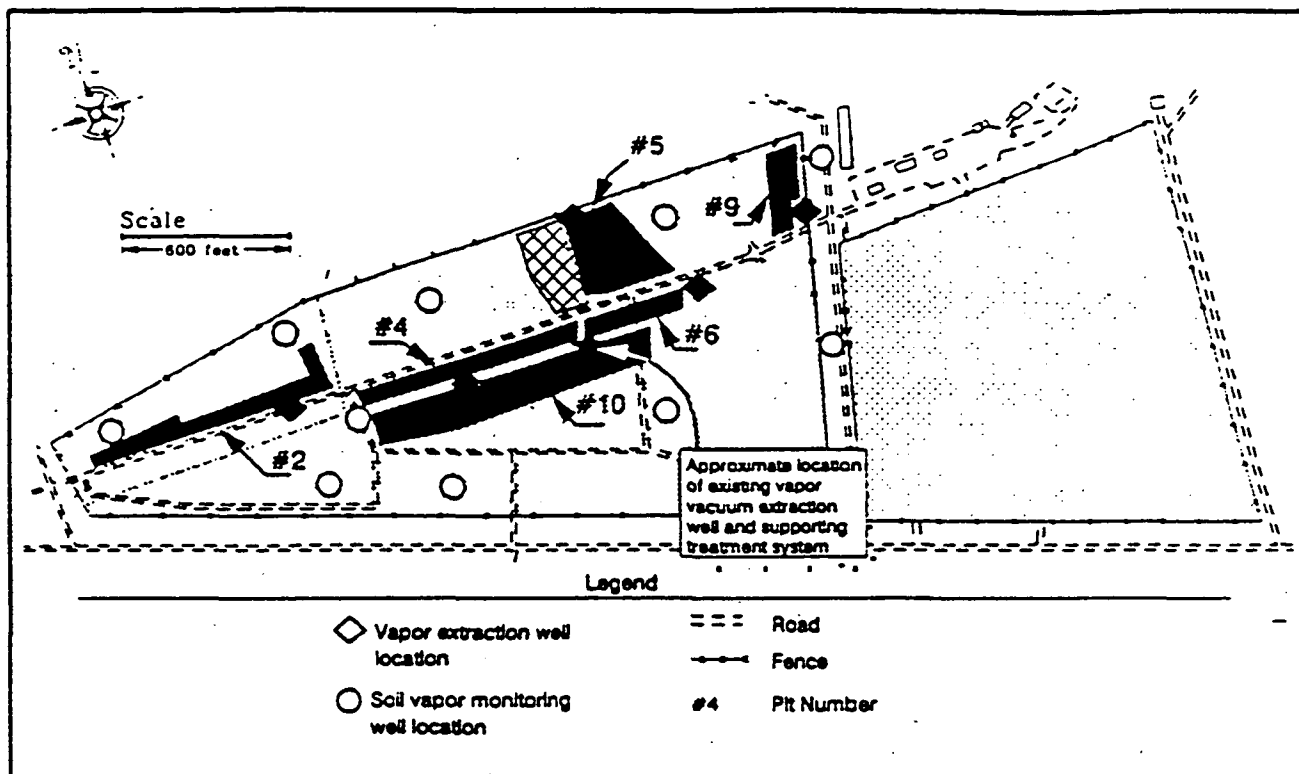


Figure 11. Alternative 2 Phase I vapor extraction/monitoring wells.

range between 125 and 150 cfm. Catalytic oxidation is basically a thermal process that is capable of converting chlorinated hydrocarbons (such as the CCl_4 , TCE, PCE, 1,1,1-TCA, and chloroform present at OCVZ) into carbon dioxide, water, and hydrochloric acid (HCl) gas. It accomplishes thermal destruction at a relatively low temperature in the presence of a catalyst. It is expected that under a possible third phase of this alternative, which would entail the most extensive use of catalytic oxidation, the HCl emission would be below applicable air discharge requirements, even without scrubbing for acid gas removal. Overall, catalytic oxidation was favored as the representative process option for air treatment because of its proven ability to destroy the types of contaminants present at OCVZ, its availability in modular compact units that could be placed adjacent to each vapor extraction well, and its relatively low operation and maintenance costs. Potentially, one catalytic oxidation unit would be dedicated to each extraction well due to the large distances between wells. The units would require fuel such as propane to maintain the contaminant oxidation process.

The FS considered other vapor treatment technologies such as biological treatment, ultraviolet treatment, and carbon adsorption. Based on available performance data, biological and ultraviolet treatment would require further development in order to be a viable vapor treatment option for the large-scale application that would be required under Alternative 2. Carbon adsorption has already been demonstrated as a viable vapor treatment option during the OCVZ treatability studies; however, difficulties associated with the handling and regeneration of contaminant-saturated carbon must be resolved in order to utilize this technology for large-scale vapor treatment at the RWMC. Further investigation of available air treatment technologies that would be most appropriate to support VVE at OU 7-08 would continue through the design of Alternative 2.

Each of the ARARs identified for this alternative would be met through appropriate engineering controls such as vapor treatment. Through the use of catalytic oxidation for vapor treatment, it is expected that no residual treatment wastes would be generated under Alternative 2. Net present value costs for implementing this alternative range from \$12.9 to \$32.4 million. The cost range corresponds to first phase operations through third phase operations for a period of two years to six years, respectively. It has been assumed that cleanup goals would be attained at some point in the zero to six year timeframe. The costs also include an assumption of thirty years for soil vapor and groundwater monitoring. It is estimated that a maximum of ten workers would be required to complete this alternative. As such, there would be no significant socio-economic impacts associated with this alternative.

Phases of Alternative 2

The potential progression of Alternative 2 to a second and third phase would be dependent on the ability of the vapor extraction system to achieve the remedial action objectives, i.e., ensure that risks to future groundwater users are within acceptable guidelines and that future contaminant concentrations in the aquifer remain below Federal and state safe drinking water standards. The performance of Alternative 2 would be reviewed on a two year (24 month) cycle, with each phase of operation under the alternative expected to last at least two years. The actual duration of each phase would be dependent on elements such as equipment procurement and installation that may be involved with each transition; however, the following description of the review cycle assumes that transitions would occur in a timely fashion every 24 months.

The first review would commence after 18 months of operation under the first phase. Data accumulated over these 18 months would be analyzed and a decision made by DOE, EPA, and the IDHW as to what would comprise the second phase of Alternative 2 (if a second phase is necessary to attain remedial action objectives). Alternative 2 would continue under first phase operations up to 24 months, at which time, after the data analysis period, a transition to the second phase would occur. Data analyzed would be relevant to the attainment of remedial action objectives (e.g., contaminant recovery rates, equilibrium contaminant concentrations in the vadose zone, etc.).

Considerable engineering judgement would be used in deciding what modifications to the first phase would be made to continue Alternative 2 into a second phase in order to achieve remedial action objectives. Potential options for continuing Alternative 2 into a second phase include: (1) continuing operation with no changes to the first phase of operation; (2) adding more vapor extraction wells; (3) extracting from different depths within existing extraction wells; (4) converting monitoring wells into extraction wells; and (5) adding and/or converting existing wells to passive venting wells. These options and others not currently identified may be carried out singly or in combinations, with the intent being to ensure that Alternative 2 achieves remedial action objectives.

The need for additional phases beyond a second phase would be evaluated using the same general approach as outlined above for the transition between the first and possible second phase. If a second phase is implemented, then the data evaluation and decision regarding a possible third phase would begin 18 months into the second phase (i.e., 42 months from the start of Alternative 2) with the third phase beginning, if necessary, approximately 48 months from the start of Alternative 2. Potential options for continuing Alternative 2 into a third phase would be similar to those listed

above. This type of phased operation would continue through phases lasting 24 months each until remedial action objectives are achieved.

7.6 Alternative 3—Extraction/Treatment by VVE with Vaporization Enhancement

Alternative 3 would include VVE (as described for Alternative 2) as the primary contaminant recovery method with radio frequency heating to enhance the vaporization of organic contamination in the vadose zone. Radio frequency heating would target contaminants that have partitioned to the aqueous phase in the vadose zone (i.e., organic contaminants dissolved in soil moisture or perched water) or have adsorbed onto material in the sedimentary interbeds. Radio frequency heating would use strategically placed antennae in boreholes to raise the temperature in discrete areas of the subsurface. The increased temperature would induce volatilization of the organic contaminants. Volatilized contaminants would then be recovered by the VVE system. The temperature in the subsurface would be raised gradually to allow the VVE system to recover organic contaminants as they volatilize. The VVE system under Alternative 3 would include 14 vapor extraction wells and 14 boreholes installed to the 110-foot interbed to accommodate the insertion of the radio frequency heating antennae.

Each of the ARARs identified for this alternative would be met as discussed for Alternative 2. Net present value costs for implementing Alternative 3 are estimated to be \$59.9 million. This cost is based on operation of a full network of VVE wells and no more than two radio frequency heating antennae operating at any given time over a period of six years. The costs include an assumption of thirty years for soil vapor and groundwater monitoring. It is estimated that no more than ten workers would be required to complete this alternative. As such, there are no significant socio-economic impacts associated with Alternative 3.

8. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

CERCLA guidance requires that each remedial alternative be compared according to nine evaluation criteria that have been developed to serve as a basis for conducting the detailed analyses of alternatives and for subsequently selecting an appropriate remedial action. The evaluation criteria are divided into three categories: (1) threshold criteria that relate directly to statutory findings and must be satisfied by each chosen alternative; (2) primary balancing criteria that include long- and short-term effectiveness, implementability, reduction of toxicity, mobility, and volume, and cost; and (3) modifying criteria that measure the acceptability of the alternatives to State agencies and the community. The following sections summarize the evaluation of the candidate remedial alternatives according to these criteria.

8.1 Threshold Criteria

The remedial alternatives were evaluated in relation to the threshold criteria: overall protection of human health and the environment and compliance with ARARs. The threshold criteria must be met by the remedial alternatives (except the No Action Alternative) for further consideration as potential remedies.

8.1.1 Overall Protection of Human Health and the Environment

This criterion addresses whether an alternative provides protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Alternatives 2 and 3, Extraction/Treatment by VVE and Extraction/Treatment by VVE with Vaporization Enhancement, respectively, satisfy the criterion of overall protection of human health and the environment. The alternatives accomplish this by recovering and treating organic vadose zone contaminants, thus, preventing unacceptable levels of contaminant migration to the SRPA and also potentially reducing the mass flow of contaminants to the surface soils and atmosphere above the RWMC.

Alternative 1, Containment of Vadose Zone Contaminants by Capping, also satisfies this criterion to the degree that it protects human health by potentially reducing the level of contaminant migration to the SRPA and by reducing the mass flow of contaminants to the atmosphere at the surface of the RWMC. It is not clear, however, how much of a reduction in the amount of organic contaminants reaching the SRPA would occur under this alternative. This uncertainty stems in part from the potential migration of contaminants at greater depths that may still be affected by water infiltrating from areas outside of the SDA. Capping would not affect organic contaminants in the vadose zone that have migrated laterally beyond the boundary of the SDA. Although not considered an ARAR for this OU, it is likely that contaminant concentrations in the aquifer would exceed MCLs in the future under this alternative.

Overall, each of the alternatives, with the exception of Alternative 0, No Action, would result in a lifetime excess cancer risk within the acceptable range of 1×10^{-4} to 1×10^{-6} . Also, hazard indices associated with the COCs would be reduced to acceptable levels. Alternative 1 would accomplish this by reducing the migration of contaminants to the SRPA through a reduction in moisture infiltration at the surface of the SDA. Alternatives 2 and 3 would accomplish this by recovering and treating the most significant levels of vadose zone contaminants present. Although there is some uncertainty in the modeling results, it is believed that the No Action Alternative would not satisfy the criterion of Overall Protection of Health and the Environment.

8.1.2 Compliance with ARARs

CERCLA, as amended by SARA, requires that remedial actions for Superfund sites comply with identified substantive applicable requirements identified under Federal and state laws. Remedial actions must also comply with the requirements of laws and regulations that are not directly applicable but are relevant and appropriate, in other words, requirements that pertain to situations sufficiently similar to those encountered at a Superfund site so that their use is well suited to the site. Combined, these are referred to as ARARs. State ARARs are limited to those requirements that are (a) promulgated, (b) uniformly applied, and (c) are more stringent than Federal requirements. Compliance with ARARs requires evaluation of the remedial alternatives for compliance with chemical, location, and action-specific requirements.

Three of the remedial alternatives considered for OCVZ comply with the identified ARARs through engineering controls and operating procedures. ARARs are not identified for the No Action

Alternative since no treatment or containment activities are proposed with this alternative. A summary of the ARAR analysis is presented in the Summary of Alternatives section and listed in Table 9. The action-specific ARARs focus on management of materials and waste and the regulation of air emissions that may result from remediation activities at the OCVZ operable unit—no chemical- and location-specific ARARs are identified. The specific substantive requirements of the action-specific ARARs are:

- Identification of hazardous wastes that may be generated from remediation activities
- Control of emissions from vapor treatment and recovery systems
- Measures to reduce potential fugitive dust from well drilling and capping activities.

8.2 Balancing Criteria

Each alternative that satisfies the threshold criteria is evaluated against each of the five balancing criteria. The balancing criteria are used in refining the selection of the candidate alternatives for the site. The five balancing criteria are: (1) long-term effectiveness and permanence; (2) reduction of toxicity, mobility, or volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost. Each criterion is further explained in the following sections.

8.2.1 Long-Term Effectiveness and Permanence

This criterion evaluates the long-term effectiveness of alternatives in maintaining protection of human health and the environment.

Alternatives 2 and 3 provide the greatest level of long-term effectiveness and permanence by targeting for recovery and treatment vapor contaminants present throughout the upper portion of the vadose zone. Alternative 2 provides a slightly lower level of long-term effectiveness than Alternative 3 because it does not incorporate an option to enhance contaminant recovery. In other words, Alternative 2 has a slightly greater potential than Alternative 3 to leave untreated contaminants in the vadose zone, although this potential is considered to be fairly small because the RI did not indicate that there was a significant amount of the COCs partitioned to perched groundwater and/or the sedimentary interbeds; i.e., regions of the vadose zone that would be targeted for enhanced recovery if contaminants were prevalent there. A degree of risk would remain with Alternatives 2 and 3 because it is not possible to remove and treat all of the vadose zone organic contaminants.

Alternative 1 also provides long-term effectiveness and permanence, but to a lesser degree than Alternatives 2 and 3 due to uncertainties associated with its performance and due to its lack of contaminant removal and treatment. That is, Alternative 1 is a less reliable remedy, and the degree of risk remaining after it is implemented would be greater than the risk remaining under Alternatives 2 or 3.

The No Action Alternative provides the lowest level of long-term effectiveness and permanence as it provides no recovery or measures to reduce the migration of contaminants through the vadose zone toward the SRPA.

8.2.2 Reduction of Toxicity, Mobility, or Volume through Treatment

This criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies, which permanently reduce toxicity, mobility, or volume of the hazardous substances as their principal element.

Alternatives 2 and 3 each provide a reduction in the volume of organic contaminants present in the vadose zone. The reduction in volume is accomplished by removing vapors with a VVE system and treating the removed organic contaminants. Alternative 3 offers an advantage over Alternative 2 because it has a greater potential to achieve the necessary organic contaminant removal more effectively by enhancing the recovery of the VVE system through heating of areas of the vadose zone. The overall improvement in contaminant recovery afforded by Alternative 3 over Alternative 2 cannot be fully evaluated at this time. It is reasonable to assume, however, that some benefit to contaminant recovery would be realized.

Alternative 1 does not provide any treatment of the contaminants present; however, it does limit the mobility of contaminants present in the vadose zone by minimizing the infiltration rate directly below the SDA. The No Action Alternative provides no reduction in toxicity, mobility, or volume of the contaminants present in the vadose zone.

8.2.3 Short-Term Effectiveness

Short-term effectiveness addresses the effects of each alternative during its construction and implementation phase until remedial action objectives are achieved. Under this criterion, the alternatives are evaluated with respect to their impacts on human health and the environment during implementation of the alternative.

In general, alternatives requiring the least amount of construction and/or operation and handling of equipment, residual wastes, etc. rank the highest in terms of short-term effectiveness. As such, the No Action Alternative ranks high under this criterion because it requires no additional on-site activities and does not result in additional acute hazards to the public or the environment.

Alternative 2 ranks slightly higher than Alternative 3 because it is simpler in terms of the amount of equipment and operations personnel involved. Each of these alternatives has a slight potential for worker risks through physical hazards associated with borehole installation and operation/maintenance of the contaminant treatment system. Alternative 3 has additional worker risk associated with the operation of the radio frequency heating system (e.g., electrical and heating hazards). There would be no significant increase in potential risks to the public under any of these treatment alternatives. This is mainly due to the fact that the bulk of the contaminants would remain isolated from the surface environment in their present form within the vadose zone beneath the RWMC. Those contaminants brought to the surface would be controlled by a surface-based vapor treatment system designed to destroy contaminants on-site. The operation of this treatment system would be monitored to ensure that releases of contaminants to the environment do not exceed acceptable air emission levels.

Alternative 1 ranks the lowest of the considered alternatives under this criterion. This alternative would require a significant level of construction activities associated with the installation

of a cap over the SDA. Potential risks to workers, including risks associated with the transportation of needed construction materials to the RWMC, outweigh all other elements under short-term effectiveness.

8.2.4 Implementability

The implementability criterion has the following three factors requiring evaluation: (1) technical feasibility, (2) administrative feasibility, and (3) the availability of services and materials. Technical feasibility requires an evaluation of the ability to construct and operate the technology, the reliability of the technology, the ease of undertaking additional remedial action (if necessary), and monitoring considerations. Administrative feasibility generally includes an evaluation of the coordination of actions between agencies, planning, and personnel training. In terms of services and materials, an evaluation of the following availability factors is required: necessary equipment and specialists, prospective technologies, and cover materials.

Each of the alternatives retained for detailed evaluation is implementable. Alternative 3 ranks lower than Alternatives 2 or 0 for implementability because of its slightly greater complexity in equipment procurement, installation, and operation. Alternative 1 ranks lower than all of the alternatives because of potential difficulties associated with construction of the cap, including: coordination with potential cleanup actions for other OUs at the RWMC (this is an administrative difficulty) and procurement of extensive amounts of materials.

Long-term monitoring under these alternatives would detect any serious failure in recovering or containing vadose zone contaminants, allowing appropriate steps to be taken to preclude significant exposures to contaminated groundwater from the SRPA. Each of the alternatives ranks equally with regard to the implementability of a long-term monitoring program.

8.2.5 Cost

In evaluating project costs, an estimation of the net present value of capital costs and operation and maintenance costs is required. In accordance with CERCLA guidance, the costs presented are estimates (i.e., -30% to +50%). Actual costs could vary based on the final design and detailed cost itemization. The cost estimates for the alternatives analyzed for OCVZ are presented in Table 10. Note that the costs presented for Alternative 2 are provided for each of the three phases of operation that may be implemented. The total cost of each phase is cumulative in that it includes costs from each prior phase.

8.3 Modifying Criteria

The modifying criteria are used in the final evaluation of remedial alternatives. The two modifying criteria are state and community acceptance. For both of these criteria, the factors that are considered include the elements of the alternatives that are supported, the elements of the alternatives that are not supported, and the elements of the alternatives that have strong opposition.

Table 10. OCVZ alternative cost estimates (net present value).

Cost element	Alternative 0 (no action)	Alternative 1	Alternative 2			Alternative 3
			Phase I	Phase II	Phase III	
Construction	0	39,118,000	3,013,000	5,036,000	6,893,000	8,296,000
Operation and Maintenance	0	140,000	4,955,000	11,443,000	19,071,000	45,211,000
Post-Closure Monitoring	4,069,000	4,069,000	4,888,000	5,495,000	6,393,000	6,403,000
Total	4,069,000	43,330,000	12,860,000	21,970,000	32,360,000	59,910,000

8.3.1 State Acceptance

The IDHW concurs with the selected remedial alternative, Extraction/Treatment by VVE. The IDHW has been involved in the development and review of the RI/FS report, the Proposed Plan, this ROD, and other project activities such as public meetings.

8.3.2 Community Acceptance

This assessment evaluates the general community response to the proposed alternatives presented in the Proposed Plan. Specific comments are responded to in the attached Responsiveness Summary portion of this document.

9. SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the detailed analysis of alternatives, and public comments, DOE-ID, EPA, and IDHW have selected Alternative 2—Extraction/Treatment by VVE as the most appropriate remedy for OCVZ, OU 7-08 at the RWMC. In terms of public risk, fate and transport modeling indicates that there is a potential unacceptable risk to future residential receptors using groundwater beginning at about the year 2062. The modeling also indicated that Federal and state drinking water standards would be exceeded for CCl₄, TCE, and PCE due to the migration of these contaminants to the SRPA. Drinking water standards could potentially be exceeded for these contaminants beginning in about 1997 and extending for several hundred years. The exposure of hypothetical future residents to contaminants in groundwater led to the selection of Alternative 2. The extraction of the most significant concentrations of contaminants from the vadose zone with subsequent treatment of the contaminants will reduce the amount of contaminants that will migrate to the SRPA. Extraction/treatment by VVE is believed to be the best alternative for minimizing public risk and providing long-term protection of the SRPA. The success of the VVE treatability study conducted at the RWMC supports the selected remedy. The phased approach of the selected remedy provides a high level of assurance that remedial action objectives will be achieved in a cost-effective manner.

9.1 Extraction/Treatment by VVE Description

The major components of Alternative 2—Extraction/Treatment by VVE include vapor extraction, vapor treatment, and institutional controls such as long-term subsurface vapor and groundwater monitoring. The selected alternative is believed to provide the best balance of trade-offs among the alternatives with respect to the nine CERCLA evaluation criteria. DOE-ID, EPA, and IDHW believe the preferred alternative is protective of human health and the environment, complies with applicable federal and state regulations, and is cost-effective.

Alternative 2 focuses on the extraction of vapor-phase organic contaminants from the vadose zone beneath the RWMC through the use of VVE. Alternative 2 will commence with extraction via the existing vapor extraction well that supported VVE tests and five additional vapor extraction wells located to recover the most significant concentrations of vapor-phase organic contaminants from the vadose zone (see Figure 11). This arrangement of six vapor extraction wells is considered the first phase of Alternative 2. Extracted vapors will be treated at the surface to destroy the organic contaminants. Vapor monitoring wells will also be installed to monitor changes in contaminant concentrations in the vadose zone as a result of the vapor extraction operations. If, following an evaluation of the implemented remedy (approximately two years after implementation), the agencies conclude that data from modeling and monitoring show that vadose zone contamination is not being sufficiently reduced to prevent Federal and state MCLs from being significantly exceeded in the aquifer (see Section 9.2), additional phases of Alternative 2 may be proposed. It is expected that there would be no need for Alternative 2 to be expanded beyond a third phase of operation. A third phase could entail the operation of up to approximately fourteen vapor extraction wells (assumed for cost estimating purposes) located at and within the vicinity of the RWMC. A detailed description of the use of phases under Alternative 2 is provided in Section 7.5 of this ROD.

In addition to the extraction and treatment of the vadose zone contaminants, Alternative 2 will include long-term groundwater and soil vapor monitoring to confirm the ability of the vapor extraction system to prevent contaminants from migrating to the SRPA at levels that would result in unacceptable groundwater contaminant concentrations. Such monitoring will continue after remediation to verify that organic contaminant concentrations in the vadose zone and groundwater remain below acceptable levels.

9.2 Remediation Goals

The purpose of Alternative 2 is to reduce the concentration of organic contaminants presently in the vadose zone and, consequently, the amount of contaminants reaching the SRPA in the future. This reduction in organic contaminants will ensure that risks to future groundwater users are within acceptable guidelines and that future contaminant concentrations in the aquifer remain below Federal and state MCLs.

The alternative will be designed so that the remedial system achieves the remedial action objectives and associated PRGs. The PRGs have been estimated through fate and transport modeling as vadose zone vapor contaminant concentrations that *will not* result in future groundwater contaminant concentrations exceeding Federal and state MCLs. The PRG for the contaminant present in the most significant concentrations, CCl_4 , is approximately 30 to 200 ppmv, depending on

the location within the vadose zone. The other vadose zone contaminants have similar cleanup goals. Contaminants remaining in the vadose zone after implementing Alternative 2 will not result in unacceptable future risks to human health and the environment, nor will they result in a violation of Federal and state MCLs.

The PRG range of 30 to 200 ppmv for CCl_4 is strictly an estimate of the CCl_4 concentration, which is based on information available to date, that will enable the remedial action objectives to be achieved. It should be noted that PRGs for the OCVZ operable unit cannot be identified as discrete COC concentrations in the vadose zone because of: (1) the complex relationship between vadose zone COC concentrations and future groundwater COC concentrations, and (2) the lack of regulatory driven standards for the COCs in vadose zone soils. During the implementation of the selected remedy, information will be obtained that will allow concentrations of the vadose zone COCs to be further defined. A better definition of the COC concentrations will allow PRGs to be refined, i.e., the targeted concentrations at various locations throughout the contaminated region of the vadose zone could be identified more specifically, and attainment of remedial action objectives more readily determined. The future refinement of PRGs will be agreed upon by the DOE, EPA, and IDHW. Such a refinement will increase the three agencies' confidence that remedial action objectives, which *will not* change, can be met and maintained.

Flexibility in cleanup goals for the OCVZ is essential for the selected remedial alternative given the level of additional information on the OCVZ that is expected to be obtained during each of the potential phases of Alternative 2. The cleanup goals will require a significant amount of re-evaluation during the course of remedial action. A re-evaluation will be focused primarily on fate and transport modeling, which will take into account information gathered while carrying out the selected remedy as well as any future cleanup actions that may take place with the pits and trenches at the SDA. Changes in fate and transport modeling will likely have an impact on the PRGs for the OCVZ.

For those remedial actions that allow hazardous substances to remain on-site, Section 121 (c) of CERCLA requires that a review be conducted of the remedy within five years after initiation of the remedial action and at least once every five years thereafter. The purpose of this review is to evaluate the remedy's performance—to ensure that the remedy has achieved, or will achieve, the remedial action objectives set forth in the ROD and that it continues to be protective of human health and the environment. During implementation of Alternative 2 at OCVZ, the remedy's performance will be reviewed on a two year (24 month) cycle, with each phase of operation under Alternative 2 expected to last at least two years. The review cycle is detailed under the description of the phases of Alternative 2, page 46. Per CERCLA, a review of the site will be conducted five years after extraction/treatment operations are discontinued.

9.3 Estimated Costs for the Selected Remedy

A summary of cost for each of the alternatives was presented in Table 10. A more detailed cost breakdown for each of the three potential phases of Alternative 2 are provided in Table 11. These costs were annualized where appropriate (e.g., long-term monitoring costs) and summarized in net present value (1993) using a five percent annual discount rate.

Table 11. OCVZ selected remedy cost summary.^a

Cost Elements	Alternative 2 Vapor Vacuum Extraction (VVE)		
	Phase 1	Phase 2	Phase 3
Construction			
VVE/Monitoring Wells	\$558,800	\$967,371	\$1,337,117
Field Personnel	\$76,200	\$131,337	\$181,235
Site Improvements	\$11,025	\$21,003	\$40,291
Treatment System/Discharge Monitor	\$583,473	\$937,257	\$1,257,423
Additional Direct Costs	\$132,691	\$219,740	\$299,603
Project Supervision & Engineering	\$955,532	\$1,597,506	\$2,186,414
Contingency (30 %)	\$695,316	\$1,162,264	\$1,590,624
Construction Subtotal	\$3,013,037	\$5,036,479	\$6,892,706
Operations and Maintenance			
Technical Support	\$75,253	\$211,765	\$373,403
Operating/Maintenance Labor	\$144,320	\$295,623	\$451,363
Materials & Equipment	\$132,735	\$340,475	\$608,127
Vapor Sampling	\$1,805,660	\$4,126,717	\$6,851,732
Additional Direct Costs	\$83,919	\$203,022	\$344,740
Project Supervision & Engineering	\$1,569,320	\$3,624,321	\$6,040,555
Contingency (30 %)	\$1,143,363	\$2,640,578	\$4,400,977
O&M Subtotal	\$4,954,569	\$11,442,502	\$19,070,897
Post Closure Monitoring			
Well Closure/Demolition	\$7,673	\$11,227	\$14,241
Vapor & Groundwater Monitoring	\$3,128,250	\$3,390,684	\$3,943,952
Project Management	\$625,644	\$747,643	\$869,642
Contingency (30 %)	\$1,126,171	\$1,345,763	\$1,565,355
Post Closure Monitoring Subtotal	\$4,887,738	\$5,495,316	\$6,393,189
TOTAL (b).....	\$12,860,000	\$21,970,000	\$32,360,000

(a) All costs represent 1994 dollars at a 5% discount rate.

(b) Total costs have been rounded to the nearest \$10,000 and are cumulative for Alternative 2.

10. STATUTORY DETERMINATIONS

Remedy selection is based on CERCLA, as amended by SARA, and the regulations contained in the NCP. All remedies must meet the threshold criteria established in the NCP: protection of human health and the environment and compliance with ARARs. CERCLA also requires that the remedy use permanent solutions and alternative treatment technologies to the maximum extent practicable and that the implemented action must be cost-effective. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the remedy meets these statutory requirements.

10.1 Protection of Human Health and the Environment

As described in Section 9, the selected remedy satisfies the criterion of overall protection of human health and the environment by reducing the level of organic contamination in the vadose zone beneath and within the immediate vicinity of the RWMC and, consequently, reducing the risk associated with the future use of groundwater from the SRPA. The remedy will ensure that cumulative carcinogenic risk levels are maintained within the NCP risk range (1×10^{-4} to 1×10^{-6}), and the cumulative hazard index is maintained less than 1.

The selected remedy will extract and treat (i.e., destroy) the most significant concentrations of organic contaminants currently in the vadose zone. The remedy will include long-term groundwater and soil vapor monitoring to confirm the ability of the vapor extraction system to prevent unacceptable levels of contaminants from migrating to the SRPA. The agencies will be involved in reviewing the performance of the remedy as part of potential phase transitions expected to occur every two years after commencement (see description of Alternative 2 phases on page 46 as well as the description of remediation goals on page 54). Once remedial action objectives are achieved and maintained and the remedy is discontinued, the agencies will review the OCVZ after a period of five years to ensure that human health and the environment are being protected. No unacceptable short term risks will be associated with this remedy.

10.2 Compliance with ARARs

The selected remedy of Extraction/Treatment by VVE will be designed to meet all substantive requirements of the identified Federal and state ARARs. The ARARs that will be achieved by the selected alternative follow.

10.2.1 Chemical-Specific ARARs

No chemical-specific ARARs are identified for the selected remedy. Soil-specific regulatory standards have not been promulgated by EPA or the State of Idaho.

10.2.2 Action-Specific ARARs

The action-specific ARARs identified for the selected remedy focus on the management of materials and waste and the regulation of air emissions that may result from any remediation activities at OCVZ. Regulations that focus on hazardous contaminants include:

RCRA

- IDAPA § 16.01.050.5005 (40 CFR 261.10, 261.20 through 261.24), "Idaho Rules, Regulations, and Standards for Hazardous Waste" identification and characterization. (Relevant and Appropriate)

If there are residuals that are hazardous, then Idaho's standards for generators of hazardous waste (IDAPA § 16.01.050.06) will be complied with throughout the implementation of this alternative.

- 40 CFR 264.600 et seq involving prevention of releases from hazardous waste constituents in miscellaneous units. The overall intent of this regulation is to provide protection of human health and the environment. (Relevant and Appropriate)

Governing regulations that focus on air quality include:

Clean Air Act

- 40 CFR 61.92, "National Emission Standards for Radionuclide Emission from DOE Facilities" (Applicable).
- IDAPA § 16.01.01.577, "Ambient Air Quality Standards for Specific Air Pollutants" (Applicable).

Idaho Toxic Air Pollutants for Non-carcinogenic and Carcinogenic Increments

- IDAPA §16.01.015.85 and 16.01.015.86 for any source constructed after May 1, 1994 (Applicable).

Idaho Rules for Control of Fugitive Dust

- IDAPA §16.01.01.651 (Applicable).

Idaho Demonstration of Preconstruction Compliance with Toxic Standards

- IDAPA §16.01.01.210.10 (Relevant and Appropriate).

10.2.3 Location-Specific ARARs

No location-specific ARARs are identified for the selected remedy as there are no known threatened and endangered species, wetlands, rivers, or floodplains located in the area of remedial activities.

10.2.4 To-Be-Considered Guidance

In implementing the selected remedy, the agencies have agreed to consider DOE Order 5820.2A, "Radioactive Waste Management" as to-be-considered guidance. The guidance is not legally binding.

DOE Order 5820.2A establishes policy, guidelines, and minimum requirements for radioactive and mixed waste management. The policy establishes that radioactive and mixed waste generation, treatment, storage, transportation, and disposal operations comply with all applicable Federal, state and local requirements. Authorities within DOE who are responsible for policy implementation are identified.

10.3 Cost Effectiveness

Based on expected performance, the selected remedy has been determined to be cost-effective. This is evident when considering the cost of Alternative 1, Containment of Vadose Zone Vapors by Capping, which is estimated to be over three times the estimated costs of the selected remedy, yet there is a high level of uncertainty associated with the ability of capping to achieve remedial action objectives. Likewise, there is a high level of uncertainty in estimating the benefits to effectiveness that Alternative 3, Extraction/Treatment by VVE with Vaporization Enhancement, would have over the selected remedy. Alternative 3 has an estimated cost that is over four times that of the selected remedy.

10.4 Use of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy utilizes permanent solutions to the maximum extent practicable for this site. The NCP prefers a permanent solution whenever possible. Because contamination at OCVZ is so extensive and the concentrations of contaminants decrease with distance from the SDA, the selected remedy focuses on the extraction and treatment of only the most concentrated areas of contamination. Those contaminants remaining in the vadose zone will not pose unacceptable risks to potential receptors. The selected remedy provides protection of human health and the environment by preventing unacceptable levels of organic vapors from migrating to the SRPA and the surface. Based on evaluation of the CERCLA remedial alternative criteria, and in particular the five balancing criteria, extraction/treatment by VVE will provide the best solution in terms of long- and short-term effectiveness, cost, and implementability.

10.5 Preference for Treatment as a Principal Element

Because the OCVZ investigation indicated that no action would lead to unacceptable levels of contaminants reaching the SRPA and that an attempt to contain the contaminants in the vadose zone above the aquifer would not provide reasonable assurance that the aquifer would be protected, extraction and treatment of the vadose zone contaminants was viewed as being the only alternative that would meet remedial action objectives for OCVZ. Extraction and treatment of OCVZ contaminants under the selected remedy includes destruction of the organic contaminant with a vapor treatment system (catalytic oxidation) at the surface. This type of treatment is irreversible because contaminants are converted to carbon dioxide, water, and HCl gas, which will be discharged at acceptable levels to the atmosphere.

11. DOCUMENTATION OF SIGNIFICANT CHANGES

The proposed plan for OCVZ was released for public comment in March 1994. The proposed plan identified Alternative 2—Extraction/Treatment by VVE, as the preferred alternative. The agencies reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments and preparation of the ROD, it was determined that no significant changes to the remedy would be required.

The source term for fate and transport modeling of contaminant migration in the vadose zone was based on estimates by Kudera (see reference on page 9) of the inventory of organic contaminants shipped from the Rocky Flats Plant in Colorado to the SDA between 1966 and 1970. Since the modeling and the risk assessment were conducted, estimates of the amount of organic wastes buried in the SDA have been revised for the development of the Contaminant Inventory Database for Risk Assessment (CIDRA). The CIDRA database is contained in *A Comprehensive Inventory of Radiological and Nonradiological Contaminants in Waste Buried in the Subsurface Disposal Area of the INEL RWMC During the Years 1952-1983*, EG&G Idaho, Inc., June 1994 (EGG-WM-10903). According to the CIDRA database, less CCl_4 and more TCE and TCA were disposed of in the SDA than originally estimated by Kudera. The revised estimates are not considered to warrant a significant change to the selected remedy because: (1) the model upon which the risk assessment is based was calibrated to VOC concentrations measured in the vadose zone in 1992; and (2) the selected remedy, VVE, will extract and treat all of the VOCs considered to be COCs, regardless of the relative concentrations of the organic contaminants in the vadose zone.

Appendix A

Responsiveness Summary

Appendix A

Responsiveness Summary

A.1 OVERVIEW

Operable Unit (OU) 7-08 is an OU within Waste Area Group (WAG) 7 of the Radioactive Waste Management Complex (RWMC) at the Idaho National Engineering Laboratory (INEL). The unit comprises the Organic Contamination in the Vadose Zone (OCVZ), as described in the Record of Decision (ROD) to which this Responsiveness Summary is attached. A Proposed Plan was released March 28, 1994, with a public comment period from March 31 to April 30, 1994. The Proposed Plan recommended a phased approach using Extraction/Treatment by a Vapor Vacuum Extraction (VVE) system. Under the plan, the existing VVE system would be augmented with additional extraction wells, monitoring wells, and vapor treatment equipment. This Responsiveness Summary recaps and responds to the comments received during the comment period. Generally, the comments reflected a broad range of views, from strong support for the selected alternative to opposition challenging the baseline data used by the agencies to select the selected alternative.

A.2 BACKGROUND ON COMMUNITY INVOLVEMENT

To initiate the OCVZ investigation, public scoping meetings were held December 9, 10, 11, 12, 1991 in Boise, Moscow, Twin Falls, and Idaho Falls, respectively. Approximately 125 people attended the four meetings. The meetings were designed to involve the public early in the investigation; to explain the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process; and to allow representatives from DOE and INEL to discuss the project, answer both written and verbal questions, and receive ideas and suggestions from the public. The scoping meetings were announced via a fact sheet conveyed through a "Dear Citizen" letter mailed on November 19, 1991, to a mailing list of 5,600 individuals in the general public and 11,700 employees of INEL. On November 20, 1991, the U.S. Department of Energy, Idaho Operations Office (DOE-ID), issued a news release to more than 40 newspaper, radio, and television media contacts. Both the letter and release gave notice to the public that OCVZ documents would be available before the beginning of the comment period in the Administrative Record section of the INEL Information Repositories located in the INEL Technical Library of Idaho Falls, as well as in city libraries in Idaho Falls, Pocatello, Twin Falls, Boise, and Moscow. Additionally, the letter and release notified the public of the various ways in which they could participate in the investigations and decision-making process.

Display advertisements announcing the 30-day public comment period on OCVZ appeared between November 20 and November 27, 1991, in eight major Idaho newspapers: the *Post Register* in Idaho Falls, the *Idaho State Journal* in Pocatello, the *South Idaho Press* in Burley, the *Times News* in Twin Falls, the *Idaho Statesman* in Boise, the *Idaho Press Tribune* in Nampa, the *Lewiston Morning Tribune* in Lewiston, and the *Idahonian* in Moscow. Similar display advertisements reminding the public of the upcoming meetings appeared in each of these newspapers several days preceding each local meeting to encourage citizens to attend and provide oral or written comments. All three media—the "Dear Citizen" letter, news release, and display advertisements—gave notice of the four

public scoping meetings and the beginning of the 30-day comment period on December 4, 1991. Two radio stations in Idaho Falls repeated announcements from the news release to the public at large.

Personal telephone calls concerning the availability of OCVZ documents and public meetings were made to key individuals, environmental groups, and organizations by INEL Outreach Office staff in Pocatello, Twin Falls, and Boise. Calls were also made to community leaders in Idaho Falls and Moscow by INEL Community Relations Program staff in Idaho Falls and Boise.

During the meetings that followed, representatives from DOE-ID and INEL discussed the project, answered questions, and received public comments. Forms for written comments were distributed at the meetings and the audience was encouraged to comment on the project. The comments received during the public scoping period were evaluated and considered as part of the Remedial Investigation/Feasibility Study (RI/FS) process.

Regular reports concerning the status of the OCVZ project were included in the *INEL Reporter* and mailed to those who attended the meetings and who were on the mailing list. Reports appeared in the March, May, July, and November 1992 and January, March, and July 1993 issues of the *INEL Reporter*.

When the investigation was complete, a Notice of Availability for the OCVZ Proposed Plan was published between March 15 and March 20, 1994, in the *Post Register* (Idaho Falls), the *Idaho State Journal* (Pocatello), the *South Idaho Press* (Burley), the *Times News* (Twin Falls), the *Idaho Statesman* (Boise), the *Lewiston Morning Tribune* (Lewiston), and *The Daily News* (Moscow). A second advertisement was placed in the same newspapers several days before each open house or meeting to remind citizens of the opportunity to attend the meetings and provide oral or written comments. Radio stations in Idaho Falls, Blackfoot, Pocatello, Burley, and Twin Falls ran advertisements during the three days before the open houses at the Pine Ridge Mall in Pocatello and the INEL office in Twin Falls.

The Proposed Plan for the remedial action of OCVZ was mailed March 28, 1994, to the 7,000 members of the general public and the 400 INEL employees on the INEL mailing list. Copies of the Proposed Plan and the entire Administrative Record are available to the public in six regional INEL information repositories: the INEL Technical Library in Idaho Falls; INEL offices in Idaho Falls, Pocatello, Twin Falls, and Boise; the University of Idaho Library in Moscow; and the Shoshone Bannock Library in Fort Hall. The original documents comprising the Administrative Record are located at the INEL Technical Library; copies from the originals are present in the five other repositories.

The public comment period on the Proposed Plan for OCVZ was held from March 31, 1994, to April 30, 1994. No requests for extensions were received. On April 13, 1994, a teleconference between the League of Woman Voters of Moscow, the Environmental Defense Institute, DOE-ID, EPA, and IDHW concerning INEL environmental restoration issues was conducted at the request of Moscow area residents. The teleconference consisted of an overview of the proposed plan, questions and answers, and a general discussion of OCVZ issues.

Open houses were held on April 12 and April 14, 1994, in Pocatello and Twin Falls, respectively; representatives from DOE-ID and IDHW attended the events to discuss the project and

answer questions. Mall display sessions were conducted throughout the day of the meeting at each location to provide access to information for individuals unable to attend the public meetings. Public meetings were held April 18, 20, and 21, 1994, in Idaho Falls, Boise, and Moscow, respectively. Approximately 83 people attended the three meetings. Representatives from DOE-ID, EPA Region X, and IDHW were present at the public meetings to discuss the project, answer questions, and receive public comments. Each public meeting was recorded by a court reporter; transcripts of the meetings have been placed in the Administrative Record.

This Responsiveness Summary has been prepared as part of the ROD. All oral comments, as given at the public meetings, and all written comments are repeated verbatim in the Administrative Record for the ROD. Fifteen people submitted written comments on the OCVZ proposal and 12 people gave oral comments at the public meetings. To more fully respond to each issue raised in the comments, DOE divided the comments received into 91 separate comments. The comments received were coded to indicate which response in the Responsiveness Summary addresses the comment. It should be noted that the Responsiveness Summary groups similar comments, summarizes them, and provides a single response. The ROD presents the preferred alternative for the OCVZ at the RWMC, selected in accordance with CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The decision for this OU is based on information contained in the Administrative Record.

A.3 SUMMARY OF COMMENTS RECEIVED DURING PUBLIC COMMENT PERIOD

Comments and questions raised during the public comment period on the OCVZ Proposed Plan are summarized below. Several questions were answered during the informal question-and-answer period during the public meetings on the Proposed Plan. This Responsiveness Summary does not attempt to summarize or respond to the issues and concerns raised during that part of the public meeting. However, the Administrative Record contains complete transcripts of these meetings, which contain the agencies' responses to these informal questions.

As discussed earlier, the public meetings were divided into an informal question-and-answer session and a formal public comment session. The meeting format was described in published announcements and meeting attendees were reminded of the format at the beginning of each meeting. The informal question-and-answer session was designed to provide immediate responses to the public's questions and concerns. Comments received during the formal comment portion of each meeting were responded to by the agencies in this Responsiveness Summary. The public was requested to provide their formal comments on the Proposed Plan either during the formal comment session of the meeting or in writing before the close of the public comment period. This Responsiveness Summary responds to those public comments that were recorded by the court reporter during the formal comment portion of the public meeting or that were submitted in writing before the close of the public comment period.

Comments and questions on a variety of subjects not specific to the OCVZ Proposed Plan were submitted during the public comment period. The agencies take public comments very seriously and have made every attempt to respond to all comments. Some comments, however, are beyond the

scope of the OCVZ Proposed Plan (i.e., statements of personal belief, favorable comments about DOE operations in other places, offers of technical assistance). While these comments are summarized and grouped at the end of the Responsiveness Summary, the agencies have not attempted to respond to these out-of-scope comments. However, additional information on these topics can be obtained from the INEL Public Affairs Office in Idaho Falls; the local INEL offices in Pocatello, Twin Falls, and Boise; and the Environmental Restoration Information Office in Moscow. Comments and questions regarding community participation were referred to the INEL Community Relations Coordinator and will be addressed during updates to the Community Relations Plan. Formal comments and questions on OCVZ submitted during the public comment period are answered below.

A.3.1 Public Participation

1. **Comment:** One commenter expressed serious distrust for the entire public comment process. The commenter suggested that the three agencies had met in secret and that it is farcical for the public to think it can change what the agencies have already predetermined. (W15-1)

Response: Comments received from the public during the scoping meetings and on the Proposed Plan are taken very seriously by the agencies and have shaped the OCVZ project. For example, one commenter suggested using natural venting or barometric pressure as an alternative method of extracting VOCs from the subsurface, which has the potential to save taxpayer dollars. The agencies are pursuing this suggestion and are currently discussing the use of this approach after the completion of Phase I, especially if there are indications that contaminant concentrations have been reduced to levels that no longer threaten the public health or environment. Through active public participation, the public can and very often does change or modify the agencies' decision.

2. **Comment:** One commenter is concerned that this project will be lost in the bureaucratic shuffle and reminded the agencies of the importance of accurate record-keeping. The commenter also wanted more information about whether the project data are being kept in computer form and whether the data is kept in places accessible to the public. (T8-6, T8-8)

Response: All sampling data, reports, and project files are kept on electronic media as well as paper copies. Reports are available to the public through the Administrative Record and at the Information Repositories, both of which are accessible to the public during normal business hours. Additional information can be requested through a FOIA (Freedom of Information Act) request filed with the U.S. Department of Energy. It is the agencies' policy to place all information that supports the decision-making processes for the particular operable units in the Administrative Record.

3. **Comment:** Several commenters commended the agencies for their efforts to include the public. Many commenters indicated that they appreciated the opportunity to be involved and asked to be notified about updated information. (T12-1, W1-1, W1-3, W2-2, W9-1, W11-1, W16-3)

Response: The agencies appreciate the public's efforts to become involved with these cleanup projects. Everyone who commented will receive a copy of the ROD, which includes this

Responsiveness Summary. Additionally, commenters will receive information on future INEL projects.

A.3.2 Risk Assessment

4. **Comment:** What forces were considered in the model (e.g., gravity, capillary attraction, atmospheric pressure) and the physical phase of the contaminants (e.g., gaseous, liquid, or both)? (W8-2)

Response: The forces considered in the risk assessment model (diffusion of the vapor phase, advection of the aqueous phase, and dissolution or phase-partitioning) were those believed to have the most significant impact on the fate and transport of VOCs in the vadose zone. Vapor advection due to density-gradients or barometric pumping, sorption, degradation, and reactions were considered but not included because of their estimated lack of importance and (in some cases) difficulty to implement and verify. During the comprehensive WAG 7 evaluation, these assumptions will be reevaluated. Barometric pumping will be given an especially close scrutiny because of its potential usefulness as a passive remediation technology. More information about the forces considered in the risk assessment model can be found in Section 5.3.1.3 of the remedial investigation (Page 5-31).

5. **Comment:** One commenter asked whether the agencies had allowed for uncertainty. (W13-1)

Response: The agencies allowed for uncertainty by conducting an uncertainty analysis as part of the Baseline Risk Assessment (BRA) (See Section 6.1.5 of Volume 1 of the RI report). Uncertainties in the BRA are due to uncertainties in the risk assessment process in general, specific uncertainties in characterizing and modeling the site, and uncertainties associated with accurately describing exposures. The Superfund process of estimating risk does not yield fully probabilistic risk estimates, but conditional estimates given a considerable number of assumptions about exposure and toxicity. The uncertainty factors associated with OCVZ, which include the extent of the vapor plume, source volumes, and moisture contents in the subsurface, are described in detail in Table 6-18 on page 6-61 of the RI report.

6. **Comment:** A commenter asked what correlation exists, if any, between the transport model and the model previously used for water (Schmalz and Polzer, *Soil Science*, vol. 108, no. 1, 1969). (W8-1)

Response: It is not known what correlation exists between the transport model and the Schmalz and Polzer model for water movement. However, the transport model was used to simulate the xenon gas injection test conducted in 1960 near Test Area North and reported by Schmalz (1969). The simulation considered vapor diffusion and advection and was successful in recreating the results of the xenon gas injection test. Aqueous advection from natural water movement was not considered due to the short duration of the test and because Xenon-133 has very low solubility in water. Aqueous advection was considered in the OCVZ transport model because of the long time-frame examined and the tendency of the organic compounds to partition into the water.

7. **Comment:** One commenter asked what degree of conservatism was introduced in the risk analysis: 10, 100, or 10,000? The commenter further stated the public should not have to search through pages 6-60 in the RI report for this vital information. (W15-8)

Response: Conservatism is introduced into the modeling and risk analysis at various points, making it difficult to estimate the total degree of conservatism. Modeling uncertainty is dealt with by using conservative parameter estimates. The strategy was to use realistic and reasonable parameter values where possible and conservative parameter estimates where there was little supporting data. It is estimated that the conservativeness of the modeling is about an order of magnitude or a factor of 10. Conservatism in the risk analysis is estimated to range from 1 to 2 orders of magnitude. This conservatism comes primarily from uncertainty factors used to account for variation in the general population, extrapolating data from animals to humans, derivation of chronic exposure limits from subchronic studies, exposure parameters, and similar issues. Therefore, the total degree of conservativeness is estimated to range from 2 to 3 orders of magnitude. However, this is not included in the report because of the complexities and difficulty in making this estimate.

A.3.3 General Technical Comments

8. **Comment:** One commenter suggested that the aquifer is comparable to a huge lake without appreciable movement and any infiltration would simply remain there and decompose. (W5-3)

Response: Unlike a lake, the area beneath the Subsurface Disposal Area at the RWMC compares more closely with a sponge. Air permeability of the vadose zone plays an important role in the vapor-phase contaminant migration to the air and groundwater pathways. Regional horizontal groundwater flow of the Snake River Plain Aquifer is to the south-southwest at rates of about 1.5 to 6 meters (5 to 20 feet) per day. The RI and baseline risk assessment results indicated that groundwater contamination due to the migration of the vadose zone organic contaminants to the aquifer will present the most significant future risk to human health if no action is taken. The modeling done as part of the RI and the risk assessment predicted that the contaminant plume would not remain in place, but rather travel several miles downgradient of the SDA if the vadose zone is not remediated. The selected remedy will be designed to minimize the migration of contaminants and reduce contaminant concentrations to levels that do not pose a significant threat to human health or the environment.

9. **Comment:** One commenter stated that there was no mention of the driving force that would continue to expand the vapor plume and suggested that the vapors would decrease to zero as evidenced by the 1960 field experiment. (W15-2)

Response: Lateral migration or expansion of the plume occurs primarily by vapor diffusion. The 1960 experiment referenced by the commenter involved injecting radioactive xenon gas into the subsurface at Test Area North. The gas concentrations decreased quickly because a relatively small amount of gas was injected. The gas also had a short half-life and decayed fairly rapidly. Thus, the results from the earlier experiment are not readily applicable to the situation at OCVZ.

10. **Comment:** Have any measurable organic contaminants been detected by air sampling at the Subsurface Disposal Area? (W15-3)

Response: Very little data exist regarding VOC concentrations in ambient air at the RWMC. VOCs were detected at the Pad A Excavation Area and at the Pad A Subsidence Hole (which are within the RWMC). Carbon tetrachloride concentrations of 17.0 milligrams per cubic meter were recorded at the Pad A Excavation Area and 11.0 milligrams per cubic meter were recorded at the Pad A Subsidence Hole. Grab air samples were collected at the Subsurface Disposal Area in 1987. These samples were collected above and within wellheads to assess worker exposure. The resulting data were not sufficient to evaluate long-term risks to human health either on or off the INEL. The volatile organics carbon tetrachloride, trichloroethylene, chloroform, tetrachloroethylene, 1,1,1-trichloroethane, and 1,1,2-trichloro-trifluoromethane were detected above their respective method quantitation limits at several of the wells. The samples represented an isolated incident and were not used to establish long-term average concentrations. Air monitoring around the RWMC, however, has not detected adverse atmospheric concentrations of VOCs.

11. **Comment:** One commenter wanted to know how long DOE-ID has been monitoring the vadose zone. The commenter asked what changes in the rate of vapor expansion were noted during the 1993 extraction. (W15-4)

Response: Vadose zone investigations at the RWMC began in 1960 and were conducted by several organizations, including the U.S. Geological Survey and EG&G Idaho, Inc. Subsurface monitoring is still being conducted as part of a subsurface investigation program that began in 1985. The investigation, which had focused on subsurface geology and hydrology to assess radionuclide migration, was expanded to include VOCs in 1987 (Mann and Knobel 1987). Because vapor phase volatile organics have only been recognized in the Subsurface Disposal Area vadose zone since 1987, the amount of data available and its distribution in the vadose media is less than the amount of data related to radionuclide and inorganic compounds.

Treatability studies are conducted to assess the effectiveness of treatment technologies that may be used at a specific site. The 1993 treatability study conducted at OCVZ evaluated the hydraulic characteristics of the vadose zone and attempted to determine how to optimize the VVE performance. No attempt was made to evaluate the expansion rate of the vapor plume during this treatability study and, thus, the agencies do not know whether there has been a reduction in the rate of vapor expansion. However, based on the quantities of contaminants extracted and treated during the treatability study, it is logical to conclude that the highest VOC concentration areas may have been temporarily reduced.

12. **Comment:** One commenter wanted to know what consideration had been given to the effect of "drying out" (removing moisture from) the vadose zone as a result of the flow of large volumes of air through it. For example, will this phenomenon occur, and if so, to what extent, and will it have a positive or negative influence on VOC fate and transport in the subsurface environment? (W14-5)

Response: The selected remedy will have the effect of drawing cleaner air through the vadose zone (from the surrounding uncontaminated subsurface) and will induce VOCs to partition or

separate from water into air. Thus, it is not likely that the selected alternative, Extraction/Treatment by VVE will significantly "dry out" the moisture from the vadose zone.

13. **Comment:** One commenter suggested restarting the existing VVE system instead of leaving it idle while the five additional Phase I extraction/monitoring wells are installed. The commenter argued that approximately 13,832 pounds of VOCs can be removed from below the Subsurface Disposal Area before Phase I is scheduled to become operational. Thus, the commenter believes that the agencies should "just get on with it." The commenter also asserted that restarting the existing system would provide a better return on the public's tax dollar investment. (W14-7)

Response: The agencies are not currently considering immediately restarting the existing VVE system because of difficulties associated with the handling and regeneration of contaminant-saturated carbon adsorption beds used during the earlier extraction process. The related disposal problems are one of the reasons that catalytic oxidation (CATOX) is being evaluated as a vapor treatment system. Until the CATOX systems are available, however, the agencies will not be able to begin extraction and treatment. The Proposed Plan includes the use of the existing extraction well and VVE system used (with CATOX modification) in the Treatability Study. By spending the time to pre-plan the remedial action, by locating the most appropriate place for the extraction/monitoring wells to ensure that VOCs are removed from the most permeable zone of the subsurface, and by ensuring that the remedial action is conducted in the safest manner possible, the taxpayers are, in a sense, getting a better return on their dollar.

14. **Comment:** Two commenters stated that using natural venting or barometric pressure would be more cost effective than the Extraction/Treatment by VVE alternative proposed by the agencies. (T1-4, W14-10) Another commenter, however, argued that natural venting would be slower and would take too many years. (T2-2)

Response: The agencies are currently considering implementing natural venting or a combination of natural venting and Extraction/Treatment by VVE after Phase I, especially if the results from the Phase I activity demonstrate sufficient reduction in contaminant levels. Originally, barometric pressure to vent contaminants (barometric pumping) was evaluated but it was not considered in the conceptual fate and transport model. The commenter who stated that natural or barometric pumping would remove VOCs at a slower rate than the selected alternative is correct. Therefore, due to uncertainty about the length of time required to reduce contaminant concentrations to safe levels and the potential for ambient air pollution, the agencies decided not to more fully explore this option. Additionally, the agencies did not believe this treatment option would meet the remedial action objective of preventing organic contaminant migration to the groundwater that would result in exceeding acceptable risk levels and/or federal and state maximum-contaminant levels. The natural venting or barometric pressure option may, however, be more fully evaluated during the comprehensive WAG 7 evaluation.

15. **Comment:** One commenter questioned the agencies' characterization of the rate of movement by contaminants from the surface to the groundwater, stating that too much documentation from other sources contradicts the characterization. (T10-3)

Response: The agencies agree with the commenter that there is uncertainty in predicting migration rates, especially of volatile organic compounds. Volatile organic compounds are highly mobile due to their ability to exist and move in a vapor state. However, a number of field investigations have been conducted at the RWMC that support the conclusions of the modeling. These investigations included the collection of geologic, hydrologic, and meteorologic data, and sampling and analysis of surficial soil, soil vapor, perched water, and groundwater. The agencies cannot comment on the general statement concerning contradicting documentation mentioned by the commenter, however, the agencies believe predictions of the rate at which contaminants move from the surface to the groundwater are realistic, reasonable, and consistent.

16. **Comment:** One commenter wants to know whether there is a way to automate the process (VVE) to reduce the labor costs involved with the activity. (T8-2)

Response: The Extraction/Treatment by VVE system is automated, which is one reason why the agencies selected this as the preferred treatment alternative. The system requires minimal labor hours to operate and maintain. Although monitoring of the system will require additional labor hours, the contractor's use of computerized gas chromatographs will reduce labor hours. Wherever possible, new technology and automated systems will be evaluated and used.

17. **Comment:** One commenter inquired whether there was a way to recover the organic vapor of the solvents and reuse it elsewhere. (T8-3)

Response: Organic solvents could be recovered and reclaimed from the vadose zone using the PURIS technology. Unfortunately, no viable use could be identified for the mixture of solvents that would be recovered.

18. **Comment:** One commenter wanted more information about the "hazard" that exists with Texaco Regal oil and whether VVE would work in its removal. (W3-4)

Response: Texaco Regal oil is a lightweight machining oil that was used in the late 1960s as a lathe coolant in the foundry at the Rocky Flats Plant near Golden, Colorado. Texaco Regal oil is a mixture of five base oils that were either solvent-dewaxed, paraffin oils, or naphthenic oils. During the process, the lathe coolant was contaminated with carbon tetrachloride and other solvents. The carbon tetrachloride and three other solvents (tetrachloroethylene, trichloroethylene, and 1,1,1-trichloroethane) are the contaminants of concern—not the Texaco Regal oil. Before disposal, the oil was mixed with calcium silicate (an absorbent) to form a viscous, paste-like, green sludge. The solvents, due to their higher vapor pressure, have migrated into the vadose zone in a vapor phase. The Texaco Regal oil is not believed to have migrated from the pits. The purpose of the VVE system is to remove the vapor phase solvents from the vadose zone, not to remove the oils from the pits.

19. **Comment:** One commenter stated that he had yet to see an entity relation diagram or a contact's diagram for a data flow diagram. In other words, he states, what are the inputs, outputs and so forth described? (T8-5)

Response: The agencies are not familiar with an entity relation diagram or the terminology used by the commenter. The agencies interpret the comment to question the validity and

usability of the data used as inputs for the results of the RI/FS and Work Plan. Data Quality Objectives were established in the Work Plan (Chatwin et al. 1992) and detailed in Attachment III to the Work Plan. The validation and data usability summary contained in Section 4.6 of the RI presents an evaluation of the data quality supporting the objectives prescribed in the Work Plan for the OCVZ RI/FS. Data Quality Objectives are established to support the overall objective of data collection: to ensure that the information collected for decision-making at the site is of known and adequate quality and is technically sound, statistically accurate, and properly documented. Per EPA guidance, Data Quality Objectives are expressed in quantitative and qualitative terms of precision, accuracy, representativeness, completeness, and comparability.

A.3.4 General Comments on the Proposed Alternatives

20. **Comment:** One commenter wanted a more in-depth analysis of the in-situ bioremediation alternative. This alternative seems to be passed off lightly as being too difficult to use for subsurface treatment, yet it presents a lower cost alternative. (W1-2)

Response: A discussion of the bioremediation alternative is contained in the Feasibility Study (See Section 3.2.4 at Page 3-24). One of the reasons the agencies decided not to pursue a more in-depth analysis of this alternative is that no bioremediation studies have ever been conducted in the soil type present at the RWMC (i.e., unsaturated, fractured basalt). This lack of information limits the ability to accurately predict bioremediation performance. To perform such an analysis would take many years and increase the cost of such a remedial action. Additionally, it is possible that vinyl chloride may be formed due to incomplete degradation of TCE. Since vinyl chloride is more toxic than TCE, a thorough evaluation of the potential for vinyl chloride formation under site-specific conditions would be required. The variable degradation rates among the organic contaminants of concern caused by site-specific conditions makes it difficult to predict the effectiveness of this option. Thus, the agencies concluded that the uncertainties associated with the bioremediation alternative made it less preferable than the proven effectiveness of Extraction/Treatment by VVE.

21. **Comment:** Several commenters addressed technology transfer, suggesting that technology developed at environmental restoration sites at the INEL be shared with other DOE sites and private industry and be published in trade publications. (T8-1, W3-5, W14-9, W14-10, W14-11)

Response: DOE agrees with the commenters. One of DOE's highest priorities is to promote United States industrial competitiveness through technology transfer. The science and technology developed in DOE research programs, laboratories, and non-laboratory facilities helps form a knowledge base that is one of our country's most valuable national assets. DOE's technology transfer goals include increasing the level of U.S.-based industry participation in DOE research and development, increasing the level of DOE program and laboratory activity in transferring technology, and accelerating the process of transferring technology and knowledge.

Various tools are used to facilitate technology transfer to the private sector. The Environmental Restoration and Waste Management Technology Integration Program has contractual mechanisms by which industry could become involved with ER&WM activities. These include

direct procurement of innovative technologies and research through Program Research and Development Announcements, Research Opportunity Announcements, and cooperative research efforts through Cooperative Research and Development Agreements (CRADAs). ER&WM can also provide assistance to small businesses in areas such as proposal preparation and technology commercialization and business planning. The ER&WM Technology Integration Program also operates a toll-free telephone number (1-800-736-3282) to identify potential matches between private sector representatives (and their technologies) and DOE points of contact, and disseminates information about DOE's R&D programs and associated business and research opportunities.

Environmental restoration technology is also transferred to the private sector through the presentation of papers at environmental remediation and technology conferences held throughout the country. In the past year, INEL scientists and environmental restoration experts presented more than 40 papers at such conferences, which discussed environmental remediation technologies used at the INEL.

22. **Comment:** Two commenters urged the agencies to move forward as soon as possible with implementation of the remedial action. (W3-6, W14-7) Another urged the agencies to start mitigation efforts to head off worse problems in the future. (W4-3)

Response: DOE, with EPA and IDHW concurrence, is accelerating remedial action to the extent practical. Based on the positive comments received in support of Extraction/Treatment by VVE and based on the need to remove organics to reduce the threat to groundwater, the agencies have decided to begin drilling of extraction and monitoring wells. Five extraction wells and 10 monitoring wells have been drilled and procurement actions have been initiated to obtain the extraction and treatment systems.

23. **Comment:** Two commenters stated that their preferred alternative was "No Action." (W5-1, W7-4, W15-9) Another commenter questioned why so much activity and cost was associated with the "No Action" alternative. The commenter further stated that "No Action means no action" and that monitoring, sampling, and other activities associated with the "No Action" alternative make the alternative meaningless. (W7-3)

Response: The agencies note these commenters' preferences for the "No Action" alternative. However, the "No Action" alternative, which is mandated to be considered by CERCLA and the National Contingency Plan was not considered a viable alternative because the results of the RI and baseline risk assessment indicated that the contamination of groundwater due to the migration of the vadose zone organic contaminants to the Snake River Plain Aquifer will present a significant future risk to human health if no action is taken. Thus, all the alternatives evaluated had to meet the remedial action objective of preventing organic contaminant migration to the groundwater in unacceptable concentrations. The "No Action" alternative did not meet this objective and was not considered further.

The costs associated with the "No Action" alternative are largely associated with a requirement in the National Contingency Plan to monitor every Superfund site at which hazardous substances will remain after the response action. Groundwater monitoring is necessary to detect contaminant concentrations in the Snake River Plain Aquifer.

24. **Comment:** One commenter was concerned that some of the tables and figures used to present technical data were unreadable. Further, the commenter stated that if the computer printouts were more readable the public would have more confidence in DOE's actions. (T8-4, T8-7)

Response: Tables and figures used in documents associated with OCVZ are generally used to summarize detailed and complex information. Every attempt is made to make the tables and figures in the Proposed Plan and the Record of Decision as technically accurate as possible while providing information that is understandable by members of the general public. In response to this comment, the ROD was reviewed to identify areas in which the tables and figures could be made more readable and understandable.

25. **Comment:** Two commenters were concerned that special care be taken with all monitoring and extraction wells located in and around the Subsurface Disposal Area. The commenters asked that all wells be properly capped and monitored so that they do not become conduits for contaminant transport into the aquifer. (T6-1, W14-6).

Response: The agencies concur with the commenters' concern about wells potentially becoming conduits for contaminants into deeper regions under the Subsurface Disposal Area. Because of this concern, each borehole at the Subsurface Disposal Area will be constructed so that it can be used as either an extraction well or a monitoring well. Extraction wells will be completed only to the 110-foot interbed to draw vapor from above the interbed where the highest VOC concentrations have been detected. Boreholes that are drilled through the 110-foot interbed will be sealed at appropriate intervals to avoid creating a conduit for downward vertical migration of VOCs and other contaminants. Finally, because the sedimentary interbeds appear to impede or slow vertical migration of VOCs, boreholes will not be drilled through the 240-foot interbed. The Snake River Plain Aquifer is located approximately 600 feet below the Subsurface Disposal Area. Additionally, engineering controls will be taken to ensure that the extraction wells used in the selected alternative are properly capped, eliminating the possibility of emissions in excess of regulatory limits.

26. **Comment:** Two commenters suggested using the OCVZ project as a "research platform" to develop and test new technologies for subsurface characterization and modeling, vapor vacuum extraction, and vapor treatment. One person asserted that this would directly support DOE's and EPA's efforts to expand the development of environmental technologies. (W14-8, W15-11) However, another commenter complimented the agencies for "not studying [the project] to death." (T11-1)

Response: Using OCVZ as a developmental research project is being considered. However, the agencies all agree that the first priority is to cleanup the site and meet the remedial action objectives. Although Extraction/Treatment by VVE is the preferred option, the contractor will be working with DOE's Office of Buried Waste and Technology Integration Program to continually pursue more efficient and cost effective extraction and treatment technologies. Currently, the INEL has teamed up with DOE's Savannah River Operations Office to conduct vapor extraction tests. These tests will be conducted at the Savannah River site. However, if the tests do not interfere with the INEL's ability to meet its cleanup objectives, additional research and development could be conducted at the INEL on vapor extraction technologies.

27. **Comment:** One commenter questioned the accuracy of the total mass balance used as the basis for the risk assessment. The commenter argued that the impact of this inaccuracy is significant. He requested to see some of the documentation on which the agencies based their figures to assure himself that the numbers are valid. (T10-1) Another commenter agreed that the initial concentrations are extremely crucial and are hard to grasp. (T11-2, T11-4)

Response: The agencies agree with the commenters that waste volume and concentrations are extremely important factors in the risk assessment. To ascertain the volume of waste at the site, three waste characterization investigations were conducted for the VOCs at the Subsurface Disposal Area. In performing the waste characterization investigations, waste management personnel at the Rocky Flats Plant were contacted to obtain as much data as possible on quantities of volatile organic wastes that were shipped to the Subsurface Disposal Area. The total volume of used oil, carbon tetrachloride, trichloroethane, trichloroethylene, and perchloroethylene received and the dates of receipt were obtained from the Rocky Flats Plant Waste Management monthly reports. These monthly reports also provided data on the amount of lathe coolant received at the Subsurface Disposal Area. Because monthly reports for 1966 and 1969 were not available, quantities of contaminants shipped to RWMC were estimated based on information contained in the other reports. As a result of these investigations, the amounts of hazardous materials stored or disposed of at the RWMC were quantified and the unique waste characteristics attributable to organic material processes were identified. A detailed discussion of the contaminant inventory is presented in Section 3.2 of the OCVZ Final Work Plan and in Section 4 of Volume 1 of the RI report. Both of these documents are in the Administrative Record associated with this remedial action and are available to the public.

The agencies agree that the accuracy of the "total mass balance" is extremely important for accurate assessment of the potential risk to human health and the environment. That is one reason why DOE went to such measures to quantify the sources of the VOCs in the vadose zone. DOE admits that the data is not 100 percent accurate because of lack of data prior to 1966 and the missing monthly reports for the years 1966 and 1969. However, the agencies feel that sufficient data exists to provide meaningful input into the risk assessment and that any inaccuracies caused by estimating the missing data do not significantly affect the quality of the results of the assessment.

28. **Comment:** One commenter challenged the assumption that institutional controls could be maintained at the remediation site for one hundred years. The commenter cited changes during the last one hundred years as examples of how difficult it is to project what will be happening one hundred years into the future. (T10-2)

Response: As part of the human health evaluation for the OCVZ, it was assumed that DOE would continue to operate and maintain the RWMC and prevent unrestricted public access to the RWMC until the year 2092. Institutional controls including restricting land use, controlling public access, posting signs, constructing fences or other barriers, and monitoring the environment are employed and will continue to be maintained at the RWMC. DOE has committed to maintain active institutional controls at all low-level radioactive waste disposal facilities for 100 years following closure. (See DOE Order 5820.2A). While the agencies agree that it is difficult to project what will be happening in 100 years, it is reasonable to assume that DOE (or its successor) will still be operating and maintaining the RWMC in 100 years.

29. **Comment:** One commenter was concerned that some of the input data was unknown (i.e., initial concentrations, time period over which the contaminants are dumped into the pit, reactions with other chemicals) and that other input factors were virtually plucked out of the air (i.e., hydraulic factors, especially porosity and dispersivity). The commenter stated that these inputs are crucial computer inputs which dramatically affect the results; in other words: garbage in, garbage out. (T11-2, T11-3)

Response: The agencies do not contend that this modeling is without any uncertainty. As noted by the commenter, there is a direct relationship between the uncertainty in the model and the amount of historical data available. The source of the contamination observed in the vadose zone below the trenches and disposal pits is documented through historical data from the contaminant inventories (See Response to Comment No. 22). Additional basis for input data into the fate and transport model were obtained from the Radioactive Waste Management Information System (RWMIS), previous waste characterization activities, and waste inventories of the materials disposed at the Subsurface Disposal Area. Parameters for the RWMC vadose zone VOC transport model included thickness, porosity, saturation, effective air porosity, and tortuosity factors. These parameters are based on previous studies and on actual data taken from in and around the RWMC. The value for porosity was estimated from results of analyses conducted on core samples for the surface sediments, interbeds, and basalt flows at the RWMC down to the 240-foot interbed. Saturation values were estimated using results from analyses conducted on vesicular basalt samples. Dispersivity values were based on analysis of contaminant transport at a nearby INEL facility and checked against ranges reported in relevant literature. Other assumptions used for the development of the transport model are presented in Section 5.3.1.3 of the RI report. As additional data are collected, valuable information on rates and direction of contaminant movement will increase the accuracy of the model and decrease the uncertainty of model predictions because less reliance is placed on estimating past releases.

30. **Comment:** One commenter stated that the alternatives for handling contaminants in the vadose zone under the RWMC should not include Alternatives 0 or 1. The commenter felt that these alternatives were not acceptable because an earthquake may shift the earth and/or open a direct path of flow to the Snake River Plain Aquifer. (W6-1) Another commenter, however, asked that the first alternative (capping) be given additional consideration, particularly in regard to the order of magnitude of the added cost of the preferred alternative. (W8-3)

Response: The agencies agree that Alternatives 0 or 1 are less protective than the selected alternative, although not because of the catastrophic earthquake scenario envisioned by the commenter. Alternative 0 (the "No Action" alternative) was not chosen because an unacceptable risk remained to both human health and the environment. Alternative 1 (Containment by Capping) also was not chosen for the same reason. Even with a cap in place, organic contaminants would continue to migrate laterally and vertically in the vadose zone, primarily in the vapor phase. However, capping would limit the contact of water with organic contaminants at shallow depths; thus, migration of organic contaminants dissolved in infiltrating moisture might decrease.

31. **Comment:** One commenter stated that it is not possible to achieve zero contamination at any practical cost and that there is no need to do so. The commenter further stated that carbon

tetrachloride, trichloroethylene, tetrachloroethylene, and 1,1,1-trichloroethane contaminants have been with us for years and haven't been shown to be toxic at low levels. (W16-2)

Response: The agencies agree that it is impossible and unnecessary to eliminate all the organic contamination from the subsurface. It is also true that the contaminants of concern have been around for a long time and are not toxic at concentrations below the MCLs.

A.3.5 Commenter Agreed with Selected Alternative

32. **Comment:** Several commenters indicated their agreement with the preferred alternative selected by the agencies. The preferred alternative, Extraction/Treatment by VVE, was recognized as presenting the least risk to workers and the public and as being the most cost effective and protective alternative that prevents organic contaminants from migrating to the groundwater, which would result in groundwater contaminant concentrations exceeding acceptable risk levels. (T1-1, T1-3, T2-1, T2-4, T2-5, T5-1, T7-1, T9-1, W3-1, W4-1, W5-2, W9-1, W10-1, W12-1, W14-1, W16-1, W16-3)

Response: DOE, EPA, and IDHW agree that Alternative 2, Extraction/Treatment by VVE, is the alternative that best meets the remedial action objectives and the nine evaluation criteria identified under CERCLA. A long-term groundwater and soil vapor monitoring program will ensure that this selected remedy will be protective of human health and the environment.

33. **Comment:** One commenter stated that VVE has been definitively shown to be effective at removing vapor-phase VOCs from the subsurface environment and that it is a fairly mature remediation technology (fairly high reliability of performance). The commenter further stated that CATOX is a logical choice for destruction of VOCs that have been removed from the subsurface. (W14-2)

Response: The agencies agree with the commenter's statement.

A.3.6 Commenter Disagreed with Selected Alternative

34. **Comment:** One commenter stated that it didn't make sense for agency representatives to justify spending his tax dollars by claiming to save lives when the agencies didn't know where the lives are that the agencies claim they're impacting. The commenter continued by stating that he didn't believe the agencies had done their homework. (T3-1) Another commenter stated that there was too much concern over highly improbable happenings. (W5-4)

Response: The results of the Human Health Evaluation (HHE) conducted as part of the Baseline Risk Assessment showed that the organic contamination present in the vadose zone, if not addressed by the selected alternative or one of the other alternatives, could migrate to the Snake River Aquifer and contaminate the groundwater. Future groundwater users would then be at risk. The agencies believe that implementation of the VVE Extraction/Treatment system will remove the risk posed to future groundwater users.

The agencies are not asserting that the results of the HHE can predict with 100 percent accuracy the exact risk to the future groundwater users. The agencies do believe, however, that sufficient information has been collected and evaluated to make reasonable estimates on the human health risks posed by the organic contamination in the vadose zone.

While the probability of a future resident using groundwater pumped from the vicinity of the RWMC may seem improbable to some, CERCLA and the NCP require the agencies to assess this risk as part of the HHE. It is true that the estimates of carcinogenic and noncarcinogenic risks are based on conservative assumptions associated with both the fate and transport modeling and the risk assessment. The conservative assumptions used in the fate and transport modeling and the risk assessment compensate for the uncertainty inherent in assessing the risks to human health and the environment.

A.3.7 Other Comments on the Selected Alternative

35. **Comment:** One commenter noted that there are commercially available, trailer-mounted units that should be more cost effective when compared with in-house design and construction. (W14-3)

Response: The agencies plan to employ commercially available VVE systems as part of the selected alternative at this site. Several manufacturers supply modular VVE/CATOX units equipped with a fan, a catalytic oxidation chamber, instrumentation, an exhaust stack, and housing. These units are compact, require very little operator interface, and are cost effective for large-scale treatment of vapor-phase contaminants, such as those present in the vadose zone at the RWMC. Any modifications to these units (in-house design) will involve the adaptation of these pre-fabricated systems to meet the site-specific requirements at the RWMC.

36. **Comment:** One commenter stated that contrary to what was presented in the Proposed Plan, wastes would be generated under Alternative 2 (i.e., catalytic waste, hydrochloric acid and/or chloride salt, and particulate matter collected by the HEPA filters). (W14-4)

Response: The commenter is correct in stating that wastes or residues will be produced by the vapor treatment system. However, under Alternative 2 with Extraction/Treatment by VVE as the selected treatment alternative, it is expected that residual treatment wastes would not be generated in quantities above regulatory limits of concern. Because such low concentrations of VOCs are associated with the vadose zone at the RWMC, catalysts are not expected to be changed frequently. At sites that have used catalytic oxidation for similar types of contamination, catalysts must be changed every two years; however, the catalysts can be disposed of as solid (not hazardous) waste. Because the results of the remedial investigation indicated no radionuclide contamination present at OCVZ, no high efficiency particulate air (HEPA) filters are required as part of the extraction and treatment system. Although the commenter is correct in stating that hydrochloric acid would be formed during catalytic oxidation, the quantities generated are below regulatory limits of concern. This small amount of waste may require further treatment through neutralization. If necessary, caustic scrubbing systems could be installed at each treatment location. The scrubbing system would produce neutral pH, low-concentration salt-water solutions that can be discharged to a publicly owned treatment works or to surface drainage.

37. **Comment:** One commenter stated that Extraction/Treatment by VVE should be initiated in the highest concentration areas and that limits should be placed on VVE operations. The commenter believed that the agencies should not attempt to remove contaminants to minuscule levels only detectable by sophisticated instrumentation. (W3-2, W3-3)

Response: The agencies agree with the commenter. The selected alternative will be centered in those areas with the highest concentrations and will remove and destroy VOCs to the targeted cleanup goal of 30–200 parts per million volume for carbon tetrachloride. The agencies believe that such a cleanup goal will meet the remedial action objective of preventing organic contaminant migration to the groundwater in levels that pose a threat to human health or the environment.

38. **Comment:** One commenter suggested incorporating some flexibility into the plan as it will almost certainly have to be modified at least slightly as the activity proceeds. (W13-2)

Response: The selected alternative, Extraction/Treatment by VVE, allows for three possible phases of clean-up activity over a 6-year period. One of the primary reasons the agencies chose a phased approach was to allow for the uncertainties involved with this project. The complexities of the subsurface environment and uncertainty associated with the modeling make it difficult to predict how many wells will eventually be needed. Thus, the agencies have incorporated sufficient flexibility to add more extraction wells if, after Phase 1, contaminants levels do not appear to be decreasing in sufficient amounts. Conversely, the selected alternative also allows for a lower-keyed approach (i.e., natural venting) if, after Phase 1, contaminant levels appear to have been decreased to safe levels.

39. **Comment:** One commenter stated that there was no indication of the amount or percentage of VOCs expected to be removed or even a goal for the activity. The commenter asserted that "believing you will remove the most significant concentration" is inadequate. (W15-7)

Response: The targeted cleanup goal from carbon tetrachloride ranges from 30 to 200 parts per million volume depending on the depth within the vadose zone. Other vadose zone contaminants have similar goals. The selected alternative will be designed so that the remedial system meets these goals. The goals have been established so that vadose zone contaminant concentrations will result in groundwater contaminant concentrations that meet the remedial action objective.

A treatability study was performed as part of the clean-up activity to assess the effectiveness of treatment technologies that may be used as remedial alternatives on site waste. The treatability at OCVZ demonstrated that Extraction/Treatment by VVE can reduce vadose zone organic contaminant concentrations. Based on the results from the treatability study, the agencies believe an array of vapor extraction wells at selected locations in the RWMC will effectively reduce contaminant concentrations in the vadose zone to acceptable levels.

40. **Comment:** One commenter stated that in previous studies, suggestions had been made to introduce cold air down the wells to freeze the moisture in the wells to prevent downward migration of water carrying contaminants. (T1-2)

Response: Introducing cold air during the winter to freeze moisture and possibly prevent or slow downward migration of dissolved contaminants was not examined in the feasibility study because it is an unproven and undemonstrated technology. If it were possible to prevent downward migration of water, VOC contamination reaching the aquifer would be reduced. However, the contaminants would still reach the aquifer as vapors.

A.3.8 Funding, Budgeting, and Scheduling

41. **Comment:** Several commenters were concerned about the cost of the preferred alternative. Most felt that the agencies were spending too much money. One commenter stated that no business would recommend spending \$13–67 million to remove a marginal threat to public health and that he would rather see his taxes spent on saving lives (e.g., Boron Neutron Capture Therapy). However, two people stated that the agencies should err on the side of safety and spend whatever is needed to protect the aquifer and public health. (T4-1, T7-2, W2-1, W15-5, W15-12)

Response: In these tight budgetary times, all the agencies share the commenters' concerns regarding the amount of money spent on remedial actions. The cost estimate of approximately \$12–32 million associated with the selected alternative includes direct and indirect costs associated with construction and operations and maintenance, and post-closure costs for long-term monitoring. Contingency costs were included for each of the three primary cost elements (construction, operations and maintenance, and annual post-closure monitoring). Contingency costs are generally reduced as details of the design for a particular remedial action are refined.

The cost estimates provided in the Proposed Plan are rough estimates (i.e., -30% to +50%) and are given for comparison purposes only. Cost estimates for sampling and monitoring activities will be provided in greater detail in the Remedial Design phase, which follows the ROD. Costs may appear high because overhead rates with the management and operations contractors and general and administrative rates are all factored into the ultimate cost estimate. The administrative costs associated with federal cleanup sites tend to be higher than those associated with private industry sites.

With an ever-shrinking federal budget, a number of measures are being taken to better manage the direct and indirect costs associated with DOE remedial actions. [At the INEL, a 5-year consolidated contract was recently awarded that is designed, in part, to reduce the levels of bureaucracy at the facility.] One cost-saving measure specific to OCVZ was selecting a phased approach to the action allowing agency decision-makers the flexibility to reduce the scope of the project if, following an evaluation of the implemented remedy (approximately two years after implementation), the agencies conclude that indications from monitoring shows that the vadose zone contamination is sufficiently reduced to prevent federal and state maximum contaminant levels from being exceeded in the aquifer. If that conclusion is reached, the agencies may decide to shut down the system or shift to a passive system.

42. **Comment:** One commenter noted that the agencies must obtain funding every budget period to allocate to this project. The commenter further noted that Alternative 2 has a good chance of getting funded because it can be demonstrated to work. (T2-3, T2-4).

Response: DOE has allocated and forecasted funding for the OCVZ project and fully expects funding to be available for the duration of this project. However, as with all government moneys, these funds are subject to congressional appropriations and oversight. This fact may potentially influence the funding for OCVZ each fiscal year.

43. **Comment:** One commenter stated that inadequate justification has been made to accelerate this applied experiment over a 2-year period. (W15-10)

Response: Extraction/Treatment by VVE is a proven and well-established remediation technology to recover vapor phase organic contaminants from subsurface soils. Based on the results of the treatability study, which proved that Extraction/Treatment by VVE would be effective for the removal of organic contamination in the vadose zone and on the generally positive public support for the project, the agencies decided to implement Alternative 2 as the selected alternative. After evaluating the results from Phase I (lasting approximately two years) a decision will be made as to the level of activity necessary to ensure protection of human health and the environment. If, after Phase I, the remedial action objective has been met (reduction of contaminant levels so that organic contaminant migration to the groundwater will not result in groundwater contaminant concentrations exceeding acceptable risk levels and/or federal and state maximum contaminant levels), then a decision will be made about the level of remedial activity needed during Phase II (i.e., reduce/expand the number of extraction wells, use natural venting, or use a combination of natural venting and Extraction/Treatment by VVE).

A.3.9 Comments Deemed Beyond the Scope of the OCVZ ROD

Comments and questions on a variety of subjects not specific to OCVZ were received during the public comment period. Those subjects included editorial comments concerning language in the Proposed Plan, statements of general distrust for the DOE actions, offers to provide technical assistance on the project, statements concerning past work at the INEL, personal preferences on how taxpayer money should be spent. These out-of-scope comments are not responded to in this Responsiveness Summary. Additional information on these unrelated subjects can be obtained from the INEL Public Affairs Office in Idaho Falls or at the local INEL offices in Pocatello, Twin Falls, and Boise.

Appendix B

Public Comment/Response List Index

Appendix B

Public Comment/Response List Index

The Public Comment/Response List Index was created to enable commenters and other interested persons to locate the agencies' responses to individual public comments. All oral comments, as given at the public meetings, and all written comments, as submitted, were typed into the attached index. Each comment was then subdivided and assigned a comment code. The codes indicate whether the comment was either written (W code) or taken from the public meeting transcript (T code). The agencies tried to divide comments according to specific concerns, issues or points made by the commenter.

Sixteen people submitted written comments (comments W1-W16) and 12 others gave oral comments at the public meetings (comments T1-T12). Copies of oral and written comments annotated with their respective comment codes are located in the Administrative Record.

To locate a response to a specific individual's comments, look up the last name of the individual, identify the specific comment you are looking for, then turn to the comment number or page indicated in the Responsiveness Summary.

If, after reviewing the annotated comments in the administrative record, a reader wishes to locate a response to a specific comment, he/she can use the comment code to locate a response as well. The reader should identify the comment code in the index, look up the comment and page number of the response then turn to that page of the Responsiveness Summary.

Comments involving multiple issues were further subdivided and answers may appear in more than one place in the Responsiveness Summary. This was done for only five of the 95 comments.

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Code	Response Number	Commenter	Comment	Page Number
NC	NA	Jack Barracough	<p>This is an interesting project to me because I first started studying the burial ground about 30 years ago at the RWMC. And along the studies, we defined the geology of which they're still using and had a feeling for what to do with this waste that's been placed there.</p> <p>In 1980, we looked for organic contaminants. We looked in the parts per million range and couldn't find them. In 1987, they were detected in the parts per billion range.</p> <p>The vapor vacuum extraction is a very exciting project, and it's one that Dr. Dave Allman—about 10 years ago, Dr. Dave Allman and I recommended it, but we had a little bit different concept where we'd use the natural breathing and venting by using wells as a short circuit and using the changes in barometric pressure as the pump and then filter the air.</p>	Out-of-Scope/Not Responded To
T1-1	32	Jack Barracough	I think the system that they've developed now is superior to our original concept.	A-17
T1-2	40	Jack Barracough	[W]e wanted to introduce cold air during the winter to freeze what moisture was in there to prevent downward migration of water carrying contaminants.	A-20
T1-3	32	Jack Barracough	And I think the analysis is good and I think the modeling studies are good. And I support the preferred alternative, and I think it's probably the most cost-effective and the most dynamic.	A-17
T1-4	14	Jack Barracough	I would suggest that you do seriously consider natural—using the changes in barometric pressure as more cost effective, maybe not now, but in the future.	A-10
T2-1	32	C. E. White, Jr.	I think the alternative that Jack is talking about is going to be the one.	A-17
T2-2	14	C. E. White, Jr.	I just—I just don't think that we—with the barometric pressure, it's going to take too many years to do it. I think it's going to be a slower process to do it, Jack. I don't know. You may not agree with me, but I think it's going to be a lot slower.	A-10

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T2-3	42	C. E. White, Jr.	And we will have to—the government will have to come up with money every period, every budget period, to allocate to this.	A-22
T2-4	32, 42	C. E. White, Jr.	[I]f we choose the No. 2 one, which is the pump, I think we've got a good chance of getting it funded because I think it will work and I think we can prove it will work.	A-17, A-22
T2-5	32	C. E. White, Jr.	I agree also that that would be the alternative to accept.	A-17
T3-1	34	Bob Belveal	It doesn't—it doesn't make sense to me for you folks to stand up here and justify spending my tax dollars doing this for the purpose of saving lives when you don't know where the lives are that you're impacting. I don't think you've done your homework.	A-18
T4-1	41	Nicole LeFavour	I'm concerned that possibly the money being spent is perhaps—I guess I should phrase this better. Perhaps you're being cautious with the money you're spending, and I guess I just want to make sure that there isn't the possibility that you need to do perhaps the \$59 million treatment. I hoped that you will err on the side of the cautious. And I think it looks good.	A-21
T5-1	32	John Anderson	I really feel that your vapor extraction is a correct method. I'm very familiar with vapor extraction and this is probably as cheap—you're going to get the best bang for your dollar right there.	A-17
T6-1	25	Fritz Bjornsen	I guess my concern would be simply that during the process, all care be taken that the monitoring wells and the vapor vacuum extraction well be properly capped and monitored to prevent increased migration both of the solvents and potentially other problems—other things existing in the soil at the RWMC that might find an easy pathway to the aquifer through the wells that are being dug.	A-14
T7-1	32	Walt Hamson	It looks to me like you've done a pretty thorough job.	A-17
T7-2	41	Walt Hamson	Personally, it seems to me that the Preferred Alternative looks pretty reasonable, as long as you hold kind of close to that 12 instead of the 32.	A-21

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Code	Response Number	Commenter	Comment	Page Number
T8-1	21	Walter Berway	I mentioned earlier the concern for technology transfer, and I think that still should be a very high priority and I don't think it's really being addressed.	A-13
T8-2	16	Walter Berway	We're also not dealing with costs in a more detailed breakdown. If you're going to run the program two years and say it goes to three, can we work at automating this to reduce the labor cost and to let it do its thing even if it takes five or ten years without high labor costs?	A-11
T8-3	17	Walter Berway	We need to look at can we recover this organic vapor solvent and reuse it elsewhere as feed stock for something else? The reason being is that you may not have a lot here, but there is a lot in other dumps elsewhere throughout the world.	A-11
T8-4	24	Walter Berway	<p>And this reinventing the wheel does bother me a bit. I still think that, like you say, I don't trust computers, and just because the computer says this, I can also program computers to make any answer I want. And this is where I need—feel, I should say, that software documentations should be readable and these programs should be described as what they do much more in the public domain. They're right now, as far as I know, almost no indication of this in the INEL Repository, or at least references to such. Part of the data processing which is not unique to INEL, it's throughout the whole computer industry.</p> <p>We're taking too much in faith that the computer model is accurate or even meaningful. I don't even know what the variables are that go into it or come out of it. All I can do is guess. I think that's unfair and also make is useless for other projects in the future.</p>	A-14
T8-5	19	Walter Berway	I have yet to see an entity relation diagram, that's how to date and relate to each other. A contact's diagram for a data flow diagram, I've yet to see one of those anywhere mentioned. In other words, what are the inputs, outputs, and so forth described.	A-12

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Code	Response Number	Commenter	Comment	Page Number
T8-6	2	Walter Betway	So I'm looking at this equipment, whatever you're doing on this, to be useful and transferable and do a good job here, rather than do a, shall we say, a least effort and then hopefully forgotten. You know, we did our project, we cleaned it up, but it's all lost like many of the other files and piles of reports and is unusable by anyone else. So record-keeping is still a critical area.	A-6
T8-7	24	Walter Betway	And I'd like to see those computer printouts, definitely as I mentioned before, be made much more readable. It's a failing that's not professional in my opinion. It's much—I think hackers even can do better jobs on some of these printouts. And as you do such things, it will give the public confidence by making these things more readable rather than, shall we say, questionable because the AEC—or Atomic Energy Commission or the DOE now—has in the past, hid so much in secrecy or in records that are questionable in value.	A-14
T8-8	2	Walter Betway	And I'd like to see where its referenced to where the data records are being kept in your Information Repository in computer form. Do you even have one, or is this kept in somebody's desk, third drawer down next to the garbage can? These are the concerns I would like to see INEL succeed and has to be dealt—these problems have to be dealt with.	A-6
T9-1	32	Kent Martin	I support any effort in site remediation at any facility in the United States. And I'm very please to see that Idaho has taken the time and effort, because it's very, very difficult to do all this. And I commend all of your on your effort to take on this monumental task. So, I support you one hundred percent.	A-17
T10-1	27	Chuck Broschious	I'm not convinced that the total mass volumes that you all are using as your base for what was disclosed of there is accurate. And in terms of the ramifications, if that number is not correct and how that would impact your risk ranges and whatnot is significant. And I would like to see some documentation on what you base those figures on, you know, to assure me that you're working from numbers that are pretty solid.	A-15

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Code	Response Number	Commenter	Comment	Page Number
T10-2	28	Chuck Broschious	In terms of maintaining institutional control for 100 years, I think it's important to stop and think about what was going on in 1894. This was decades before even the automobile. This was before paved highways and this was during the time when people road the trains around, a lot of them were wood fired. So, in terms of projecting, you know, another hundred years out there and making assumptions that there's going to be something that we call the United States of America is being very presumptuous. And I think we need to be thinking about these things when we just lay these projections out there.	A-16
T10-3	15	Chuck Broschious	And again, I do not have a lot of faith in your characterization of how fast contaminants move from the surface to the groundwater, because I've had too much documentation, other geologists, hydrologists, and in and out of Department of Energy, Atomic Energy Commission, Energy Resource and Development Agency. You know, it doesn't—you know there's too much challenge in documentation.	A-11
T11-1	26	Neil Farmer	I see a few positive aspects and a few negative aspects. One positive comment that I'd like to make it towards people working on this problem, that at least we're coming to a conclusion for a remedial effort that is—at least we aren't studying it to death as we are with the salmon issue.	A-15
T11-2	27, 29	Neil Farmer	Some of the negative parts of the presentation is of course some of the data given by computer programs as mentioned. I just go through with an assignment basically doing the exact same thing with a different program. And it is true, initial concentrations are extremely crucial, over what time period they are dumped into a pit, and the reactions with other chemicals. So this—and a lot of this is completely unknown.	A-15, A-16

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Code	Response Number	Commenter	Comment	Page Number
T11-3	29	Neil Farmer	And that's not even to mention the hydrologic factors of the aquifer, namely effective porosity, spurgivity, a good many others, that most, even well experienced and seasoned hydrogeologists most of the time have to virtually pluck out of the air because there is no hard data for that. And those are crucial inputs into the computer programs which will dramatically affect program, garbage in and garbage out.	A-16
T11-4	27	Neil Farmer	What I'm trying to say is the input data is in essence so hard to get a firm grasp on—the it's very difficult to have much reliance on the output of the computer program. But that's not to say that there are completely inadequate. They're only as good as the input in, and that's personal experience and from conversations with seasoned hydrogeologists, I suppose namely on the University faculty.	A-15
T12-1	3	Joe Lance	I'd like to thank you for the opportunity at least to hear more about what the problem is. Having worked the last 20 years or more in the Hagerman Valley with fisheries' people and irrigators and agriculturists, I understand the importance of this aquifer. I guess my only comment would be I appreciate the opportunity to hear it, and the opportunity to respond. I wish I'd knew more bout it such as many of the people here, but I have learned. And I would like to apologize for the mistakes that my generation made by drilling holes into the aquifer, and maybe through some of this cleanup, this won't happen, but we at least left it to our kids to clean up. I appreciate the opportunity to be here.	A-6
W1-1	3	Walt Hampson	Excellent communication—[I] have seldom seen more accurate and thorough technical composition in a general publication.	A-6
W1-2	20	Walt Hampson	[I] would like to see more in-depth analysis of the In Situ Bioremediation Alternative. It seems to have been passed off a little lightly as too difficult for this subsurface. However <i>if not</i> too difficult—it would certainly be a much lower cost alternative.	A-12
W1-3	3	Walt Hampson	Thanks for this opportunity to comment and good luck!	A-6

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Code	Response Number	Commenter	Comment	Page Number
W2-1	41	Phyllis Jones	We need to clean up the problems of the water regardless of cost and ASAP as a federal project and maybe helped by the state.	A-21
W2-2	3	Phyllis Jones	Please keep us updated as to future information. Thanks.	A-6
W3-1	32	Rodger F. Colgan	I support your recommended Alternative 2.	A-17
W3-2	37	Rodger F. Colgan	There should be limits for effective VVE operation, not to remove contaminants to levels of detection for sophisticated instrumentation.	A-19
W3-3	37	Rodger F. Colgan	Activity should be initiated in the highest concentration areas.	A-19
W3-4	18	Rodger F. Colgan	I am not aware of what "hazard" exists in <i>Texaco Regal Oil</i> and if VVE would work in its removal.	A-11
W3-5	21	Rodger F. Colgan	The technology for VVE should be common, simple, reasonably cost effective, and shared in trade publications such as <i>Environmental Protection</i> and <i>T.N.E.J.</i> , etc.	A-13
W3-6	22	Rodger F. Colgan	The implementation should begin as soon as possible.	A-13
W4-1	32	Andy Holderreed	The outlined plans would appear to be reasonable.	A-17
W4-2	NC	Andy Holderreed	Plans allow for more well drilling and testing to determine the extent of the remediation.	Out-of-Scope/Not Responded To
W4-3	22	Andy Holderreed	I think we must get on with efforts to mitigate the waste problems to head off worse problems ahead.	A-13
W5-1	23	Warren Barry	[If we were voting,] I would favor Alternative 0 and simply monitor the material at a great saving in cost to all.	A-13
W5-2	32	Warren Barry	My second choice would be Alternative 2, VVE Phase I. This should satisfy all <i>reasonable</i> objections and provide an acceptable solution.	A-17
W5-3	8	Warren Barry	My understanding the aquifer is comparable to a huge lake without appreciable movement. Any infiltration would simply remain there and decompose.	A-8
W5-4	34	Warren Barry	Too much concern over highly improbable happenings.	A-18

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Code	Response Number	Commenter	Comment	Page Number
W6-1	30	Willard Adams	Alternatives for handling contaminants in the Vadose Zone under RWMC should not include Alternative 0 or 1. They do not cut it if one was to consider an earthquake that may shift the earth and/or open a direct path of flow to the Snake River Plain Aquifer.	A-17
W7-1	NC	R. Ham Hamilton	The last sentence of "Alternative 0: No Action" should be the last sentence of Remedial Action Objectives.	Out-of-Scope/Not Responded To
W7-2	NC	R. Ham Hamilton	Move the 4.1 million from page 11 to page 10.	Out-of-Scope/Not Responded To
W7-3	23	R. Ham Hamilton	"No Action" means to do nothing in good English.	A-14
W7-4	23	R. Ham Hamilton	After all your blather—leave everything be: Monitor once each 10 years with improved technology.	A-13
W8-1	6	Bruce L. Schmalz	What correlation exists, if any, between the transport model and that previously used for water (Schmalz and Polzer, <i>Soil Science</i> , vol. 108, no. 1, 1969)?	A-7
W8-2	4	Bruce L. Schmalz	What forces were considered in the model (e.g., gravity, capillary attraction, atmospheric pressure, etc.) and the physical phase of the contaminants (e.g., gaseous or liquid or both)?	A-7
W8-3	30	Bruce L. Schmalz	It is this commentator's intuitive opinion that the first alternative be given additional consideration, particularly in regard to the order of magnitude of the added cost of the preferred Alternative 2.	A-17
NC	NC	C. E. White, Jr.	I have read all of the data available on your proposed method of extraction have had some one-on-one discussions with Reuel Smith (among others) and . . .	Out-of-Scope/Not Responded To
W9-1	3, 32	C. E. White, Jr.	[I]t is my feeling that you have a workable and safe remediation procedure. Thanks for the opportunity to comment.	A-6, A-17
NC	NC	David H. Nedrud	In December of 1992, our company started a Vapor Extraction project for a Nevada engineering firm. The project involved a leaking UST with unleaded gasoline. From our air and water well monitoring, we have seen dramatic decreases in contamination levels in soils.	Out-of-Scope/Not Responded To

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W10-1	32	David H. Nedrud	No doubt in our minds that Vapor Extraction does work, is cost effective, and should be a viable option for some soil problems at the INEL.	A-17
NC	NC	David H. Nedrud	If we can be of any assistance, call our office anytime. (208) 232-2034 Idaho is our home. Please keep cleaning up the site! Thank you DOE/EPA.	Out-of-Scope/Not Responded To
W11-1	3	Stan Sorensen	No comments at this time, but would like to receive a copy of the Record of Decision and Responsiveness Summary.	A-6
W12-1	32	Robert Gates	Your efforts have convinced me that you are doing the right thing to protect the people and the environment. Keep up the good work.	A-17
W13-1	5	Allen Merritt	Have you allowed for uncertainty?	A-7
W13-2	38	Allen Merritt	Incorporate some flexibility as this plan will almost certainly have to be modified at least slightly as the effort proceeds.	A-20
W14-1	32	Robert M. Lugar	In general, I agree with the preferred remedial action alternative presented in this proposed plan.	A-17
W14-2	33	Robert M. Lugar	Vapor vacuum extraction has been definitively shown to be effective at removing vapor-phase VOCs from the subsurface environment beneath the RWMC and is a fairly mature remediation technology (fairly high reliability of performance). Catalytic oxidation is a logical choice for destruction of the VOCs once removed from the subsurface . .	A-18
W14-3	35	Robert M. Lugar	[T]here are presently commercially available trailer-mounted units which should be the most cost effective option (versus in-house design and construction).	A-19

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W14-4	36	Robert M. Lugar	On page 12, it states that "it is expected that no residual treatment wastes would be generated under Alternative 2 . . ." Keep in mind that eventually the catalyst will require either replacement or regeneration, and the associated catalyst waste disposal/replacement or regeneration costs. In addition, under catalytic oxidation, you will likely end up with a relatively small amount of hydrochloric acid (HCL) and/or a chloride salt, depending on the particular catalytic process used. There may also be small amounts of particulate matter collected by cyclone separator and/or HEPA filters upstream of VOC treatment component.	A-19
W14-5	12	Robert M. Lugar	Has any consideration been given to the effect of "drying out" (removing moisture) of the vadose zone as a result of the flow of large volumes of air through it. For example, will this phenomenon occur, and if so, to what extent, and will it have a positive or negative influence on VOC fate and transport in the subsurface environment? This does not effect the basic selection of the preferred alternative; however, it should be considered for future phase implementation and modeling.	A-10
W14-6	25	Robert M. Lugar	I suggest that throughout all the phases, the number of extraction and monitoring wells be minimized to the extent possible. Although present day well construction techniques should protect the subsurface from inadvertently acting as conduits for contaminant transport to the deeper regions, any penetrations in the SDA are potential conduits.	A-14

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W14-7	13, 22	Robert M. Lugar	<p>I suggest the agencies (DOE, IDHW, and EPA) consider restarting the existing VVE system at RWMC as soon as possible instead of leaving it idle until the additional five Phase I extraction/monitoring wells are installed and VVE systems for these wells are operational. At an estimated VOC extraction rate (based on the treatability study) of 1.754 pounds of VOCs/hour, 90% system availability, and a Phase I startup date of April 1995, approximately 13,832 pounds of VOCs can be removed from the SDA subsurface BEFORE the Phase I alternative is initiated if the existing system is restarted! The remedial objective is to remove subsurface VOCs to below cleanup goals . . . and we presently do not have a reliable prediction of how long this will take (from page 17 of the Proposed Plan), so why not get on with it as soon as possible rather than wait for a whole new set of paperwork, design reviews, safety analysis and reviews, etc. for the Phase I systems?</p> <p>The existing VVE system has proven itself to be safe and effective; all the necessary operating procedures, safety reviews, and monitoring procedures are in place, and trained personnel are available to operate the system. The disposal of the spent carbon adsorbers used on this system should not be an issue, since precedent has been set by the recent DOE-HQ approval of off-site disposal (at a licensed disposal facility) of spent adsorbers generated during the treatability study. Although we know now that carbon adsorption is not necessarily the optimum technology to treat the extracted VOC vapors from the RWMC, it is a widely accepted and utilized VOC vapor treatment method, and perfectly suitable until the Phase I wells/systems are operational.</p> <p>A tremendous amount of money has been invested in this existing system (especially if one includes the 1989/1990 tests and 1993 treatability tests), and we have only recovered an estimated 4,473 pounds of VOCs to date with it! Why not let it provide a better return on our tax dollar investment?</p>	A-10, A-13

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Code	Response Number	Commenter	Comment	Page Number
W14-8	26	Robert M. Lugar	<p>On page 17 it is stated that "the complexities of the subsurface environment and uncertainty associated with the modeling, make it difficult to predict how many wells will eventually be needed, how long it would take to achieve cleanup goals, and at what point the agencies could safely turn off the system." In light of this, I suggest the agencies consider expanding the benefit of the existing and future vapor vacuum extraction systems beyond regulatory driven risk reduction and remediation, and allow INEL, university, industry, and regulatory partners to use the VVE extraction and monitoring system(s) as a research "platform" to develop and test new technologies for subsurface characterization and modeling, vapor vacuum extraction and vapor treatment. Applied research and development activities using this platform would help us better understand the complexities of the subsurface, help us optimize the VVE process and be candidates for subsequent technology transfer to the private sector. Applied research and development activities associated with this concept would directly support the Department of Energy's and EPA's efforts to expand the development of environmental technologies, as directed by President Clinton's Environmental Technology Initiative and EPA's Technology Innovation Strategy (the former initiative specifically proposes to use the national laboratories as testing and evaluation centers in support of site characterization technology and use federal facility sites for full scale demonstrations of innovative remediation technologies). This platform would also support increased interaction between local universities, particularly in the geosciences and environmental engineering disciplines, and broaden our knowledge of VOC fate and transport in the vadose zone overlying the Snake River Plain aquifer.</p>	A-15

**PUBLIC COMMENTS RECEIVED ON THE
ORGANIC CONTAMINATION IN THE VADOSE ZONE
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Code	Response Number	Commenter	Comment	Page Number
W14-9	21	Robert M. Lugar	<p>Our subsurface vapor contaminant problem at RWMC is not unique; many other DOE sites (e.g., Hanford, DOD sites) and even USDA grain storage sites have discovered similar subsurface VOC contaminant plumes requiring VVE techniques to remove and treat the vapors. An INEL VVE and VOC treatment research program could not only help find the optimum treatment technology for DOE sites, but also assist others to develop, test, and apply emerging vapor removal and treatment technologies. VOC emission abatement, control, and treatment is the most rapidly growing component of the U.S. air pollution control industry. Many of the new emission control requirements of the recently reauthorized Clean Air Act are aimed specifically at controlling VOC vapor emissions from a variety of industry categories. Certain operations at DOE facilities will be impacted by these new VOC emission requirements. These regulatory drivers have created market pull for new and innovative VOC treatment technologies. Already the list of emerging technologies for VOC treatment is growing faster than any other pollution control area. Emerging vapor treatment technologies include catalytic oxidation, thermal oxidation, biological treatment, cryogenic techniques, solar oxidation, and electron beam destruction. On page 12 of this Proposed Plan it states "... biological and ultraviolet treatment would require further development in order to be a viable vapor treatment option for the large scale application. . . ."</p> <p>" Why not let scientists and engineers from INEL/university/industry collaborate on this problem and use a sidestream of one of the extraction wells to address this technology development need?</p>	A-13

PUBLIC COMMENTS RECEIVED ON THE
ORGANIC CONTAMINATION IN THE VADOSE ZONE
DURING THE 31 MARCH-30 APRIL 1994 COMMENT PERIOD

Code	Response Number	Commenter	Comment	Page Number
W14-1 0	14, 21	Robert M. Lugar	The advantages of using the OCVZ as a basis for conducting subsurface, VVE and VOC treatment research is that the vapor plume is fairly well characterized, maintains a relatively stable concentration and composition, and will be continually monitored during the duration of VVE operations. Extracted vapor could be made available for bench or pilot scale treatment studies using a sidestream from the extraction well. The effects of natural barometric "pumping" could be studied, enhanced subsurface vapor tracer studies could be performed, and advanced subsurface contaminant fate and transport models could be calibrated against the monitored plume behavior.	A-10, A-13
W14-1 1	21	Robert M. Lugar	The INEL has a noteworthy experience and capabilities base in this area (e.g., the design, testing, and optimization of the existing VVE system at RWMC), a cadre of subsurface modeling experts, the joint INEL/industry development of the BioCube (a biological VOC treatment technology), contaminant monitoring experts, engineering expertise, and state-of-the-art vapor analytical capabilities. In order for the INEL to survive and flourish into the next century, we must be attuned to opportunities to expand our knowledge base and develop new technologies. The OCVZ work performed so far has laid the foundation to build upon, and I would hope the agencies might recognize that the project has the potential to be much more than just a remediation project.	A-13
W15-1	1	John R. Horan	The process of public input after the three agencies have met in secret to select the preferred alternate is seriously flawed. It's a farce to even consider that public comment can change a predetermined plan. A review of your CERCLA history in Idaho shows it has never been done. Community involvement and public comment, in its present form, only wastes additional taxpayer dollars which should be used on <i>real</i> risks rather than hypothetical <i>potential</i> risks of a low order.	A-6

**PUBLIC COMMENTS RECEIVED ON THE
ORGANIC CONTAMINATION IN THE VADOSE ZONE
DURING THE 31 MARCH-30 APRIL 1994 COMMENT PERIOD**

Code	Response Number	Commenter	Comment	Page Number
W15-2	9	John R. Horan	Note that the main vapor plume has diffused about 100 feet over about 20 years. No mention has been made of a driving force that is expected to continue this expansion. I would expect the rate to decrease to zero as evidenced by 1960 field experiments.	A-8
W15-3	10	John R. Horan	All wells as well (no pun intended) as ground surfaces breath during atmosphere pressure changes. Have any measurable organic contaminants been detected by air sampling at the SDA? This would be real data as compared to your use of an estimated hazard to hypothetical workers.	A-9
W15-4	11	John R. Horan	How long has ID been monitoring the vadose zone? What changes in the rate of vapor expansion were noted during the 1993 extraction?	A-9
W15-5	41	John R. Horan	No business enterprise would recommend the spending of 13-67 million dollars to possibly remove what has been conservatively overestimated as a marginally potential health problem with no noncarcinogenic health effects and acceptable carcinogenic risks for the public.	A-21
W15-6	NC	John R. Horan	Note that every phase in this long sentence is taken directly, but out of original context, from your March 1994 statement.	Out-of-Scope/Not Responded To
W15-7	39	John R. Horan	No place have you indicated what amount or percentage of the offending vapor you expect to remove or is even a goal of the program "Believing you will remove the most significant concentration" is inadequate.	A-20
W15-8	7	John R. Horan	What is the degree of conservatism introduced in your risk analysis? 10, 100, or 10,000? The public should not have to search through pages 6-60 in the RI report for this vital information.	A-8
W15-9	23	John R. Horan	While it won't matter, my health and technical choice is Alternative 0.	A-13
W15-10	43	John R. Horan	Inadequate justification has been made to accelerate this applied experiment over a 2-year period.	A-22

**PUBLIC COMMENTS RECEIVED ON THE
ORGANIC CONTAMINATION IN THE VADOSE ZONE
DURING THE 31 MARCH-30 APRIL 1994 COMMENT PERIOD**

Code	Response Number	Commenter	Comment	Page Number
W15-1 1	26	John R. Horan	As a developmental research project you might be able to make a case to use existing equipment on other wells in sequence. You have not considered this lower keyed approach.	A-15
W15-1 2	41	John R. Horan	As a taxpayer I would prefer to see my money spent on saving lives (e.g., Boron Neutron Capture Therapy).	A-21
W15-1 3	NC	John R. Horan	I cannot understand how you can get engineers and scientists to work on this type of pork barrel project which is basically unprofessional and unethical.	Out-of-Scope/Not Responded To
W16-1	32	George Leedom	From the presentation I heard at Moscow, Idaho, on April 21, 1994, I feel there is a potential problem and the action you propose of venting and destroying the contaminant appears to be very logical and thought out. I fully agree with your clean up proposal and the sooner the better.	A-17
W16-2	31	George Leedom	I realize there is no getting to zero contamination at any practical cost and there is really no need to. Carbon tetrachloride, trichloroethylene, tetrachloroethylene, and I, II,-trichloroethylene contaminants have been with us for years and haven't shown been toxic at low levels.	A-17
W16-3	3, 32	George Leedom	Therefore, I feel that getting contaminations down to a reasonable level (minor risk) at reasonable cost is the best alternative. I feel that you have chosen the reasonable alternative. Thank you very much.	A-6, A-17

Appendix C

**Idaho National Engineering Laboratory
Administrative Record File Index of the
RWMC Vadose Zone Organics RI/FS Operable Unit 7-08
10/20/94**

Appendix C

Idaho National Engineering Laboratory Administrative Record File Index of the RWMC Vadose Zone Organics RI/FS Operable Unit 7-08 10/20/94

ADMINISTRATIVE RECORD VOLUME I FILE NUMBER

AR3.1 SAMPLING AND ANALYSIS PLAN

- ▲ Document #: EGG-WM-10175, Vol. 1
Title: Sampling and Analysis Plan for the Organic Contamination in the Vadose Zone
Author: Anderson, I. R.
Recipient: N/A
Date: 06/01/92
- ▲ Document #: EGG-WM-10175, Vol. 2
Title: Sampling and Analysis Plan for the Organic Contamination in the Vadose Zone
Author: Anderson, I. R.
Recipient: N/A
Date: 06/01/92

ADMINISTRATIVE RECORD VOLUME II

AR3.3 WORK PLAN

- ▲ Document #: ERD-025-92
Title: Organic Contamination in the Vadose Zone Remedial Investigation/Feasibility Study Work Plan
Author: Lyle, J. L.
Recipient: Pierre, W.; Nygard, D.
Date: 02/27/92
- ▲ Document #: EGG-WM-10049
Title: Final Work Plan for the Organic Contamination in the Vadose Zone
Author: Chatwin, T. D.
Recipient: N/A
Date: 06/01/92

FILE NUMBER**AR3.4 REMEDIAL INVESTIGATION**

- ▲ Document #: ER-VVED-076
Title: Long Term Testing at OCVZ (OU-8), Possible Origin of Chloroform at the RWMC
Author: Downs, W. C.
Recipient: ARDC
Date: 05/04/94

AR3.10 SCOPE OF WORK

- ▲ Document #: EGG-ERD-10376, Rev. 7
Title: Scope Of Work for Organic Contamination in the Vadose Zone Remedial Investigation/Feasibility Study
Author: Matthern, G. E.
Recipient: N/A
Date: 06/01/92

AR3.12 RI/FS REPORTS

- ▲ Document #: EGG-ER-10684, Vol. 1
Title: Remedial Investigation/Feasibility Study Report For The Organic Contamination in the Vadose Zone—Operable Unit 7-08
Volume I: Remedial Investigation
Author: Duncan, F. L.
Recipient: N/A
Date: 12/01/93

ADMINISTRATIVE RECORD VOLUME III

- ▲ Document #: EGG-ER-10684, Vol. 2
Title: RI/FS Report For The Organic Contamination in the Vadose Zone—Operable Unit 7-08
Volume II: Remedial Investigation Appendices
Author: Duncan, F. L.
Recipient: N/A
Date: 12/01/93

ADMINISTRATIVE RECORD VOLUME IV
FILE NUMBER

AR3.12 RI/FS REPORTS (continued)

- ▲ Document #: EGG-ER-10684, Vol. 3
Title: RI/FS Report For The Organic Contamination in the Vadose Zone—
Operable Unit 7-08
Volume II: Feasibility Study
Author: Hamel, C. M.
Recipient: N/A
Date: 12/01/93
- ▲ Document #: OPE-ER-70-94
Title: Transmittal of Final Inserts for the OCVZ Final RI/FS
Author: Green, L.
Recipient: Pierre, W.; Nygard, D.
Date: 03/24/94

AR3.17 RI/BRA REPORTS

- ▲ Document #: AM/ERWM-ERD-092-92
Title: Organic Contamination in the Vadose Zone Remedial
Investigation/Feasibility Study
Author: Lyle, J. L.
Recipient: Pierre, W.; Nygard, D.
Date: 10/09/92
- ▲ Document #: AM/ERWM-ERD-017-93
Title: Transmittal of Draft Organic Contamination in the Vadose Zone Remedial
Investigation and Baseline Risk Assessment Report
Author: Lyle, J. L.
Recipient: Pierre, W.; Nygard, D.
Date: 03/03/93

FILE NUMBER

AR3.18 ENVIRONMENTAL ASSESSMENT

- ▲ Document #: 5620
Title: NEPA—Environmental Assessment of Remediation of Organic Contamination in the Vadose Zone at the INEL
Author: DOE-ID
Recipient: Administrative Record
Date: 02/25/94

AR3.19 FINDING OF NO SIGNIFICANT IMPACT

- ▲ Document #: 5619
Title: Draft Finding of No Significant Impact for the Remediation of the Organic Contamination in the Vadose Zone
Author: DOE-ID
Recipient: N/A
Date: 02/01/93

AR3.20 TREATABILITY STUDY

- ▲ Document #: AM/ERWM-ERD-085-92
Title: Vapor Vacuum Extraction Treatability Study at the RWMC
Author: Macdonald, D. W.
Recipient: Nygard, D.
Date: 09/11/92
- ▲ Document #: EGG-WM-10132
Title: Final Work Plan for the OCVZ OU 7-08 Pilot Scale Treatability Study
Author: Herd, M.
Recipient: N/A
Date: 03/01/94
- ▲ Document #: OPE-ER-69-94
Title: Transmittal of the Draft Treatability Study Report for OCVZ (OU-7-08)
Author: Green, L. A.
Recipient: Pierre, W.; Nygard, D.
Date: 03/25/94

FILE NUMBER

AR4.3 PROPOSED PLAN

- ▲ Document #: 5642
Title: Proposed Plan for Organic Contamination in the Vadose Zone
Author: INEL Community Relations
Recipient: N/A
Date: 03/01/94
- ▲ Document #: 5672
Title: Transmittal of the Proposed Plan for Organic Contamination in the Vadose Zone, Idaho National Engineering Laboratory
Author: Robison, S. A.
Recipient: Burns, T. F.
Date: 02/18/94

AR5.1 RECORD OF DECISION

- ▲ Document #: OPE-ER-152-94
Title: Transmittal of the Draft Record of Decision for Organic Contamination in the Vadose Zone, RWMC, INEL
Author: Lyle, J. L.
Recipient: Pierre, W.; Nygard, D.
Date: 07/11/94
- ▲ Document #: 5761
Title: Record of Decision for Organic Contamination in the Vadose Zone, RWMC, INEL
Author: DOE-ID, EPA, IDHW
Recipient: N/A
Date: 11/08/94

AR7.8 OFFSITE WASTE SHIPMENTS

- ▲ Document #: 5609
Title: Approval of an EG&G Idaho Waste Shipment
Author: Lytle, J. E.
Recipient: Burns, T. F.
Date: 11/22/93

FILE NUMBER

AR7.9 SECRETARIAL POLICY

- ▲ Document #: OPE-ER1-056-94
Title: Changes in the Environmental Restoration (ER) Program Due To The Secretarial Policy on the National Environmental Policy Act (NEPA)
Author: Green, L. A.
Recipient: Addressees
Date: 07/13/94

AR10.4 PUBLIC MEETING TRANSCRIPTS

- ▲ Document #: 5703
Title: Public Meeting Transcripts for the Organic Contamination in the Vadose Zone (OCVZ)
Author: Ecology and Environment, Inc.
Recipient: N/A
Date: 05/24/94

This document can be found in the INEL OU 8-07 Administrative Record Binder

AR10.6 PRESS RELEASES

- ▲ Document #: 5640
Title: DOE Seeks Public Comment on Organic Contamination in the Vadose Zone
Author: N/A
Recipient: N/A
Date: 03/01/94

AR12.1 EPA COMMENTS

- ▲ Document #: 5358
Title: Comments for Draft Work Plan for Organic Contamination in the Vadose Zone Remedial Investigation/Feasibility Study, Operable Unit 7-8, December 1991
Author: Pierre, W.
Recipient: Lyle, J. L.
Date: 02/26/92

FILE NUMBER

AR121 EPA COMMENTS (continued)

- ▲ Document #: 5674
 Title: INEL RWMC—Draft Final Work Plan for The Organic Contamination in the Vadose Zone, Operable Unit 7-08 Focused Remedial Investigation / Feasibility Study, Dated May 1992
 Author: Nearman, M. J.
 Recipient: Macdonald, D.
 Date: 05/21/92
- ▲ Document #: 5357
 Title: INEL WAG 7—Draft RI Report for the Organic Contamination in the Vadose Zone (OU 7-08), February 1993
 Author: Nearman, M. J.
 Recipient: Macdonald, D.
 Date: 04/29/93
- ▲ Document #: 5613
 Title: EPA Comments on the Draft RI/FS Report for the Organic Contamination in the Vadose Zone OU 7-08, 3 volumes, dated August 1993
 Author: Nearman, M. J.
 Recipient: Macdonald, D.
 Date: 11/04/93
- ▲ Document #: 5628
 Title: EPA Comments: INEL OU 7-08 Draft Final RI/FS Report
 Author: Jones, E.
 Recipient: Green, L.
 Date: 02/14/94
- ▲ Document #: 5707
 Title: EPA Concurs: Preliminary Design Summary Report for OCVZ, RWMC, INEL
 Author: Pierre, W.
 Recipient: Green, L.
 Date: 05/18/94

FILE NUMBER

AR12.1 EPA COMMENTS (continued)

- ▲ Document #: 5765
Title: EPA Comments on the Record of Decision for the OCVZ
Author: Wilkening, R. M.
Recipient: Green, L.
Date: 08/22/94

AR12.2 IDHW COMMENTS

- ▲ Document #: 5675
Title: Technical Review Comments for Draft Final Focused RI/FS Work Plan for Organic Contamination in the Vadose Zone
Author: Nygard, D.
Recipient: Lyle, J. L.
Date: 05/22/92
- ▲ Document #: 5696
Title: Review of DOE-ID Letter Dated 09/11/92 Providing Air Emissions Information for Meeting the Substantive Requirements of Idaho's Air Quality Regulations, VVE Treatability Study at the RWMC
Author: Nygard, D.
Recipient: Lyle, J. L.
Date: 10/16/92
- ▲ Document #: 5355
Title: Review of EG&G Letter Dated November 9, 1992 Providing Air Emissions Information for the Pilot Scale Treatability Study, Operable Unit (OU 7-08) at the RWMC
Author: Nygard, D.
Recipient: Lyle, J. L.
Date: 11/30/92
- ▲ Document #: 5356
Title: Review Comments for Draft RI Report for the Organic Contamination in the Vadose Zone, (EGG-ER-10684)
Author: Nygard, D.
Recipient: Macdonald, D.
Date: 04/21/93

FILE NUMBER

AR122 IDHW COMMENTS (continued)

- ▲ Document #: 5571
Title: Technical Review Comments for the Draft Remedial Investigation /
Feasibility Study Report for the Organic Contamination in the Vadose Zone
Operable Unit 7-08
Author: Koch, D. F.
Recipient: Williams, A. C.
Date: 11/03/93
- ▲ Document #: 5708
Title: Confirmation of OCVZ Well Installation Modification
Author: Koch, D.
Recipient: Green, L.
Date: 05/16/94
- ▲ Document #: 5766
Title: IDHW Review of the Record of Decision—Declaration of
OCVZ—OPE-ER-152-94
Author: Koch, D.
Recipient: Green, L.
Date: 08/26/94

AR123 DOE RESPONSE TO COMMENTS

- ▲ Document #: ERD1-081-92
Title: Scope for Organic Contamination in the Vadose Zone Remedial
Investigation/Feasibility Study
Author: Lyle, J. L.
Recipient: Pierre, W.; Nygard, D.
Date: 03/27/92
- ▲ Document #: 5588
Title: Resolution on the Comments for the Draft Remedial Investigation Report
for the Organic Contamination in the Vadose Zone (Operable Unit 7-08).
February 1993
Author: EG&G Idaho, Inc.
Recipient: IDHW
Date: 02/01/93

FILE NUMBER

AR123 DOE RESPONSE TO COMMENTS (continued)

- ▲ Document #: OPE-ER-004-94
Title: DOE Response to IDHW and EPA Comments on the Draft RI/FS for Organic Contamination in the Vadose Zone OU 7-08
Author: Green, L.
Recipient: Pierre, W.; Nygard, D.
Date: 01/13/94
- ▲ Document #: OPE-ER-267-94
Title: DOE Response to IDHW and EPA Comments on the Draft Record of Decision (ROD) for Organic Contamination in the Vadose Zone (OCVZ) OU 7-08 at the RWMC, INEL
Author: Green, L.
Recipient: Pierre, W.; Nygard, D.
Date: 09/30/94

AR124 REQUEST FOR EXTENSION

- ▲ Document #: ERD1-118-92
Title: Extension Of Comment Period For Organic Contamination in the Vadose Zone (OCVZ) Remedial Investigation/Feasibility Study
Author: Lyle, J. L.
Recipient: Pierre, W.; Nygard, D.
Date: 03/27/92

This Administrative Record Index is complete.

DOE-ID WAG Manager

Date

LITCO WAG Manager

Date