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Office of
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Remedial Response

EPA/ROD/R08-87/011
June 1987

EPA

Superfund Record of Decision:

RMA Off-Post RI/FS, CO

[redacted]

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16. ABSTRACT

The Rocky Mountain Arsenal (RMA) is a facility owned and operated by the United States Department of the Army. It was established in 1942 with the primary mission of manufacturing and assembling chemical and incendiary munitions to support the war effort. Afterwards, pesticides and herbicides were produced on-post by private leases. Many of these substances, their by-products and residues were later disposed of on-post. The RMA off-post site is located northeast of downtown Denver, Colorado, adjacent to RMA. The area is nearly completely developed with residential subdivisions, industrial facilities and gravel operations. South Adams County Water and Sanitation District (SACWSD) was created in 1953 to supply approximately 30,000 customers with well water from the alluvium and bedrock. Recent studies by EPA and SACWSD indicate that significant concentrations of organic solvents are present in the local and Regional ground water system which is the main source of drinking water for SACWSD. This operable unit addresses treatment or replacement of contaminated ground water within the RMA off-post site prior to its use as drinking water by customers of the SACWSD. The hazardous substances of primary concern present in the ground water supplying the SACWSD wells include: trichloroethylene (TCE), tetrachloroethylene (PCE), 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethylene, and trans-1,2-dichloroethylene. Other volatile, semi-volatile, and non-volatile organic
(See Attached Sheet)

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Record of Decision Rocky Mountain Arsenal, CO First Remedial Action Contaminated Media: air, gw Key contaminants: organics/VOCs, TCE, PCE, 1,1,1-trichloroethane, 1,1-dichloroethane, trans-1,2-dichloroethylene, vinyl chloride		

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Rocky Mountain Arsenal, CO
First Remedial Action

16. ABSTRACT (continued)

compounds are present in the ground water in areas adjacent to a upgradient of RMA off-post site, but have not been detected in SACQSD supply wells to date. Vinyl chloride has also been detected upgradient from the SACWSD wells.

The remedial alternative selected for this site includes: construction of a granular activated carbon (GAC) water treatment system with regeneration of spent carbon at another loction; modification of the GAC system, if necessary, to include an air stripping facility to treat vinyl hloride; replacement of existing well pumps and motors; installation of transmission piping; and, construction of laboratory and office space to ensure that the remedy operates effectively. The estimated capital cost for the GAC system is $8,869,000. If an air stripping facility is required, the cost will be $10,100,000. The estimated annual O&M cost is $372,000.

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REGION VIII
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198-RI1-DD-EQVL

RECORD OF DECISION
SUMMARY OF REMEDIAL ALTERNATIVE SELECTION
COMMUNITY RELATIONS RESPONSIVENESS SUMMARY

First Operable Unit
EPA's RMA Off-Post RI/FS Site

Commerce City, Colorado

June 4, 1987

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION FOR FIRST OPERABLE UNIT

SITE

EPA's RMA Off-Post RI/FS Site
Commerce City, Colorado

DOCUMENTS REVIEWED

I am basing my decision on the administrative record for the site, including, but not limited to, the following documents describing the analysis of the cost and effectiveness of the remedial alternatives for the EPA's RMA Off-Post RI/FS site:

- Remedial Investigation for the First Operable Unit - EPA's RMA Off-Post RI/FS Site, dated December 1986 and prepared by Camp Dresser & McKee (Includes Public Health Endangerment Assessment)
- Feasibility Study for the First Operable Unit - EPA's RMA Off-Post RI/FS Site, dated December 1986 and prepared by Camp Dresser & McKee
- Preliminary Risk Assessment of the South Adams County Water and Sanitation District Water Distribution System, dated April 17, 1986 and prepared by Clement Associates, Inc. for Camp Dresser & McKee
- Treatability/Feasibility Study for District Water Quality Improvement, dated May 1986 and prepared by James M. Montgomery Consulting Engineers Inc. for South Adams County Water and Sanitation District
- Detailed Analysis for Organic Contaminant Removal, dated October 1986 and prepared by Black and Veatch for South Adams County Water and Sanitation District.
- Summary of Remedial Alternative Selection (attached hereto)
- Responsiveness Summary (attached hereto)
- Staff Summaries and Briefing Documents

DESCRIPTION OF SELECTED REMEDY

This operable unit addresses treatment or replacement of contaminated ground water within the EPA's RMA Off-Post RI/FS site prior to its use as drinking water by customers of the South Adams County Water and Sanitation District (SACWSD). The hazardous substances of primary concern that have been released into the environment and are present in ground water supplying the SACWSD wells include trichloroethylene (TCE), tetrachloroethylene (PCE), 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethylene and trans-1,2-dichloroethylene. The contaminated ground water is the main source of drinking water for SACWSD.

The selected remedy for the first operable unit of the EPA Off-Post RI/FS site is the construction of a granular activated carbon (GAC) water treatment system and regeneration of spent carbon at another location. The GAC system will treat contaminated water from the South Adams County Water and Sanitation District (SACWSD) drinking water supply wells prior to its consumption as drinking water. The GAC system will attain a degree of cleanup of the hazardous substances of primary concern which will assure protection of human health. Other volatile, semi-volatile, and non-volatile organic compounds are present in the ground water in areas adjacent to and upgradient of EPA's RMA Off-Post RI/FS site, but have not been detected in SACWSD supply wells to date. In the event that other volatile, semi-volatile, and/or non-volatile organic compounds are identified in ground water supplying the SACWSD wells, the GAC system will have the greatest capability of the treatment alternatives evaluated to treat a wide spectrum of such hazardous substances to a level that will assure protection of human health, without modification.

Vinyl chloride (a highly volatile polar compound) has also been detected upgradient from the SACWSD supply wells, although it has not been detected in SACWSD supply wells to date. The GAC system may not treat vinyl chloride to acceptable levels. The GAC system can be modified by the addition of an air stripping facility to treat vinyl chloride in the event

that vinyl chloride currently detected upgradient of the SACWSD supply wells poses a threat to the SACWSD supply wells and the public health. The selected air stripping facility would be designed to treat vinyl chloride to levels that assure protection of public health. EPA will continue to monitor for vinyl chloride to determine whether it presents a threat to public health.

Additionally, in order to ensure that the remedy operates effectively and provides adequate safe drinking water supplies for the estimated SACWSD water demand of 12.0 MGD, the remedy consists of the replacement of existing well pumps and motors, the installation of transmission piping, and the construction of laboratory and office space.

To assure protection of the public health in the interim period between approval of the Record of Decision and completion of the selected permanent GAC treatment system, the selected remedy provides for the continued leasing and operation and demobilization of the temporary GAC treatment system, installed in June, 1986 under EPA's removal authority, to treat SACWSD drinking water until the permanent system is on line. The temporary system is designed to treat contaminated ground water to levels at or below Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act (SDWA).

The remedy includes the following operation and maintenance activities:

- Periodic replacement of granular activated carbon and routine equipment maintenance and replacement;
- Provision of electrical power to run the facility;
- Provision of chemical additives to prevent scaling and bacterial growth within the GAC contactors; and
- Personnel to operate the new facility.

DECLARATIONS

Consistent with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and the National Contingency Plan, 40 CFR Part 300, I have determined that construction of a granular activated carbon water treatment facility to treat contaminated ground water underlying the EPA Off-Post RI/FS site is a cost-effective operable unit remedial action, is protective of human health, and is consistent with possible future remedial actions. The selected remedy includes the possible addition of an air stripping facility, as appropriate to assure protection of human health, in the event that vinyl chloride currently identified upgradient of the SACWSD wells poses a threat to the SACWSD wells. The selected remedy also provides for the replacement of existing well pumps and motors, the installation of transmission piping, and the construction of laboratory and office space. Until the permanent GAC system is on line, the selected remedy provides for continued leasing of the temporary GAC system currently in place.

The selected remedy utilizes permanent solutions and treatment technologies to the maximum extent practicable for contaminants identified to date in SACWSD drinking water supply wells (GAC treatment with incineration of spent carbon at another location) for this operable unit. The selected remedy for this operable unit will reduce the volume and the toxicity and mobility of contaminants identified in south Adams County drinking water to date through incineration of the volatile organic compounds adsorbed on the granular activated carbon when the carbon is regenerated. Spent carbon from the GAC treatment system will be regenerated at an incinerator in compliance with Sections 3004 and 3005 of the Solid Waste Disposal Act (SWDA) and Section 121(d)(3) of CERCLA.

The applicable or relevant and appropriate requirements for this operable unit are the Maximum Contaminant Levels ("MCLs") established under the Safe Drinking Water Act ("SDWA") for hazardous substances, pollutants, or

contaminants identified in south Adams County drinking water. Under the SDWA, Congress established a two-pronged approach for determining permissible levels of contaminants in water which is delivered to any user of a public water system: (1) maximum contaminant level goals ("MCLGs") are to be set at the level at which no known or anticipated adverse effects on health of persons occur and which allovs an adequate margin of safety; and (2) MCLs are to be set as close to the MCLG as is feasible. Section 1412(b)(4) of the SDWA. MCLGs are non-enforceable health goals. MCLs are enforceable requirements which specify the maximum permissible level of a contaminant in water which is delivered to any user of a public water system. Section 1401(3) of the SDWA.

Congress defined the term feasible to mean:

> ... with the use of the best technology, treatment techniques, and other means which the Administrator finds, after examination for efficacy under field conditions and not under laboratory conditions, are available (taking cost into consideration) .... Granular activated carbon is feasible for the control of synthetic organic chemicals, and any technology, treatment technique, or other means found to be the best available for the control of synthetic organic chemicals must be at least as effective in controlling synthetic organic chemicals as granular activated carbon."

Section 1412(b)(5) of the SDWA.

The selected remedial action for this operable unit is a granular activated carbon treatment system. In selecting GAC, EPA is utilizing a technology which Congress explicitly recognized as feasible under the Safe Drinking Water Act. Id. Moreover, by specifying MCLs as the applicable or relevant and appropriate requirement that cannot be exceeded for this operable unit, EPA is implementing and acting consistently with the statutorily mandated process and criteria that Congress prescribed for all public drinking water systems nationwide. In addition, the MCLs selected as applicable or

relevant and appropriate requirements for this operable unit for contaminants identified in south Adams County drinking water assure adequate protection of human health.

For the above reasons, EPA has selected MCLs as the legally applicable or relevant and appropriate requirement which the selected remedy must at least attain for this operable unit.[1]

Section 121(d)(2)(A) of CERCLA provides that remedial actions "require a level or standard of control which at least attains (MCLGs) ... where such goals ... are relevant and appropriate under the circumstances of the release." This language, on its face, and Section 121 of CERCLA, taken as a whole, gives EPA the discretion to determine, in light of the specific facts at CERCLA sites, whether MCLGs are relevant and appropriate. It is within the Agency's discretion to determine that MCLs are the applicable or relevant and appropriate cleanup standards based on the circumstances present at this site. For this particular operable unit, additional factors are not present which suggest the need to attain MCLGs in order to assure protection of human health. Therefore, the Agency has determined that MCLGs are not relevant and appropriate under the circumstances of this operable unit.

Specifically, the selected remedy shall at least attain, and shall in no circumstances exceed, the following levels for hazardous substances, pollutants or contaminants identified in south Adams County drinking water: (1) proposed MCLs for volatile synthetic organic chemicals. See 50 Fed. Reg. 46902 (Nov. 13, 1985); and (2) final MCLs. Table A sets forth EPA's final and proposed MCLs. In the event that MCLs are revised, or amended to include additional contaminants identified in south Adams County drinking

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1. Applicable or relevant and appropriate requirements are selected on a site-specific basis. The selection of MCLs as the applicable or relevant and appropriate requirement for this operable unit is not intended to establish precedent for remedial action at other sites or operable units, including, but not limited to, ground water and surface water restoration, and is not intended to establish precedent for any contaminants not identified in south Adams County drinking water.

TABLE A

FINAL AND PROPOSED MCLs

PROPOSED MCLs FOR VOLATILE SYNTHETIC ORGANIC CHEMICALS[a]	mg/l
Organic	
Trichloroethylene (TCE)	0.005
Carbon Tetrachloride	0.005
Vinyl Chloride	0.001
1,2-Dichloroethane	0.005
1,1,1-Trichloroethane (TCA)	0.200
p-Dichlorobenzene[c]	0.005
Benzene	0.005
1,1 Dichloroethylene	0.007

FINAL MCLs FOR ORGANIC AND INORGANIC CHEMICALS[b]	mg/l
Inorganic	
Arsenic	0.05
Barium	1
Cadmium	0.010
Chromium	0.05
Fluoride	4.0
Lead	0.05
Mercury	0.002
Nitrate (as N)	10
Selenium	0.01
Silver	0.05
Organic	**mg/l**
Chlorinated hydrocarbons:	
Endrin	0.0002
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.005
Chlorophenoxys:	
2,4-D	0.1
2,4,5-TP Silvex	0.01
Total Trihalomethanes	0.10

[a] See 50 Fed. Reg. 46902 (Nov. 13, 1985).
[b] See 40 CFR Part 141, Subpart B.
[c] See 52 Fed. Reg. 12878 (April 17, 1987).

water, the agency will evaluate such revised or amended MCLs and amend the Record of Decision, if appropriate, to require that the remedy attain the revised or amended MCLs and assure adequate protection of human health.

The Agency expects that the MCLs will drive the design and operation of the remedy. By not exceeding MCLs, the selected remedy will assure protection of human health for other hazardous substances, pollutants, or contaminants identified in south Adams County drinking water for which MCLs have not been proposed or finally promulgated. In any event, the selected remedy will at least attain a level of control for such other hazardous substances, pollutants, or contaminants that falls within a total risk range of 10^{-4} to 10^{-7} over a 70-year lifetime exposure, with a goal of attaining a level of control that reflects a 10^{-6} risk.

National Emission Standard for Hazardous Air Pollutants (NESHAPs), established under the Clean Air Act, for vinyl chloride and benzene, are relevant and appropriate in the event that air stripping is required to treat vinyl chloride (40 CFR Part 61, Subparts F and J).

Pretreatment standards promulgated pursuant to Section 307 of the Clean Water Act are applicable or relevant and appropriate in the event that the selected remedy involves the discharge, indirect discharge, or introduction of pollutants into a publicly owned treatment works from a source regulated under sections 307(b), (c), or (d) of the Clean Water Act. The remedy currently does not contemplate such a discharge, indirect discharge or introduction of pollutants.

This degree of cleanup will assure protection of human health under this operable unit. The selected remedial action is relevant and appropriate under the circumstances of the release or threatened release of the hazardous substances, pollutants, or contaminants of concern identified to date in SACWSD drinking water supply wells.

The State of Colorado provided EPA with a list of applicable or relevant and appropriate State standards, requirements, limitations, or criteria ("State requirements") for this operable unit on January 8, 1987. The State amended its list on March 17, 1987 to delete several requirements and add an additional requirement. EPA has reviewed the proposed State requirements under the criteria set forth in Section 121(d) of CERCLA, and determined that certain provisions within the following State requirements generally are applicable or relevant and appropriate:

1. The Colorado Hazardous Waste Act and Regulations

   Applicable to the extent the selected remedy involves the generation, transportation, treatment, or storage of hazardous waste in the spent granular activated carbon. The selected remedy does not contemplate disposal of hazardous waste.

2. The Colorado Primary Drinking Water Regulations

   Applicable or relevant and appropriate to the drinking water which will be supplied to the public through the selected remedy, for contaminants identified in the ground water which supplies the SACWSD supply wells.

3. The Colorado Air Quality Control Regulations

   Applicable or relevant and appropriate to fugitive particulate emissions and emissions which may result from the selected remedy if air stripping of vinyl chloride is required, or if storage or transfer of volatile organics compounds is required.

4. The Colorado Noise Abatement Statute

   Applicable or relevant and appropriate to establish maximum permissible noise levels for construction or operation of the selected remedy.

5. The Colorado Wildlife Statutes and Regulations

   Applicable to the extent the selected remedy involves the taking, possession, transportation, exportation, shipment, removal, capture, or destruction of wildlife. The selected remedy does not contemplate any of these activities.

6. The Water Well and Pump Installation Contractor Act and Regulations

   Applicable or relevant and appropriate to pump installation. The selected remedy does not contemplate the construction of water wells.

7. Historical, Prehistorical, and Archaeological Resources Act

   Applicable or relevant and appropriate if the selected remedy involves the investigation, excavation, gathering or removal from the natural state of any historical , prehistorical, and archaeological resources within the state. The selected remedy does not contemplate any of these activities.

8. The Colorado Water Quality Control Act and Regulations

   Applicable or relevant and appropriate to the extent the selected remedy involves the discharge of pollutants to waters of the State of Colorado. The selected remedy does not contemplate such a discharge.

A detailed evaluation of the State requirements is set forth in Appendix B. The selected remedy will at least attain the legally applicable or relevant and appropriate State requirements identified in Appendix B.

The State of Colorado and the SACWSD have been consulted and concur with the selected remedy (Appendix C). The action will require future operation and maintenance activities to assure the continued effectiveness of the remedy.

The Agency for Toxic Substances and Disease Registry (ATSDR) revieved the Remedial Investigation and Feasibility Study reports, including the Public Health Evaluations, and stated the opinion that "any of the proposed remedial alternatives for treatment of the South Adams County Water and Sanitation District (SACWSD) ground water will achieve the necessary treatment required to protect public health." ATSDR's concurrence is included in the Administrative Record.

Pursuant to an Agreement entered into between the Army and EPA on September 26, 1986, the selected response action for this operable unit will be partially financed by the U.S. Army. The selected remedy is a cost-effective response measure necessary to abate, minimize, stabilize, mitigate, or eliminate the threat posed to public health by TCE in south Adams County drinking water. To the extent that Army or other PRP funds are used for the design, construction and implementation of the response action, the State cost share requirements under Section 104(c)(3) of CERCLA shall not apply. The State cost share requirements under Section 104(c)(3) shall apply to any Fund-financed construction and implementation of the selected remedial action.

The EPA will continue its comprehensive remedial investigation/feasibility studies for the entire EPA RMA Off-Post RI/FS site, and expects to complete such studies by about Spring of 1988. The feasibility study will evaluate whether or not further response actions are necessary at the EPA RMA Off-Post site to protect human health and the environment. Following completion of the FS, a Record of Decision will be prepared addressing future response actions, if any. The selected remedy for this operable unit is consistent with a permanent remedy.

June 4, 1987
Date

James Scherer
Regional Administrator
Environmental Protection Agency
US EPA - Region 8

SUMMARY OF REMEDIAL ALTERNATIVES SELECTION

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SUMMARY OF REMEDIAL ALTERNATIVE SELECTION
EPA'S RMA OFF-POST RI/FS SITE

SITE LOCATION AND DESCRIPTION

The Rocky Mountain Arsenal (RMA) was proposed for inclusion on the National Priorities List (NPL) in October, 1984. RMA is a facility owned and operated by the United States Department of the Army. RMA was established in 1942 with the primary mission of manufacturing and assembling chemical and incendiary munitions to support the war effort. Subsequently, pesticides and herbicides were produced on-post by private leasees. Many of these substances, their by-products and residues were disposed on-post. The Army is conducting RI/FS studies on-post and off-post north of 80th Avenue.

EPA's RMA Off-Post RI/FS site is located about 10 miles northeast of the downtown area of Denver, Colorado and adjacent to RMA. The site extends westward from the Rocky Mountain Arsenal to the South Platte River. The southern boundary is formed by 56th Avenue and Sand Creek, and the northern boundary by 80th Avenue from the Arsenal to the South Platte (Figure 1). The site encompasses a large part of the municipality of Commerce City and a portion of unincorporated Adams County. The area is nearly completely developed with residential subdivisions, industrial facilities and gravel operations.

The South Adams County Water and Sanitation District (SACWSD) supplies approximately 30,000 customers with water from wells completed in alluvium and bedrock within the study area. Recent studies completed by the EPA and SACWSD in the study area indicate that significant concentrations (100 parts per billion range) of organic solvents are present in the local and regional ground water system. Private wells and SACWSD wells located within the study area are contaminated by organic solvents. Two of these organic compounds--trichloroethylene - TCE and 1,1-dichloroethylene--were

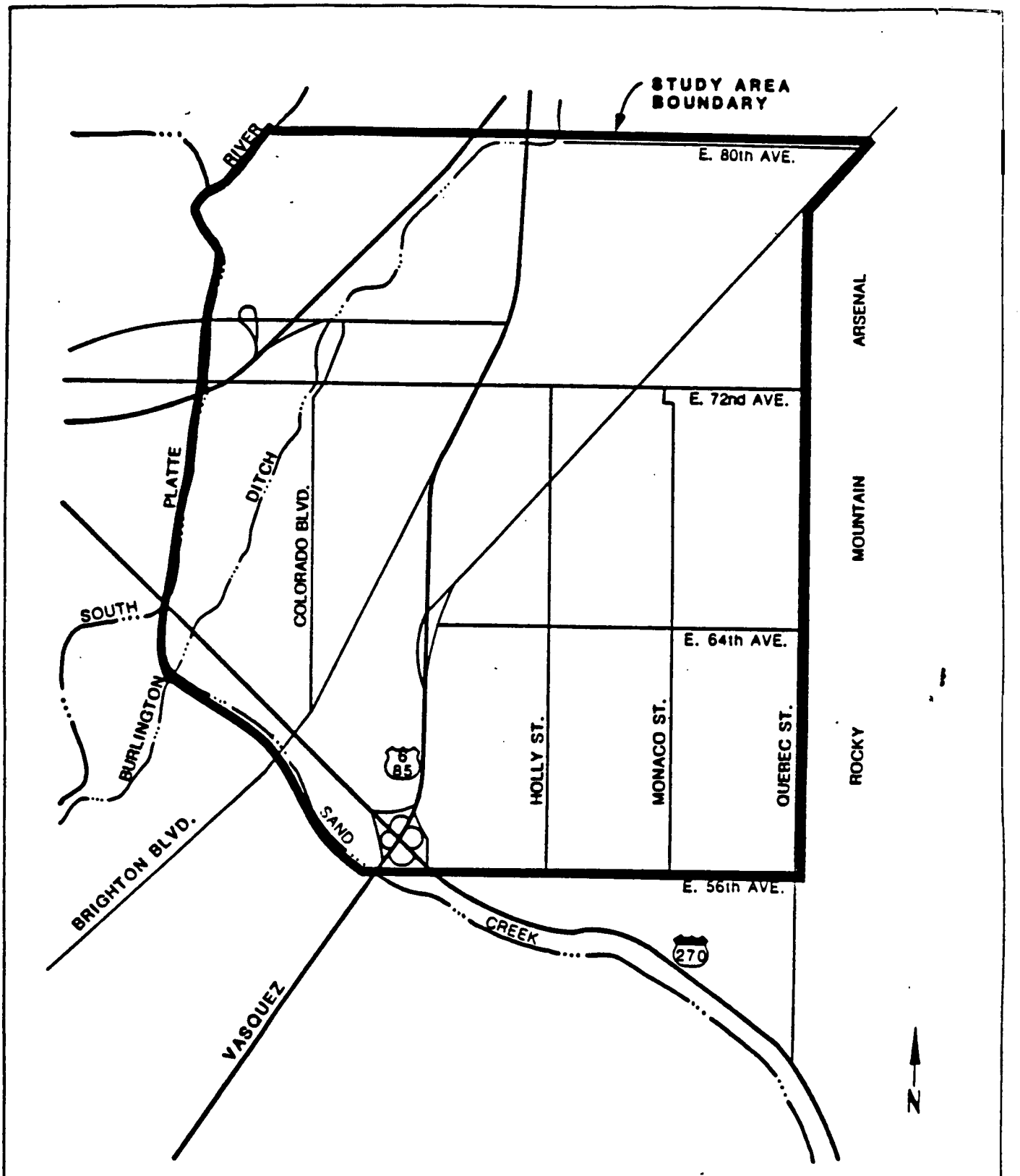

Figure 1

EPA STUDY AREA

reported in concentrations in wells in excess of maximum contaminant limits established under the Safe Drinking Water Act. To date, organic solvent contamination appears to be limited to the alluvial aquifer.

SITE HISTORY

The municipality of Commerce City and adjacent areas grew in response to the rapid post-war proliferation of industry north and east of the City of Denver. In order to provide a water supply and sewage treatment to the residents and businesses, a special governmental district was created in 1953: The South Adams County Water and Sanitation District (SACWSD). The SACWSD supplies its approximately 30,000 customers (1986) with water from wells completed in alluvium and bedrock.

Until recently, hundreds of private supply wells were in use throughout the south Adams County area. Almost all of the private wells tapped the alluvial aquifer. Most of these private wells were taken out of service in summer 1986 when residences were connected to the public water supply system as part of an Emergency Removal Action conducted by EPA. EPA Field Investigation Team (FIT) data showed that water from these wells exceeded Safe Drinking Water Act criteria for volatile organic compounds and posed a threat to public health.

Contaminated ground water containing organic solvent compounds has been detected by various government bodies, including EPA, sporadically since 1981 throughout the EPA Off-Post RI/FS site in both individual and SACWSD supply wells. The Rocky Mountain Arsenal, a proposed site on the National Priorities List (NPL), has been identified as one of two or more sources of the contamination. To date, EPA has not identified positively other sources of the contamination, but surrounding potential sources include two other CERCLA sites (Sand Creek and Woodbury) which are listed on the NPL and are directly to the south and southwest of EPA's Off-Post RI/FS site, local industries within south Adams County and upgradient of the supply wells, or a combination of any of these sources. Many of these operations

require the use of degreasing solvents, including TCE and other chlorinated hydrocarbons. Additional data must be gathered to determine the nature and extent of contamination from individual sources, and relative contributions from such sources.

On March 20, 1986, the Army signed an Agreement with EPA under which the Army agreed to transfer to EPA $1,000,000 for use by the EPA in selecting, designing and implementing response measures necessary to abate, minimize, stabilize, mitigate or eliminate the threat or potential threat posed to the public health or welfare by the presence of TCE in south Adams County drinking water. EPA is using the Army money pursuant to its Agreement with the Army to pay for the leasing of granular activated carbon filters for the temporary treatment of well water at SACWSD well sites located at 77th and Quebec, 77th and Pontiac, and 64th and Quebec. The treatment system commenced operation in May 1986. The current leased system is a temporary treatment method. The leased equipment will have to be replaced with a permanent system. The current system is leased, is sized to treat only a portion of the current maximum day flow of 12 MGD, and is not cost effective over a 30-year plant operation period.

In addition to addressing the public water supply system through installation of the temporary system, EPA connected private wells in areas of south Adams County with contaminated ground water to the SACWSD public system pursuant to EPA's removal authority.

During the course of the Remedial Investigation, EPA determined, in accordance with 40 CFR 300.68(c), that an operable unit should be conducted to address replacement or treatment of contaminated ground water prior to its use as drinking water to assure continued protection of the public health. The operable unit approach is cost effective and consistent with the final remedy.

This operable unit addresses treatment or replacement of contaminated ground water within the EPA Off-Post RI/FS site prior to its use as

drinking water by customers of the SACWSD. EPA is currently planning field studies for subsequent operable units which will address response actions necessary to protect human health and the environment. These response actions may include aquifer restoration and source control measures.

CURRENT SITE STATUS

Ground water sampling results collected from the various areas of investigation through August 1986, indicate the presence of large areas of contaminated ground water within the EPA RI/FS off-post study area boundaries. Contamination levels are highest in the area east of Holly Street. Volatile organic compounds are present in the highest concentrations and are most widespread throughout the sampled area. Six volatile organic compounds are detected consistently in ground water samples. These compounds are 1,1-dichloroethane (DCA), 1,1-dichloroethene (DCE), trans 1,2-dichloroethane (Trans-DCE), 1,1,1-trichloroethane (TCA), trichloroethylene (TCE) and tetrachloroethene (PCE). While these compounds each vary in levels of concentration and extent, they are all found in detectable concentrations between Holly and Quebec Streets in the study area and between 56th and 80th avenues. Samples collected from the SACWSD municipal wells in this zone also show detectable contamination from volatile organic compounds. The recent highest measured concentrations of VOCs within the study area as shown in Table 1.

Other compounds detected in areas potentially upgradient of the SAC alluvial production wells include benzene, vinyl chloride, pesticides, and other non-volatile organic compounds. Several upgradient potential source areas both on and off the Arsenal have yet to be characterized. These potential sources are being studied by EPA and the Army.

Concentration plots of these six VOCs, based on recent ground water sampling data, are provided as Figures 5-24 through 5-29 of the Remedial

TABLE 1

ROCKY MOUNTAIN ARSENAL
EPA OFF-POST RI/FS SITE

FREQUENTLY REPORTED CHEMICALS DETECTED IN RECENT CLP-VALIDATED ANALYTICAL RESULTS FOR GROUND WATER MONITORING WELLS IN THE OFF-POST STUDY AREA

Chemical	Maximum Reported Concentration March - July 1986 (ug/liter)	Standard/ Advisory (ug/liter)
1,1-Dichloroethane	14[a]	4000[d]
1,1-Dichloroethylene	11	7[b]
trans-1,2-Dichloroethylene	16	70[e]
1,1,1-Trichloroethane	58	200[b]
Trichloroethylene	120	5[b]
Tetrachloroethylene	21	0.7[c]

[a] This value is an estimated quantity because quality control criteria were not met. Highest reported unqualified value is 6 ug/liter.

[b] MCL or proposed MCL.

[c] No promulgated or proposed MCL, therefore, the reference concentration for potential carcinogens (at a 10^{-6} risk level) is shown.

[d] There is no MCL or reference concentration developed to date for potential carcinogens. Therefore, an EPA Health Effects Assessment level for lifetime exposure is shown.

[e] There is no MCL or reference concentration developed to date for potential carcinogens. Therefore, an EPA Health Advisory level for lifetime exposure is shown.

SOURCE: Report of Groundwater Analyses--Adams County Wells (CDM 1986 a,b,e).

Investigation. The presence of other identified volatile and non-volatile organic compounds and pesticides is shown on Figures 5-30 through 5-34 of the Remedial Investigation.

Table 2 shows a reference list of all other compounds tentatively identified to date in private wells within the Off-Post RI/FS study area. Sampling data for the SACWSD supply wells for the period November 1985 to May 1986, is listed in Table 3. Two of the compounds, DCE and TCE, exceed the Federal SDWA MCLs for presence of VOCs in drinking water.

Higher concentrations than those shown in Table 1 for a number of organic solvents, have been identified in areas adjacent to and upgradient of the current study area. Monitoring for ground water contaminants is continuing.

People may be exposed to volatile organic contaminants present in water while using the water for drinking, bathing, cooking, cleaning, irrigation, and other routine domestic activities. Exposure may be through ingestion, inhalation, or dermal contact. A preliminary evaluation (Clement Associates, Inc. April 17, 1986) indicated that the potential incremental health risks associated with direct ingestion of water and inhalation of volatilized contaminants while showering are reasonably quantifiable and outweigh the risks associated with other potential exposure pathways. Additionally, estimation of potential exposure by direct ingestion of water and inhalation during showering would provide a reasonable order-of-magnitude estimate of risk from exposure by all routes. Therefore, only exposure by these two pathways was considered in the endangerment assessment for this operable unit (Remedial Investigation Report, Section 6.0).

Carcinogenicity potency factors were used to estimate the potential excess cancer risks associated with exposure to the contaminants of concern listed in Table 1.

TABLE 2

OTHER DETECTED TENTATIVELY IDENTIFIED ORGANIC COMPOUNDS

Abbreviation[a]	Compound	CAS #
MECL	methylene chloride	75-09-2
ACET	acetone	67-64-1
CCL4	carbon tetrachloride	56-23-5
TOL	toluene	108-88-3
VYCL	vinyl chloride	75-01-4
CLRF	chloroform	67-66-3
2DCA	1,2 DCA	107-06-2
DIMP	DIMP	DIMP
XYL	total xylenes	1330-20-7
ETHB	ethyl benzene	100-41-4
CLB	chlorobenzene	108-90-7
DCP	1,2 dichloropropane	78-87-5
2TCA	1,1,2 TCA	79-00-5
MXYL	m-xylene	?
OXYL	o,p-xylene	?
BUT	2-butanone	78-93-3
FLOR	flourene	86-73-7
PHL	phenol	108-95-2
PNAN	phenanthrene	85-01-8
PHTH	phthalate	?
BBPH	butylbenzylphthalate	85-68-7
DEPH	diethyl phthalate	84-66-2
DBPH	di-N-butylphthalate	84-74-2
NAP	napthalene	91-20-13
MNAP	2-methylnaphthalene	91-57-6
DPHL	2,4 dimethylphenol	106-44-5
HETH	1-hexanol 2-ethyl	104-76-7
DFRN	dibenzofuran	132-64-9
BPH	bis(2 ethylhexyl)phthalate	117-81-7
ANIL	aniline	62-53-3
CNAP	chloronaphthalene	91-58-7
2DCB	1,2 dichlorobenzene	95-50-1
3DCB	1,3 dichlorobenzene	541-73-1
4DCB	1,4 dichlorobenzene	106-46-7
DBCP	DBCP	96-12-18

TABLE 2 (cont.)

OTHER DETECTED TENTATIVELY IDENTIFIED ORGANIC COMPOUNDS

Abbreviation[a]	Compound	CAS #
DIAZ	diazinon	333-41-5
ABHC	alpha-BHC	319-84-6
DDT	4,4 DDT	50-29-3
24D	2,4-D	94-75-7
TP	2,4,5-TP	93-72-1
DDD	4,4 DDD	72-54-8
HPEP	heptachlor epoxide	1024-57-3
ALDN	aldrin	309-00-2
ISDN	isodrin	?
ENDN	endrin	72-20-8
DLDN	dieldrin	60-57-1
DDE	4,4 DDE	72-55-9
EDSF	endosulfan II	33213-65-9
ETPR	ethylparathion	56-38-2

[a] Abbreviation code used on Figures 5-24 through 5-34 of the Remedial Investigation Report.

TABLE 3

ROCKY MOUNTAIN ARSENAL
EPA OFF-POST RI/FS SITE

RECENT ANALYTICAL RESULTS FOR SACWSD MUNICIPAL WELLS
(ug/liter)

Chemical	Sampling Date Nov. 85	Dec. 85	Jan. 86	Feb. 86	Mar. 86	May 86
Well No. 1						
Methylene chloride	NS	NS	NS	4[b]	NS	NS
Well No. 2						
1,1-Dichloroethane	6	4	<1[a]	<1	<1	NS
1,1,1-Trichloroethane	7	5	6	3	3	NS
Trichloroethylene	19	31	40	29	36	NS
Tetrachloroethylene	11	7	5	4	<1	NS
Methylene chloride	<1	9	<1	3[b]	<1	NS
Well No. 3						
1,1,1-Trichloroethane	5	4	6	3	4	NS
Trichloroethylene	46	39	40	40	47	NS
Trans -1,2-Dichloroethylene	3	<2	<2	<2	<2	NS
Methylene chloride	<1	9	<1	<1	<1	NS
Tetrachloroethylene	8	5	4	5	5	NS
Well No. 5						
Trichloroethylene	11	6	7	7	7	NS
Tetrachloroethylene	4	3	<1	3	<1	NS
Bromoform	14	<1	<1	<1	<1	NS
Methylene chloride	<1	7	<1	3[b]	<1	NS
1,1,1-Trichloroethane	<1	<1	<1	1	<1	NS
Well No. 12						
Trichloroethylene	NS	NS	NS	3	NS	NS
Well No. 14						
Trichloroethylene	8	NS	NS	NS	NS	NS
Tetrachloroethylene	2	NS	NS	NS	NS	NS

TABLE 3

RECENT ANALYTICAL RESULTS FOR SACWSD MUNICIPAL WELLS
(ug/liter) (Continued)

Chemical	Sampling Date Nov. 85	Dec. 85	Jan. 86	Feb. 86	Mar. 86	May 86
Well No. 15						
Methylene chloride	NS	5	<1[a]	4[b]	<1	NS
1,1,1-Trichloroethane	NS	<1	<1	1	2	NS
1,1-Dichloroethane	NS	<1	<1	2	<1	NS
Trans 1,3-Dichloropropene	NS	<1	<1	2	<1	NS
Well No. 16						
1,1,1-Trichloroethane	5	NS	4	5	5	NS
Trichloroethylene	15	NS	13	14	11	NS
Tetrachloroethylene	8	NS	5	5	<1	NS
Chloroform	<1	NS	2	<1	<1	NS
Methylene chloride	<1	NS	<1	4[b]	<1	NS
1,1-Dichloroethane	<1	NS	<1	4	6	NS
Well No. 17						
1,1,1-Trichloroethane	4	3	5	3	5	3
Trichloroethylene	10	8	8	9	9	12
Tetrachloroethylene	1	<1	<1	<1	<1	2
Methylene chloride	<1	4	<1	3[b]	<1	4
1,1-Dichloroethylene	<1	<1	<1	<1	<1	2
Well No. 18						
1,1,1-Trichloroethane	1	<1	3	<1	<1	NS
Tetrachloroethylene	1	<1	<1	<1	<1	NS
1,1,2,2-Tetrachloroethane	2	<1	<1	<1	<1	NS
Methylene chloride	<1	11	<1	<1	<1	NS
Trichloroethylene	<1	2	2	<1	<1	NS
Toluene	<1	2	<1	<1	<1	NS

NS = Not sampled

[a] Concentrations are below the approximate method/sample detection limit listed.

[b] Methylene chloride was also found in the laboratory blank at 4 ug/liter.

SOURCE: HRS Water Consultants, Inc. Summary data and Cenref Labs Laboratory Reports.

The use of SACWSD water during two exposure periods was considered in the public health endangerment assessment: (1) the 1- to 2-year period needed to complete the RI/FS and follow-up activities for the SACWSD system[1], and (2) lifetime period. The total excess cancer risks associated with exposure by ingestion and inhalation to 1,1-dichloroethylene, tetrachloroethylene, and trichloroethylene in water from SACWSD wells are shown in Table 4. The risks associated with 2-year exposure at the minimum and mean concentrations considered by either ingestion or inhalation, and the total risk for concurrent exposure by both routes are less than 10^{-6}. At maximum exposure concentrations, the risks for 2-year exposure by either ingestion or inhalation or for concurrent exposure by both routes equal or exceed 10^{-6}. The additive excess cancer risks associated with lifetime exposure to contaminants in SACWSD wells by ingestion and inhalation ranges from 10^{-6} to 10^{-4} for the three exposure levels considered.

The pathway of concern for this operable unit is that which is transporting the contaminants from sources to the receptors. The principal migration pathway for organic contaminants is the ground water within the alluvial aquifer that underlies the site. This aquifer is the primary drinking water source for approximately 30,000 area residents via several SACWSD municipal wells. A significant plume of organic contamination has been documented to extend up to 4 miles upgradient from the municipal wells in the area of 77th and Quebec.

ENFORCEMENT ANALYSIS

On March 20, 1986, EPA entered into an Agreement with the United States Department of the Army for the purpose of transferring $1 million from the Army to EPA for use in the selection, design, and implementation of treatment systems or other cost-effective response measures necessary to abate, minimize, stabilize, mitigate, or eliminate the threat or potential

1. EPA installed a temporary treatment system in May 1986 which is providing safe drinking water at levels below the SDWA MCLs.

TABLE 4

ROCKY MOUNTAIN ARSENAL
EPA OFF-POST RI/FS SITE

TOTAL POTENTIAL EXCESS CANCER RISKS ASSOCIATED WITH INGESTION AND INHALATION EXPOSURE ROUTES--SACWSD MUNICIPAL WELLS[a]

Route of Exposure	Additive Cancer Risk for 2-Year Exposure	Additive Cancer Risk for Lifetime Exposure
	Minimum Exposure	
Ingestion	6×10^{-8}	2×10^{-6}
Inhalation	5×10^{-9}	1×10^{-7}
Total Risk	6×10^{-8}	2×10^{-6}
	Mean Exposure	
Ingestion	3×10^{-7}	1×10^{-5}
Inhalation	2×10^{-8}	8×10^{-7}
Total Risk	3×10^{-7}	1×10^{-5}
	Maximum Exposure	
Ingestion	2×10^{-6}	1×10^{-4}
Inhalation	1×10^{-6}	3×10^{-5}
Total Risk	3×10^{-6}	1×10^{-4}

[a] Total excess cancer risks were obtained by summing the risks associated with ingestion and inhalation exposure to 1,1-dichloroethylene, trichloroethylene, and tetrachloroethylene, respectively. Trichloroethylene and tetrachloroethylene are classified in EPA's weight-of-evidence for carcinogenicity Group B2, meaning they are considered probable human carcinogens. 1,1-Dichloroethylene is classified in Group C, meaning it is considered a possible human carcinogen. Exposure to 1,1-dichloroethylene is only considered under the maximum exposure concentration scenario.

threat posed to the public health or welfare by the presence of TCE contamination in south Adams County drinking water. The Agreement states that the Army was one of two or more sources or potential sources of TCE contamination of drinking water supplies in South Adams County and provided for EPA reimbursement of the Army in the event that EPA determines that sources other than the Army are responsible for TCE contamination and liability may be approximately and reasonably apportioned to these other sources. The Agreement also provided that EPA may enter into cooperative agreements pursuant to section 104(d) of CERCLA with the State of Colorado or political subdivisions thereof to perform the work called for under the Agreement.

On April 4, 1986, EPA authorized the leasing and installation of a temporary GAC treatment system pursuant to its removal authority. EPA entered into a cooperative agreement on April 7, 1986 in the amount of $500,000 with the SACWSD and the State of Colorado for the leasing, installation, and operation of mobile GAC filters. The Cooperative Agreement was amended on May 19, 1986 to provide an additional $500,000. Army funds transferred to EPA under the March 20, 1986 Cooperative Agreement were used to fund the removal action under the Cooperative Agreement.

On September 28, 1986, the Army provided EPA with an additional $6 million pursuant to an amendment to the March 20, 1986, Agreement for the same purposes as provided for under the March 20, Agreement. To date, other responsible parties for the TCE and other hazardous substance contamination of the south Adams County drinking water supply have not been positively identified. In the event such parties are identified, EPA may seek to recover its response costs from such parties pursuant to section 107 of CERCLA and to require the PRPs to undertake any additional response action at the site to the extent provided for by CERCLA, RCRA, or other relevant authority. EPA may also seek additional funding from the Army.

ALTERNATIVES EVALUATION

The FS evaluated alternatives suitable to abate the threat posed by hazardous substances, pollutants, or contaminants in SACWSD drinking water. Individuals exposed over a lifetime to the highest levels of contamination in the ground water through ingestion or inhalation have an excess risk of cancer of $1x10^{-4}$ to $2x10^{-6}$. The remedial alternatives evaluated for this operable unit have the objective of minimizing or eliminating exposure to the contaminants present in the contaminated ground water used as a drinking water source by the SACWSD in order to assure protection of public health. Future operable units will address source control measures, and/or cleanup of the ground water.

In accordance with Section 300.68(f) of the NCP, EPA developed the following categories:

Category	Description
1.	Alternatives for treatment or disposal at an off-site facility.
2.	Alternatives which attain applicable or relevant and appropriate public health or environmental standards.
3.	Alternatives which exceed applicable or relevant and appropriate public health or environmental standards.
4.	Alternatives which do not attain applicable or relevant and appropriate public health or environmental standards but will reduce the likelihood of present or future threat from the hazardous substances and which provide significant protection to public health, welfare, and the environment. This must include an alternative which most closely approaches the level of protection provided by the applicable or relevant standards.
5.	No action alternative.

The alternatives screened are:

Alternative	Category
1. No Action	5
2. Alternate Water Supply	2,3
3. Air Stripping of Volatile Organic Compounds	2,3
4. Air Stripping of Potential Semi-Volatile Organic Compounds	2,3
5. Air Stripping of Volatile Organic Compounds with Off-Gas Treatment	2,3
6. Air Stripping of Potential Semi-Volatile Organic Compounds with Off-Gas Treatment	2,3
7. Granular Activated Carbon (GAC)	2,3
8. Air Stripping with Off-Gas Treatment for Wells 14 and 16. GAC for wells 2, 3, 5, 15, and 17	2,3
9. Continued Use of GAC System Leased for Removal Action	2,3
10. Blending	4

In addition, alternatives 5-9 provide a range of treatment alternatives which permanently and significantly, in whole or in part, reduce the toxicity, volume or mobility of the hazardous substances, pollutants or contaminants identified in SACWSD drinking water supply wells to date.

The RI/FS for this operable unit was initiated on October 2, 1985, prior to the enactment of SARA. In accordance with current EPA policy at the time of commencement of the RI/FS, the Region considered Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act (SDWA) as the applicable or relevant and appropriate requirements ("ARARs") for this operable unit. See "CERCLA Compliance with Other Environmental Statutes," 50 Fed. Reg. 47946, 47949 (Nov. 29, 1985) (MCLs included in list of potential ARARs; MCLGs (formerly RMCLs) included in list of other requirements to be considered).

EPA developed alternatives to attain or exceed MCLs, the ARARs for this operable unit before SARA. The table above reflects this approach, i.e., alternatives that attain or exceed ARARs are alternatives that attain or exceed MCLs. All of the alternatives, with the exception of blending and no action will attain or exceed MCLs.

After the enactment of SARA, EPA identified a range of ARARs for public comment in the FS, which included MCLs, MCLGs, and water quality criteria. See Consistency with Other Environmental Requirements, pp. 26. EPA has determined that the applicable or relevant and appropriate requirements for this operable unit are the Maximum Contaminant Levels ("MCLs") established under the Safe Drinking Water Act ("SDWA") for hazardous substances, pollutants, or contaminants identified in south Adams County drinking water. Under the SDWA, Congress established a two-pronged approach for determining permissible levels of contaminants in water which is delivered to any user of a public water system: (1) maximum contaminant level goals ("MCLGs") are to be set at the level at which no known or anticipated adverse effects on health of persons occur and which allows an adequate margin of safety; and (2) MCLs are to be set as close to the MCLG as is feasible. Section 1412(b)(4) of the SDWA. MCLGs are non-enforceable health goals. MCLs are enforceable requirements which specify the maximum permissible level of a contaminant in water which is delivered to any user of a public water system. Section 1401(3) of the SDWA.

Congress defined the term feasible to mean:

> ... with the use of the best technology, treatment techniques, and other means which the Administrator finds, after examination for efficacy under field conditions and not under laboratory conditions, are available (taking cost into consideration) ... Granular activated carbon is feasible for the control of synthetic organic chemicals, and any technology, treatment technique, or other means found to be the best available for the control of synthetic organic chemicals must be at least as effective in controlling synthetic organic chemicals as granular activated carbon."

Section 1412(b)(5) of the SDWA.

The selected remedial action for this operable unit is a granular activated carbon treatment system. In selecting GAC, EPA is utilizing a technology which Congress explicitly recognized as feasible under the Safe Drinking Water Act. Id. Moreover, by specifying MCLs as the applicable or relevant and appropriate requirement that cannot be exceeded for this operable unit, EPA is implementing and acting consistently with the statutorily mandated process and criteria that Congress prescribed for all public drinking water systems nationwide. In addition, the MCLs selected as applicable or relevant and appropriate requirements for this operable unit for contaminants identified in south Adams County drinking water assure adequate protection of human health.

For the above reasons, EPA has selected MCLs as the legally applicable or relevant and appropriate requirement which the selected remedy must at least attain for this operable unit.[2]

Section 121(d)(2)(A) of CERCLA provides that remedial actions "require a level or standard of control which at least attains (MCLGs) ... where such goals ... are relevant and appropriate under the circumstances of the release." This language, on its face, and Section 121 of CERCLA, taken as a whole, gives EPA the discretion to determine, in light of the specific facts at CERCLA sites, whether MCLGs are relevant and appropriate. It is within the Agency's discretion to determine that MCLs are the applicable or relevant and appropriate cleanup standards based on the circumstances present at this site. For this particular operable unit, additional factors are not present which suggest the need to attain MCLGs in order to

2. Applicable or relevant and appropriate requirements are selected on a site-specific basis. The selection of MCLs as the applicable or relevant and appropriate requirement for this operable unit is not intended to establish precedent for remedial action at other sites or operable units, including, but not limited to, ground water and surface water restoration, and is not intended to establish precedent for any contaminants not identified in south Adams County drinking water.

assure protection of human health. Therefore, the Agency has determined that MCLGs are not relevant and appropriate under the circumstances of this operable unit.

Specifically, the selected remedy shall at least attain, and shall in no circumstances exceed, the following levels for hazardous substances, pollutants or contaminants identified in south Adams County drinking water: (1) proposed MCLs for volatile synthetic organic chemicals. See 50 Fed. Reg. 46902 (Nov. 13, 1985); and (2) final MCLs. Table A sets forth EPA's final and proposed MCLs. In the event that MCLs are revised, or amended to include additional contaminants identified in south Adams County drinking water, the agency will evaluate such revised or amended MCLs and amend the Record of Decision, if appropriate, to require that the remedy attain the revised or amended MCLs and assure adequate protection of human health.

The Agency expects that the MCLs will drive the design and operation of the remedy. By not exceeding MCLs, the selected remedy will assure protection of human health for other hazardous substances, pollutants, or contaminants identified in south Adams County drinking water for which MCLs have not been proposed or finally promulgated. In any event, the selected remedy will at least attain a level of control for such other hazardous substances, pollutants, or contaminants that falls within a total risk range of 10^{-4} to 10^{-7} over a 70-year lifetime exposure, with a goal of attaining a level of control that reflects a 10^{-6} risk.

Since shipment of contaminated soils or drinking water is not within the objective of this operable unit, development of an alternative for off-site treatment or disposal (40 CFR Section 300.68(f)(1)(i)) is not appropriate. However, spent carbon from the GAC system will only be transferred to a facility operating in compliance with sections 3004 and 3005 of the Solid Waste Disposal Act (SWDA), in accordance with section 121(d)(3) of CERCLA.

A discussion of ARARs for this operable unit follows in the section of this document titled "Consistency With Other Environmental Requirements."

Alternatives were subjected to an initial screening to narrow the list of potential remedial actions for further detailed analysis using the criteria of cost, effectiveness, and acceptable engineering practices as directed by 40 CFR Section 300.68(g). Costs including Operation and Maintenance (O&M) were considered for each alternative. Each alternative was screened by evaluating feasibility, applicability, and reliability. Effectiveness in protecting human health was considered.

During the screening process, the No Action alternative was eliminated based on effectiveness because it does not protect human health. Inhabitants would continue to remain exposed at risk levels above 10^{-6}, due to VOC concentrations in drinking water.

Alternative No. 9 for using the leased GAC units was eliminated during the screening process based on effectiveness, acceptable engineering practices, and cost because the units are undersized (excessive head loss through the filters will not allow the District to meet peak demands), are not cost effective for a 30-year plant life and the manufacturer's statement that the units are not for sale. The alternate water supply alternative and the alternative of air stripping of potential semi-volatile organics with off-gas treatment were eliminated based on cost criteria. The costs of these two alternatives far exceed the capital and O&M costs of other alternatives evaluated and do not provide substantially greater public health protection.

The blending alternative was eliminated based on effectiveness. TCE concentrations are too high in individual wells to produce blended water that would have TCE concentrations below the SDWA MCLs.

The remaining alternatives were evaluated in more detail in accordance with 40 CFR Section 300.68(h). Each alternative was evaluated for cost, effectiveness in achieving the desired human health protection, implementability of the alternatives, permanency resulting in a permanent

and significant decrease in the toxicity, mobility and volume of the hazardous substance, institutional considerations, and adverse impacts.

COST

Table 5 contains the estimated present value costs of each of the remaining alternatives. Three alternatives (granular activated carbon, air stripping with off-gas treatment, and air stripping with off-gas treatment for two wells and GAC for five wells) were comparable at all three discount rates. The other two air stripping alternatives were eliminated because they do not meet the preference under Section 121 of SARA for remedies which permanently and significantly reduce the mobility, toxicity, and volume of volatile organic compounds.

INSTITUTIONAL CONSIDERATIONS

Future use of ground water from new private wells that would draw water from the alluvium underlying the study area is not expected to meet the ARAR criteria. Therefore, the EPA may consider seeking institutional controls that would restrict future use of alluvial ground water underlying the EPA Off-Post RI/FS study area for drinking water as a part of the second operable unit. As previously noted, existing private wells were connected to the SACWSD system by EPA in Summer 1986.

TECHNICAL FEASIBILITY

Engineering, implementation, reliability and constructability were evaluated. The treatment technologies are all based on proven technologies and all have a history of acceptable use. All treatment alternatives reduce the concentration of volatile organic compounds to less than the levels that EPA has determined to be applicable Federal and State requirements (see page 17).

TABLE 5

COST SUMMARY TABLE

Alternative	Discount Rate (%)	Cost Estimates Dollars			Present Worth at Discount Rate ($1,000)		
		Capital	Annual O&M	Annualized Equipment Replacement	5%[a]	8 3/8%[b]	10%[c,d]
Granular Activated Carbon	5	$8,869,000	604,100	28,600	18,593	16,024	15,005
	8 3/8			40,500			
	10			46,600			
Air Stripping of VOCs	5	$3,659,700	496,400	26,300	11,694	9,460	8,744
	8 3/8			37,200			
	10			42,800			
Air Stripping of Semi-VOCs	5	$7,105,500	2,084,900	89,200	40,521	31,140	28,137
	8 3/8			126,200			
	10			145,400			
Air Stripping of VOCs With Off-Gas Treatment	5	$5,409,400	896,000	52,300	19,985	15,953	14,662
	8 3/8			74,000			
	10			85,200			
Air Stripping Wells No. 14, 16, GAC Wells No. 2, 3, 5, 15 & 17	5	$7,238,100	567,900	31,700	16,454	13,899	13,081
	8 3/8	($7,738,400)[e]	(687,000)[e]	44,900	(18,785)[e]	(15,694)[e]	(14,704)[e]
	10			51,700			

[a] Present Worth of Annuity Factor (30 yr) = 15.37
[b] Present Worth of Annuity Factor (30 yr) = 10.87
[c] Present Worth of Annuity Factor (30 yr) = 9.43
[d] Use of 10% Discount Rate Recommended by EPA (ref. No. 31)
[e] With Off-gas Treatment

In accordance with Section 300.68(h)(2)(v) of the NCP, an analysis was made of waste minimization, reuse, and destruction. Under the recommended alternative, the VOCs will be destroyed by incineration when the carbon is regenerated.

PUBLIC HEALTH AND ENVIRONMENTAL IMPACTS

The RI/FS included an assessment of the extent to which each alternative would effectively prevent, mitigate, or minimize threats to, and provide protection of public health and an analysis of adverse environmental impacts. These are summarized in Table 6. The second operable unit will address whether or not future response actions are necessary to protect public health, welfare, and the environment.

PERMANENCY

All the water treatment alternatives evaluated reduce the concentrations of volatile organic compounds in drinking water to less than the levels that EPA has determined to be applicable Federal and State requirements (see page 17). The GAC and air stripping with off-gas treatment alternatives provide a permanent treatment solution by either incinerating at an approved RCRA facility or recovering the VOCs. The air stripping without off-gas treatment alternatives transfer the VOCs from the water to air. (These are summarized in Table 6).

COMMUNITY RELATIONS

The Community Relations Responsiveness Summary (attached) describes the community's nature and level of concern, and the responses and concerns regarding the alternatives evaluated in the FS.

TABLE 6 WATER TREATMENT ALTERNATIVES FOR EPA OFF-POST RI/FS SITE

Alternative	Cost ($1,000) Capital	Present Worth 5%	Present Worth 8 3/8%	Present Worth 10%	Public Health Concerns	Environmental Concerns[a]	Technical Concerns	Community Response Concerns	Permanency[b]	Others
1. Granular Activated Carbon	8,869	18,593	16,024	15,005	Reduces public health threat to less than the ARARs.	—	If contaminant levels increase significantly, carbon replacement costs may be high. Polar compounds would not be removed.	Low resistance	VOC's are incinerated and destroyed during regeneration of GAC	Compatible with long range remediation of area
2. Air Stripping - VOC's	3,660	11,694	9,460	8,774	Reduces public health threat to less than the ARARs. Potential worker exposure.	Venting of VOC's to the atmosphere contributes to ozone formation	Mixture of contaminants may change. Non-volatile contaminants may render stripper ineffective and require additional equipment.	Moderate resistance due to venting VOC's to atmosphere	VOC's are transferred from water to air	Compatible with long range remediation of area
3. Air Stripping - Semi-VOC's	7,106	40,521	31,140	28,137	Reduces Public health threat to less than the ARARs. Potential worker exposure.	Venting of VOC's to the atmosphere contributes to ozone formation	System may be overdesigned for organics that may never be present in the water. Non-volatile contaminants may render stripper ineffective and require additional equipment.	Moderate resistance due to venting VOC's to atmosphere	VOC's are transferred from water to air	Compatible with long range remediation of area
4. Air Stripping of VOC's With Off-Gas Treatment	5,409	19,985	15,953	14,662	Reduces public health threat to less than the ARARs.	—	High maintenance for disposal of solvents. Non-volatile contaminants may render stripper ineffective and require additional equipment.	Low to Moderate resistance	VOC's are recovered and incinerated or recycled	Compatible with long range remediation of area

TABLE 6 WATER TREATMENT ALTERNATIVES FOR EPA OFF-POST RI/FS SITE (cont.)

Alternative	Cost ($1,000) Capital	Present Worth 5%	Present Worth 8 3/8%	Present Worth 10%	Public Health Concerns	Environmental Concerns[a]	Technical Concerns	Community Response Concerns	Permanency[b]	Others
5. Air Stripping Wells 14 & 16 GAC Wells 2, 3, 5, 15 & 17	7,238	16,454	13,899	13,081	Reduces public health threat to less than the ARARs. Potential worker exposure.	Venting of VOC's to the atmosphere contributes to ozone formation	Three separate facilities are required. Non-volatile contaminants may render stripper ineffective and require additional equipment. GAC does not remove polar compounds.	Low to moderate resistance due to venting VOC's to atmosphere	VOC's are transferred from water to air	Compatible with long range remediation of area
5a. Air Stripping with Off-Gas Treatment Wells 14 & 16. GAC Wells 2, 3, 5, 15 & 17	7,738	18,785	15,694	14,704	Reduces public health threat to less than the ARARs.		Three separate facilities are required. Non-volatile contaminants may render stripper ineffective and require additional equipment. GAC does not remove polar compounds.	Low resistance	VOC's are incinerated or recovered and recycled	Compatible with long range remediation of area

[a] Each alternative evaluated addresses only the public water supply. Subsequent operable units will address cleanup of the contaminated ground water supply aquifer. These studies are in progress.

[b] Section 121, of the Superfund Amendments and Reauthorization Act of 1986.

CONSISTENCY WITH OTHER ENVIRONMENTAL REQUIREMENTS

On October 17, 1986, the President signed the Superfund Amendments and Reauthorization Act of 1986 (SARA). Section 121(d)(1) of SARA requires that selected remedial actions attain a degree of cleanup of hazardous substances released into the environment and of control of further release at a minimum which assures protection of human health and the environment. Section 121(d)(2) of SARA states that remedial actions shall require a level or standard of control which at least attains legally applicable or relevant and appropriate standards, limitations, criteria, and requirements ("requirements") of Federal environmental laws, and applicable or relevant and appropriate promulgated requirements under State environmental or siting laws that are more stringent than federal requirements.

The Feasibility Study for this operable unit identified a range of potential ARARs[3], including MCLs, MCLGs, water quality criteria established under the Clean Water Act, NESHAPs for vinyl chloride and National Ambient Air Quality Standards (NAAQS). After consideration of public comments, the Agency has determined that the applicable or relevant and appropriate requirements for this operable unit are the Maximum Contaminant Levels ("MCLs") established under the Safe Drinking Water Act ("SDWA") for hazardous substances, pollutants, or contaminants identified in south Adams County drinking water. Under the SDWA, Congress established a two-pronged approach for determining permissible levels of contaminants in water which is delivered to any user of a public water system: (1) maximum contaminant level goals ("MCLGs") are to be set at the level at which no known or

3. The RI/FS for the site was commenced prior to the enactment of SARA. At the commencement of the RI/FS, the Agency had identified Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act as the ARARs for the site in accordance with current Agency policy. The Region identified a range of ARARs for public comment in the FS, which included MCLs, MCLGs, and water quality criteria. All alternatives evaluated in the FS, with the exception of the no action and blending alternatives, would reduce the concentration of volatile organic compounds to less than the levels that EPA has determined to be applicable Federal and State requirements (see page 17).

anticipated adverse effects on health of persons occur and which allows an adequate margin of safety; and (2) MCLs are to be set as close to the MCLG as is feasible. Section 1412(b)(4) of the SDWA. MCLGs are non-enforceable health goals. MCLs are enforceable requirements which specify the maximum permissible level of a contaminant in water which is delivered to any user of a public water system. Section 1401(3) of the SDWA.

Congress defined the term feasible to mean:

> ... with the use of the best technology, treatment techniques, and other means which the Administrator finds, after examination for efficacy under field conditions and not under laboratory conditions, are available (taking cost into consideration) ... Granular activated carbon is feasible for the control of synthetic organic chemicals, and any technology, treatment technique, or other means found to be the best available for the control of synthetic organic chemicals must be at least as effective in controlling synthetic organic chemicals as granular activated carbon."

Section 1412(b)(5) of the SDWA.

The selected remedial action for this operable unit is a granular activated carbon treatment system. In selecting GAC, EPA is utilizing a technology which Congress explicitly recognized as feasible under the Safe Drinking Water Act. Id. Moreover, by specifying MCLs as the applicable or relevant and appropriate requirement that cannot be exceeded for this operable unit, EPA is implementing and acting consistently with the statutorily mandated process and criteria that Congress prescribed for all public drinking water systems nationwide. In addition, the MCLs selected as applicable or relevant and appropriate requirements for this operable unit for contaminants identified in south Adams County drinking water assure adequate protection of human health.

For the above reasons, EPA has selected MCLs as the legally applicable or relevant and appropriate requirement which the selected remedy must at least attain for this operable unit.[4]

Section 121(d)(2)(A) of CERCLA provides that remedial actions "require a level or standard of control which at least attains (MCLGs) ... where such goals ... are relevant and appropriate under the circumstances of the release." This language, on its face, and Section 121 of CERCLA, taken as a whole, gives EPA the discretion to determine, in light of the specific facts at CERCLA sites, whether MCLGs are relevant and appropriate. It is within the Agency's discretion to determine that MCLs are the applicable or relevant and appropriate cleanup standards based on the circumstances present at this site. For this particular operable unit, additional factors are not present which suggest the need to attain MCLGs in order to assure protection of human health. Therefore, the Agency has determined that MCLGs are not relevant and appropriate under the circumstances of this operable unit.

Specifically, the selected remedy shall at least attain, and shall in no circumstances exceed, the following levels for hazardous substances, pollutants or contaminants identified in south Adams County drinking water: (1) proposed MCLs for volatile synthetic organic chemicals. See 50 Fed. Reg. 46902 (Nov. 13, 1985); and (2) final MCLs. Table A sets forth EPA's final and proposed MCLs. In the event that MCLs are revised, or amended to include additional contaminants identified in south Adams County drinking water, the agency will evaluate such revised or amended MCLs and amend the

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4. Applicable or relevant and appropriate requirements are selected on a site-specific basis. The selection of MCLs as the applicable or relevant and appropriate requirement for this operable unit is not intended to establish precedent for remedial action at other sites or operable units, including, but not limited to, ground water and surface water restoration, and is not intended to establish precedent for any contaminants not identified in south Adams County drinking water.

Record of Decision, if appropriate, to require that the remedy attain the revised or amended MCLs and assure adequate protection of human health.

The Agency expects that the MCLs will drive the design and operation of the remedy. By not exceeding MCLs, the selected remedy will assure protection of human health for other hazardous substances, pollutants, or contaminants identified in south Adams County drinking water for which MCLs have not been proposed or finally promulgated. In any event, the selected remedy will at least attain a level of control for such other hazardous substances, pollutants, or contaminants that falls within a total risk range of 10^{-4} to 10^{-7} over a 70-year lifetime exposure, with a goal of attaining a level of control that reflects a 10^{-6} risk.

NESHAPs for vinyl chloride and benzene are relevant and appropriate in the event air stripping is needed to treat vinyl chloride (40 CFR part 61, subparts F and J).

Pretreatment standards promulgated pursuant to Section 307 of the Clean Water Act are applicable or relevant and appropriate in the event that the selected remedy involves the discharge, indirect discharge, or introduction of pollutants into a publicly owned treatment works from a source regulated under Sections 307(b), (c), or (d) of the Clean Water Act. The remedy currently does not contemplate such a discharge, indirect discharge or introduction of pollutants.

The State of Colorado provided EPA with a list of applicable or relevant and appropriate State standards, requirements, limitations, or criteria ("State requirements") for this operable unit on January 8, 1987. The State amended its list on March 17, 1987 to delete several requirements and add an additional requirement. EPA has revieved the proposed State requirements under the criteria set forth in Section 121(d) of CERCLA, and determined that certain provisions within the following State requirements generally are applicable or relevant and appropriate:

1. The Colorado Hazardous Waste Act and Regulations

   Applicable to the extent the selected remedy involves the generation, transportation, treatment, or storage of hazardous waste in the spent granular activated carbon. The selected remedy does not contemplate disposal of hazardous waste.

2. The Colorado Primary Drinking Water Regulations

   Applicable or relevant and appropriate to the drinking water which will be supplied to the public through the selected remedy, for contaminants identified in the ground water which supplies the SACWSD supply wells.

3. The Colorado Air Quality Control Regulations

   Applicable or relevant and appropriate to fugitive particulate emissions and emissions which may result from the selected remedy if air stripping of vinyl chloride is required, or if storage or transfer of volatile organics compounds is required.

4. The Colorado Noise Abatement Statute

   Applicable or relevant and appropriate to establish maximum permissible noise levels for construction or operation of the selected remedy.

5. The Colorado Wildlife Statutes and Regulations

   Applicable to the extent the selected remedy involves the taking, possession, transportation, exportation, shipment, removal, capture, or destruction of wildlife. The selected remedy does not contemplate any of these activities.

6. The Water Well and Pump Installation Contractor Act and Regulations

   Applicable or relevant and appropriate to pump installation. The selected remedy does not contemplate the construction of water wells.

7. Historical, Prehistorical, and Archaeological Resources Act

   Applicable or relevant and appropriate if the selected remedy involves the investigation, excavation, gathering, or removal from the natural state of any historical, prehistorical, and archaeological resources within the state. The selected remedy does not contemplate any of these activities.

8. The Colorado Water Quality Control Act and Regulations

   Applicable or relevant and appropriate to the extent the selected remedy involves the discharge of pollutants to waters of the State of Colorado. The selected remedy does not contemplate such a discharge.

A detailed evaluation of the State requirements is set forth in Appendix B. The selected remedy will at least attain the legally applicable or relevant and appropriate State requirements identified in Appendix B.

RECOMMENDED ALTERNATIVE

The remedy recommended is a granular activated carbon treatment system and regeneration of spent carbon. The recommended alternative is a cost effective remedial alternative that effectively mitigates and minimizes threats to and provides adequate protection of public health. Cost, technology, reliability, and permanency, and the effect on the public health were evaluated in selecting this alternative from among those that provide adequate protection of public health.

The GAC system will treat contaminated water from the South Adams County Water and Sanitation District (SACWSD) drinking water supply wells prior to its consumption as drinking water. The GAC system will remove the hazardous substances of primary concern from the drinking water to levels which will assure protection of human health and attain applicable or relevant and appropriate requirements. In the event that other volatile, semi-volatile, and non-volatile organic compounds are identified in ground water supplying the SACWSD wells, the GAC system will treat such hazardous substances to a level that will assure protection of human health without modification and attain applicable or relevant and appropriate requirements.

The GAC system may not treat vinyl chloride to acceptable levels; therefore, the system will be designed so that an air stripping facility can be added to treat vinyl chloride in the event that vinyl chloride

detected upgradient of the SACWSD supply wells poses a threat to the SACWSD and public health. EPA will continue to monitor periodically for vinyl chloride to determine whether it presents a threat to public health.

Additionally, in order to assure that the remedy operates effectively and provides adequate safe drinking water supplies for the estimated SACWSD water demand of 12.0 MGD, the remedy consists of the replacement of existing well pumps and motors, the installation of transmission piping, and the construction of laboratory and office space necessary to operate and analyze this 12.0 MGD system.

Spent carbon from the GAC treatment system will be regenerated at an incinerator in compliance with sections 3004 and 3005 of SWDA, in accordance with section 121(d)(3) of CERCLA. The currently estimated capital costs for the GAC system are $8,869,000 (Table 7). If an air stripper to treat vinyl chloride is required, the total capital costs would be increased by $1,231,000 (Table 7).

To assure protection of the public health in the interim period between approval of the Record of Decision and completion and operation of the selected remedy, the temporary GAC treatment system, installed in June 1986 under EPA's removal authority to treat SACWSD drinking water will continue to be leased and operated and demobilized, until the permanent system is on line. The temporary system is designed to treat contaminated ground water to levels at or below Maximum Contaminant Levels established under the Safe Drinking Water Act. The currently estimated operation and maintenance costs for this temporary GAC treatment system are $31,000/month (Table 7).

The least costly alternative, air stripping without off-gas treatment, only transfers the volatile organic compounds from a water media to the atmosphere and does not result in a permanent and significant decrease in the toxicity, mobility, and volume of the hazardous substances and was, therefore, rejected. This alternative does not achieve the preference of CERCLA section 121(b) for permanent remedies, and was therefore rejected.

The air stripping with off-gas treatment alternatives ranked equally with the GAC alternative in terms of cost, ability to protect public health, technical feasibility, environmental impacts, and treatment which permanently and significantly reduces the mobility, toxicity, and volume of volatile organic compounds. However, the GAC alternative is recommended over air stripping with off-gas treatment. In the event that other volatile, semi-volatile, and/or non volatile organic compounds are identified in ground water supplying the SACWSD wells, the GAC system will have the greatest capability of the treatment alternatives evaluated to treat a wide spectrum of such hazardous substances to a level that will assure protection of human health, without modification. Capital costs for the recommended alternative are listed in Table 7.

The State of Colorado and the SACWSD have been consulted and concur with the selected remedy (Appendix C).

The action will require future operation and maintenance activities to assure the continued effectiveness of the remedy. O&M activities include electric power, chemicals, maintenance, repair, and labor. O&M costs are shown on Table 8.

SCHEDULE

The following key milestones have been established for this project:

Approve Remedial Action (sign ROD)	June 1987
Award Cooperative Agreement to SACWSD for Design	June 1987
Initiate Design	June 1987
Complete Design	January 1988
Start Second Operable Unit RI/FS	March 1987
Award Cooperative Agreement to SACWSD for Construction	December 1987
Begin Construction	February 1988
Startup of GAC Units	September 1988
Complete Construction	December 1988

TABLE 7
CAPITAL COSTS - CARBON ADSORPTION

Item			Cost
1.	Land		$ 250,000
2.	Transmission System		
	a) Replacement Well Pumps, Motors, Controls		
	Well No.	H.P.	
	2	50	31,900
	3	100	47,300
	5	150	61,300
	14	50	31,900
	15	25	23,500
	16	40	28,000
	17	150	61,300
	b) Distribution System		830,700
		Sub-total Transmission System	$1,115,900
3.	Building[a] 15,700 S.F.; 30 ft. high		$1,020,500
4.	Office Building and Lab[b] 3,550 S.F.		284,000
5.	GC Equipment		50,000
6.	Chlorination and Chemical Feed Equipment		105,000
7.	Sitework/Landscaping		166,200
8.	Carbon Adsorbers, Piping, Instrumentation, Clearwell		3,300,000
9.	Carbon - Initial Charge (400,000 lb)		400,000
	Sub-total		$6,691,600
		Contingency (15%)	1,003,700
		Engineering, Design[c]	839,100
		Construction Engineer (5%)	334,600
		Sub-Total	$8,869,000[e]
10.	Temporary GAC System Lease and Carbon Changeout Costs (needed to fund as of 12/86)[d]		908,900
		TOTAL	$9,777,900[e]

[a] Based on $65/S.F. Price is based upon a steel frame building. The exterior walls are concrete block. Estimated added square foot costs for other exterior finishes are:

Precast Concrete Panels	$3/S.F.
Insulated Metal Panels	$0/S.F.
Face Brick on Common Brick	$7.50/S.F.

Footnotes continued on page 35.

TABLE 7
CAPITAL COSTS - CARBON ADSORPTION (Continued)

b Based on $80/S.F.

c SACWSD

d Based on:

Lease costs from 1/1/87: $23,846/Mo x 21 Mo =	$500,800
Monthly Monitoring and O&M: $5000/Mo x 21 Mo	105,000
GAC Changeout	294,400
Demobilization of Treatment Plant	131,100
Demobilization of Temporary Structure	34,400
Contingency $2000/Mo x 21 Mo	42,000
	$1,107,700
Funds Available 12/86	198,800
	$908,900

e Additional estimated costs for an air stripping facility to treat vinyl chloride, if needed, are $1,231,000. This figure is based on estimated capital cost of $962,000 plus contingency (15%), engineering (8%), and construction engineering (5%). Details are given in Attachment C of the Responsiveness Summary. Total capital costs including the air stripping facility would be $10,100,000. Total costs, including continuation of leasing, operation, and demobilization of the temporary GAC system would be $11,008,900.

TABLE 8

ANNUAL O&M COSTS AND EQUIPMENT REPLACEMENT COSTS - CARBON ADSORPTION

Item		Cost
1. Labor		
1 Operator (Class A)	2920 x $20	$ 58,400
1 Laborer	2080 x $15	31,200
Mechanical & Electrical	200 x $20	4,000
2. Power		
Wells		44,000
Building HVAC and Lighting		24,000
Chemical Feed Pumps (1 kw)(24 hrs/day) (30 day/mo)(12 mo)($0.06/kw)		500
3. Carbon Replacement (400,000 lb/year) ($1.00/lb)		400,000
4. GAC Contactor Maintenance $1,500/unit/changeout for Insp. & Maint.		25,000
5. Chlorine (By District)		-0-
6. Sodium Hexametaphosphate Dose 0.5 mg/l = 40 gal/week 1 Drum/Week x $326/Drum x 52		17,000
	Annual O&M	$ 604,100
7. Equipment Replacement Costs (over 30 years)		
a. Well Pumps every 10 years (by district)		-0-
b. Chemical Feed every 10 years (2) (50,000)		100,000
c. Lining Replacement every 5 years (5) (68,000)		340,000
	Total	$ 440,000

FUTURE ACTIONS

A subsequent feasibility study is ongoing which will address whether aquifer restoration is appropriate. EPA is currently conducting the RI studies necessary to support such a feasibility study (FS), and the FS report is anticipated in early FY 1988. EPA is investigating whether or not further response actions, in addition to aquifer restoration, may be necessary at the EPA's RMA Off-Post site to protect human health and the environment. The Army is conducting on-post RI/FS activities and is scheduling completion of a cleanup master plan in 1989.

APPENDIX A

FINAL
RESPONSIVENESS SUMMARY
FOR THE FIRST OPERABLE UNIT

THE ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS SITE
COMMERCE CITY, COLORADO

JUNE 1987

The U.S. Environmental Protection Agency (EPA) has prepared this community relations Responsiveness Summary for the first operable unit of the EPA portion of the Rocky Mountain Arsenal (RMA) Off-Post site. This Responsiveness Summary is divided into the sections below.

Section I. Introduction and Background. This section provides a brief introduction to the site as well as investigations and remedial actions taken to address the drinking water contamination.

Section II. The Community Relations Program at the RMA Off-Post Site. This section provides a brief history of community relations activities during the remedial investigation activities at the site.

Section III. Summary of Major Comments Received and EPA's Responses. This section summarizes comments received in the categories below.

- o Comments received from inception of the project through November 1986.

- Comments received during the public comment period (December 12, 1986 through January 7, 1987) on the Remedial Investigation and Feasibility Study Reports for the first operable unit.

- Comments raised after the close of the public comment period.

This section categorizes written and oral comments by related topics and generally indicates the sources of the comments. Summaries of EPA's responses to these comments are also provided.

I. INTRODUCTION AND BACKGROUND

A description of the Off-Post RI/FS site is included in the Remedial Investigation and Feasibility Study Reports.

In the summer of 1985, area media began to publish stories about the chemical trichloroethylene (TCE) that had been discovered by EPA and the South Adams County Water and Sanitation District (SACWSD) in some of the water district's public wells and some private wells. SACWSD provides water to the 30,000 residents of Commerce City. The stories raised considerable concern among area residents and their elected representatives at all levels. EPA determined that the TCE contamination warranted more immediate attention, and that a temporary system to deliver clean water to affected Commerce City residents would be a first priority in the response actions at the site. Initial activities included installation of temporary granular activated carbon (GAC) treatment systems at three of the SACWSD well sites and a private well hookup

program, under EPA's removal authority.

Treatment of the south Adams County public drinking water with a permanent treatment system has been designated the first operable unit of EPA's RMA Off-Post site. For the second operable unit, EPA will investigate the potential for control of contaminant migration and source removal. A remedial investigation and feasibility study (RI/FS) for the first operable unit was completed in the fall of 1986. EPA proposed to install a permanent centralized granular activated carbon water filtration system as the preferred alternative for remedial action for the first operable unit, and conducted a public comment period (December 12, 1986 through January 7, 1987) on that and other alternatives. Other treatment alternatives evaluated included air stripping for different types of contaminants and a combination of GAC with air stripping.

In general, community reaction to EPA's preferred alternative of installing a granular activated carbon filtration system has been favorable. The majority of commenters supported that alternative, including the Citizens Against Contamination (CAC), the Colorado Department of Health (CDH), the South Adams County Water and Sanitation District (SACWSD), the Tri-County Health Department, the City of Commerce City, the Adams County Commission, and Adams County School District 14. The only exception was the law firm of Holme, Roberts and Owen. The U.S. Army commented that "the treatment alternative selected appears technically sound for remediation of the water to an acceptable quality." Some commenters had specific technical questions regarding the ground water models in the RI/FS Report and regarding the risk assessment. All the comments received and EPA's responses are summarized in Section III of this Responsiveness Summary.

II. THE COMMUNITY RELATIONS PROGRAM AT EPA'S PORTION OF THE RMA OFF-POST SITE

A summary of community relations activities conducted by EPA is included in Attachment A.

Since the discovery of TCE in the ground water, community concern about EPA's portion of the RMA Off-Post site has been high. On several occasions, new information about the site has been front-page news in one or both of the Denver daily newspapers. A citizen interest group, Citizens Against Contamination (CAC), was formed in the summer of 1985 at the time of the discovery of the TCE in the ground water, and it has been active since that time.

EPA's community relations program has responded to this interest at the site. In the spring of 1986, the Agency prepared and distributed widely a videotape that answered common questions residents have had regarding the TCE in their water. EPA also has published three fact sheets on the site. The first one, in February 1986, provided the public with a directory of agencies and contacts for issues relating to the site. The second fact sheet, in August 1986, described the site, RI/FS plans at the site, other studies in progress in the area, major agencies involved at the site, and the Superfund community relations program. The third fact sheet, issued in December 1986 upon the release of the RI/FS Report, described the remedial alternatives under consideration and provided information about the public comment process.

At key points during the RI/FS, EPA has issued press releases and held press conferences to keep the public informed as new information became available. EPA has attended all of the CAC public meetings. These meetings were held July 24 and November 25, 1985; and February 13, March 5, and May 22, 1986.

In addition, EPA has responded to numerous citizen, vendor, and press inquiries; kept elected U.S. officials informed of site activities; and met with area residents on many occasions.

EPA released the draft RI/FS Report on the first operable unit to the public on December 12, 1986, and held a public comment period on the report from December 12, 1986 through January 7, 1987. The Agency provided an opportunity for a public meeting during or following the public comment period but did not receive any request for such a meeting.

III. SUMMARY OF COMMENTS RECEIVED AND EPA'S RESPONSES

This section summarizes concerns the public has expressed during the remedial investigation for the first operable unit and EPA's responses to these concerns.

A. Summary of Comments Received from Inception of the Remedial Investigation Through November 1986

The high level of community interest in EPA's portion of the RMA Off-Post site is shown in a continuing pattern of community concerns, questions, and comments expressed to EPA. EPA has summarized the comments received during the remedial investigation through November 1986 in the four groups below.

- Health Concerns.
- Technical Issues.
- Economic and Social Issues.
- Process Issues.

EPA's responses to the public's questions and comments are summarized following each item.

Health Concerns

1. Comment: Numerous residents have expressed concern that contaminated water could cause health problems.

   EPA's Response: EPA prepared a Preliminary Risk Assessment (Camp Dresser & McKee, April 17, 1986) and a Public Health Endangerment Assessment (part of the Remedial Investigation Report, Camp Dresser & McKee, December 1986) to address the health risk. In May 1986, EPA installed a temporary water treatment facility to treat ground water from SACWSD public water supply wells. The temporary system is providing safe drinking water at levels below the Safe Drinking Water Act Maximum Contaminant Levels. In the summer of 1986, EPA connected all willing households with private drinking water wells to the newly clean public water supply.

2. Comment: A number of residents expressed confusion regarding the meaning of drinking water standards.

   EPA's Response: Under the Safe Drinking Water Act (SDWA), EPA has set Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) for contaminants in public drinking water supplies. MCLGs are non-enforceable health goals which are set at levels which would result in no known or anticipated adverse health effects with an adequate margin of safety. MCLs are enforceable standards and are set as close to the MCLGs as is feasible. MCLs are based upon treatment technologies, costs and other feasibility factors such as the availability of analytical

methods, treatment technologies and costs for achieving various levels of removal. See generally, 50 Fed. Reg. 46880 et seq., Nov. 13, 1985 and the Safe Drinking Water Act, 42 U.S.C. Section 300(f) et seq.

3. Comment: Some residents asked questions about the risks associated with different routes of TCE exposure (i.e., from drinking, or from vapors during cooking or bathing). They also wanted to know how long they have been exposed to the contamination and whether a long period of exposure will result in grave health effects.

EPA's Response: The EPA investigation for the first operable unit focuses on the remediation of current public water supply contamination from SACWSD wells. To-date, the studies have not determined the length of previous exposure SACWSD customers have had to contaminated water.

As described above, EPA twice prepared documents that address risks to public health associated with untreated SACWSD ground water. The risk assessments assumed that SACWSD customers ingested two liters per day, and showered for ten minutes per day, with untreated water. A potential excess cancer risk of 10^{-6} (one excess cancer in every one million individuals exposed throughout their lifetimes) is used by EPA as a guideline for determining an acceptable level of exposure within one or two orders of magnitude. The risk assessments showed that exposure by ingestion or inhalation, or by both routes concurrently, to untreated water from the SACWSD system may pose an unacceptable health risk. The additive excess cancer risks for lifetime exposure by ingestion and inhalation range from 2×10^{-6} to 1×10^{-4} (Table 6-8 in the RI Report). Installation of the temporary treatment system, however, reduced the exposure to contaminated water through the SACWSD system to MCLs

established under the SDWA.

4. Comment: Some residents asked whether the unpleasant taste of the water indicates the presence of contamination.

   EPA's Response: The levels of TCE and other organic contaminants in the public water supply are well below concentration where the taste of the water would be affected.

Technical Issues

1. Comment: In reviewing the draft RI/FS Report provided to the Memorandum of Agreement (MOA) parties, CDH expressed the concern that the RI/FS Report focused on a range of contaminants that was too limited and that the characterization of sources on and off the Arsenal was substantially incomplete. CDH also said that since non-volatile organics have been identified in the aquifer, the assessment of proposed treatment systems must show how these contaminants would be treated.

   EPA's Response: EPA addressed CDH's comments in the final RI/FS Report. The RI/FS did not characterize sources on and off of the Arsenal. A future operable unit report may address sources that are currently being characterized by other EPA studies and the U.S. Army.

2. Comment: In reviewing the draft RI/FS Report provided to MOA signers, CDH stated that use of air stripping without emission controls would not meet Colorado regulations to protect the air, or requirements under the 1986 Superfund Amendments and Reauthorization Act (SARA) to provide a permanent remedy.

EPA's Response: The final FS Report does address 1986 SARA preference for providing permanent solutions, and narrows the possible alternatives to those that would provide a permanent reduction of the toxicity, mobility, and volume of the contaminants. Also, EPA identified Colorado applicable, or relevant and appropriate requirements (ARARs) for air emissions in the Record of Decision.

Economic and Social Issues

1. Comment: Several residents expressed concern that their property values would fall as a result of negative publicity about contamination in their water.

   EPA's Response: Implementation of temporary and permanent ground water treatment systems provides drinking water to SACWSD customers that meets all criteria set under the SDWA. SACWSD officials have met with local residents and realtors to assure all parties that drinking water is not a problem to residents.

2. Comment: Some local officials and residents expressed concern that economic development in the area would be depressed as a result of publicity about the RMA Off-Post RI/FS site.

   EPA's Response: Implementation of temporary and permanent ground water treatment systems provides drinking water to SACWSD customers that meets all criteria set under the SDWA. SACWSD officials have met with local residents and realtors to assure all parties that drinking water is not a problem to residents.

3. Comment: Several residents expressed concern about costs that individuals will bear due to plumbing damage and other problems resulting from the contamination found at the RMA Off-Post site and efforts to clean it up.

EPA's Response: The volatile organic compounds that were present in the SACWSD water prior to initiation of treatment in May 1986 are not corrosive and would not cause damage to plumbing. However, SACWSD ground water is naturally hard, which might cause damage to plumbing from scaling. SACWSD follows guidelines on water pressure set by the Colorado Department of Health.

4. Comment: Some local officials and community residents expressed concern about the negative reputation the contamination will give the community.

EPA's Response: Implementation of temporary and permanent ground water treatment systems provides drinking water to SACWSD customers that meets all criteria set under the SDWA. SACWSD officials have met with local residents and realtors to assure all parties that drinking water is not a problem to residents.

Process Issues

1. Comment: A number of local officials and area residents expressed confusion about the respective roles of the Colorado Department of Health, EPA, the South Adams County Water and Sanitation District, and the U.S. Army.

EPA's Response: EPA has coordinated its activities conducted under the Off-Post RI/FS with the U.S. Army, the State of Colorado and SACWSD to avoid unnecessary

duplication of effort and to ensure that pertinent information is shared by all parties. EPA, the CDH, the U.S. Army and Shell Chemical Company entered into a Memorandum of Agreement on December 6, 1982 for the cooperation, exchange of information, and participation of the parties in the development and implementation of appropriate response actions for releases of contaminants at RMA. EPA has responsibility for conducting an RI/FS in the area shown in Figure 1 of the Record of Decision, pursuant to CERCLA, the National Contingency Plan (NCP) and executive orders delegating the functions of the President under CERCLA.

2. Comment: Several residents and local officials expressed concern that studies were getting in the way of action at the site.

EPA's Response: Superfund (CERCLA) and the NCP require specific site investigations and analysis of cleanup alternatives, see 40 CFR Section 300.68 of the NCP and Sections 104 and 121 of CERCLA, as well as public comment prior to implementation of remedial action. These studies are necessary in order to assure protection of public health. The removal actions (to provide the temporary GAC treatment system and to connect the households using private wells to the public system) were taken as quickly as NCP guidelines and funding availability would allow.

3. Comment: A number of people expressed concern about who would pay for the studies and the cleanup of contamination, and from whom EPA and the U.S. Army could recover the costs.

EPA's Response: The U.S. Army has provided a total of $7,000,000 to EPA for use in the selection, design and

implementation of response actions to address TCE contamination in SACWSD ground water. EPA is continuing to investigate other potential sources of contamination. If such sources are identified, EPA may sue potentially responsible parties in order to recover study and cleanup costs. EPA may seek additional funds from the U.S. Army.

4. Comment: In reviewing the draft RI/FS Report provided to MOA signers, CDH objected to the limited review time of one week, as requested by EPA. CDH said that the MOA stipulates a review period of 60 days for MOA parties and that this rush effort may misrepresent the nature of the long-term problem. CDH added that its plan review and final concept approval process would require 45 days prior to final CDH approval.

EPA's Response: CDH's comments were received and incorporated into the final RI/FS Report.

B. Summary of Comments Received in December 1986 and January 1987, and EPA's Responses

The comments received on the first operable unit RI and FS documents during the public comment period between December 12, 1986 and January 7, 1987 are grouped into the five categories listed below. Each comment is followed by a summary of EPA's response to the comment.

- Remedial alternative preferences.
- Technical comments.
- Health concerns.

- Financial comments.

- Community relations concerns.

Remedial Alternative Preferences

1. Comment: Commenters generally favored EPA's preferred remedial alternative of installation of a granular activated carbon treatment system. These commenters included Citizens Against Contamination (CAC), SACWSD, CDH, the City of Commerce City, the Adams County Commission, Adams County School District 14, and the Tri-County Health Department. CAC expressed the opinion that not all contaminants have been identified as yet, and supported the addition of air-stripping towers to remove potential concentrations of other contaminants that may not be removed by the GAC system.

   EPA's Response: The Record of Decision is based upon implementing the GAC alternative. In addition, the remedy provides for the possible addition of air stripping units if vinyl chloride is detected in SACWSD drinking water and poses a threat to public health. Attachment B to this Responsiveness Summary presents a risk assessment for vinyl chloride emissions to the air from such air strippers. The risks are within EPA's approximate guidelines for determining an acceptable level of excess cancer risk. A risk assessment for other contaminants emitted from an air stripper is presented in Appendix B of the FS Report. Attachment C presents the best estimate cost at this time for such air strippers.

2. Comment: One citizen expressed the opinion that Commerce City should use the Denver municipal water system.

EPA's Response: SACWSD has its own water rights in the alluvial aquifer. Further, the cost of buying into the Denver system would be approximately $30,000,000, which far exceeds the costs of the other available remedies evaluated without providing substantially greater public health benefits.

Technical Comments

1. Comment: A contractor representative of the U.S. Army asked what problems had been observed with the leased activated carbon system currently in operation in SACSWD.

   EPA's Response: SACWSD operations personnel report that there are no operational problems with the leased system and that the system produces effluent that meets SDWA criteria. However, they do report that the system is undersized to meet peak water demands.

2. Comment: A contractor representative of the U.S. Army expressed the opinion that the FS Report does not appear to address all reasonably available alternatives and technologies, and does not appear to provide sufficient justification for elimination of alternatives.

   EPA's Response: The FS Report was prepared based on the NCP and the EPA guidance document, "Guidance on Feasibility Studies Under CERCLA." Justifications for elimination of alternatives were consistent with the NCP.

3. Comment: The SACWSD expressed the opinion that the possible addition of air-stripping to the treatment system will require use of a clearwell system.

EPA's Response: The clearwell system will be implemented as part of the facility design. The expected cost would add $387,000 to the treatment system cost, which is included in the cost shown in Table 3-4 of the FS Report in the Record of Decision.

4. Comment: CDH commented that the proposed parallel configuration for a GAC treatment facility may lead to operational problems in blending the effluents.

EPA's Response: Each carbon bed will be monitored to determine when it is necessary to take the bed out of service for carbon replacement. The monitoring of individual carbon beds and the treatment plant effluent will ensure compliance with applicable, or relevant and appropriate requirements.

5. Comment: The U.S. Army, the law firm of Holme, Roberts and Owen, and the Colorado Department of Health questioned the use of the preliminary flow and transport models in the First Operable Unit RI/FS Report. A summary of these concerns is listed below.

- o No results of sensitivity analysis for model parameters or boundary conditions were presented in the report.
- o Several commenters expressed concern about the use of steady state rather than transient calibration.
- o Detailed summaries of model parameters were not presented in the report.
- o The solute transport model was not calibrated against current conditions.

- o The flow system has not been completely characterized.

- o Additional aquifer tests throughout the area to be modeled are required.

- o Results of the modeling are preliminary in nature.

- o Field data for total organic carbon are required for realistic assessment of contaminant retardation. The U.S. Army said that their studies indicate almost no retardation potential in the aquifer material.

EPA's Response: The RI Report states that the preliminary modeling efforts were intended to provide insight to the processes controlling contaminant transport, a framework for summarization of the aquifer systems, and the current best estimate of future contaminant concentrations. Results obtained from these preliminary efforts are adequate for producing the preliminary estimates of future concentrations at SACWSD wells needed to assist in design of the first operable unit. Insufficient detailed field information in the vicinity of the plumes is currently available for explicit calibration of the models. Studies are planned for the second operable unit to address these data gaps, since plume definition and remediation will require more accurate data. Availability of more data may justify the complexity of transit calibration of future models and allow additional uses of the model. The applicability of this approach will be assessed as additional data are gathered.
In addition, technical information on modeling methodology and parameters is available in the administrative record.

6. Comment: A contractor representative of the U.S. Army

asked why alternative remedial actions for semi-volatile organics are being considered when they were not defined as a problem in the RI Report. He expressed the opinion that more documentation is needed in the FS Report to justify how contaminants of concern were determined. He asked if the detection of TCE was the only reason for concern and whether there were other contaminants that caused problems.

EPA's Response: The final RI Report presents data identifying the presence of a wide range of low level semi-volatile and non-volatile compounds scattered in areas potentially upgradient of SACWSD production wells. The contaminants of concern are detailed in Section 6 (Endangerment Assessment) of the RI/FS Report. The chemicals reported most frequently and at the highest concentrations in validated monitoring well and private well data are: 1,1-Dichloroethane, 1,1-Dichloroethylene, trans-1,2-Dichloroethylene, 1,1,1-Trichloroethane, tetrachloroethylene and trichloroethylene. These chemicals may be considered ground water contaminants of primary concern. A number of other organic chemicals including toluene, cis-1,3-dichloropropene, phenol, vinyl chloride, dibromochloropropane, aniline, methylene chloride, carbon tetrachloride, chloroform, heptachlor epoxide, dieldrin, and several phthalate esters also were detected in some ground water samples from the EPA Off-Post study area. However, these chemicals were detected infrequently and generally at low concentrations. In addition, identified potential contaminant sources both on and off the RMA are currently being characterized and are potential sources of semi-volatile and non-volatile compounds. The potential future threat from these compounds formed the basis for considering an alternative of air stripping to address semi-volatile compounds. This alternative was eliminated in the initial screening of alternatives because the cost

of this alternative far exceeds the capital and O&M costs of other alternatives evaluated and does not provide substantially greater public health protection. Since the costs of the GAC and other air stripping alternatives (for volatiles only) were comparable, EPA recommended the GAC alternatives over such air stripping alternatives because the GAC system will have the greatest capability, without modification, to treat a wide spectrum of such hazardous substances to a level that will assure protection of public health.

7. Comment: The law firm of Holme, Roberts and Owen and the contractor representative of the U.S. Army said that the treatment facility should not be designed to treat ground water based on the results of the preliminary modeling effort, but should be based upon the current situation in south Adams County.

EPA's Response: The risk assessments showed that exposure by ingestion or inhalation, or by both routes concurrently, to untreated water from the SACWSD system may pose an unacceptable health risk. The additive excess cancer risks for lifetime exposure by ingestion and inhalation range from 2×10^{-6} to 1×10^{-4} (Table 6-8 in the RI Report). The risk assessments were based on actual current sample results from SACWSD wells and not upon future circumstances. Based upon the current threat shown in the risk assessments, the Agency determined that remedial action was required.

The GAC system and other alternatives were designed to address both current and predicted future concentrations in order to assure adequate protection of public health. However, no change in design of the alternatives would be required within the range of existing and future predicted

concentration levels. The design is based on the quantity of water to be treated.

8. Comment: A contractor representative of the U.S. Army questioned whether sufficient studies have been conducted to ensure that bedrock wells are clean enough for blending with treated water. The U.S. Army recommended that bedrock wells be monitored if blending water from them is going to be considered.

   EPA's Response: Data available to-date indicate that the quality of the water from the bedrock aquifers is adequate for blending. Monitoring will continue in the future to verify this suitability.

9. Comment: The contractor representative for the U.S. Army commented that a prevailing northward flow of ground water would take contamination directly from the Woodbury Chemical Company Superfund site into the study area for the Rocky Mountain Arsenal Off-Post site. The U.S. Army expressed the opinion that the "ground water divide" should be explained.

   EPA's Response: The ground water divide is present due to the presence of a high bedrock trend separating the South Platte Valley and the north-south trending paleochannel that parallels Quebec Street. This flow configuration limits the potential for contribution of contamination to SACWSD wells from the Woodbury site.

10. Comment: The contractor representative for the U.S. Army asked when the FS for the other operable units will be performed and whether surface water will be considered an operable unit.

EPA's Response: The second operable unit will consider primarily aquifer cleanup options. Treatment of ground water used for drinking serves the dual purpose of meeting SACWSD demand with their existing water rights and aiding in ultimate cleanup of the aquifer system. EPA will evaluate surface water contamination in the study area.

11. Comment: The law firm of Holme, Roberts and Owen expressed the opinion that the risk assessment is based on unrealistically conservative estimates of the situation. They said that if EPA had used more realistic estimates, the hazards may not be as severe as presented.

EPA's Response: The risk assessment techniques utilized are standard to EPA and utilized at Superfund sites. These techniques were developed after considerable scientific and public comment. Quantities of water ingested and water utilized for other purposes, such as showers, are realistic, worst-case estimates which assure adequate protection of public health. This approach does provide a basis for comparison for the risk analysis.

12. Comment: The consultant to SACWSD expressed the opinion that if EPA determines that Maximum Contaminant Level Goals (MCLGs) should be met by the water treatment facility, then SACWSD should verify that the recommended downflow, fixed-bed GAC treatment process is capable of cost-effectively meeting these stringent standards.

EPA's Response: EPA has determined that the Maximum Contaminant Levels (MCLs) in the Safe Drinking Water Act are the applicable or relevant and appropriate requirements for this operable unit.

13. Comment: CDH provided a list of the applicable or relevant and appropriate state standards, requirements, limitations, and criteria ("requirements") for the management of wastes at the RMA On- and Off-Post sites. CDH reserved the right to amend the list if any more regulations or standards are identified.

EPA's Response: EPA has discussed the list with the State, the State has provided a revised list, and the Record of Decision identifies the applicable or relevant and appropriate State requirements.

14. Comment: CDH said it is the position of the State of Colorado that although permits may not be required for certain activities at the Arsenal, the requirements of the State of Colorado governing all information submittals, notification requirements, monitoring, data collection, and data reporting requirements are applicable at the RMA On- and Off-Post sites.

EPA's Response: EPA's response is set forth in Appendix B to the Record of Decision.

15. Comment: CDH, the U.S. Army, and the law firm of Holme, Roberts and Owen made comments on the sources of contamination at the RMA Off-Post site. Holme, Roberts and Owen said that plume maps would help to identify sources of concern rather than to infer that the Arsenal is the major source of many contaminants at the RMA Off-Post site. CDH suggested that EPA remove from the FS Report all disclaimers concerning the lack of intent to identify

contributing sources of contamination at the site, since the RI Report discusses potential sources of contamination at length, and the purpose of an RI is to identify sources of contamination. The contractor representative of the U.S. Army stated that the contaminant concentration maps presented suggest source areas other than RMA. The modeling effort should be considered the initial phase of a more detailed study using site specific data.

EPA's Response: Insufficient information on potential sources is currently available for identification of or apportionment of responsibility to individual sources. The selection, identification, evaluation and design of treatment alternatives for the SACWSD drinking water do not require identification of the responsible sources. Efforts to identify the responsible sources on and off the Arsenal are continuing.

Health Concerns

1. Comment: A local resident asked if the water is safe to drink.

   EPA's Response: EPA explained that the temporary water treatment system that EPA arranged for SACWSD is providing safe water at levels at or below the SDWA Maximum Contaminant Levels until installation of the permanent treatment system. EPA also explained the public comment process and encouraged the resident to review the documents describing the proposed remedial alternatives and to comment on them.

Financial Comments

1. Comment: A local resident asked if the expenditures on a permanent water treatment system can be justified when, in his opinion, SACWSD will eventually have to use surface water in the future.

   EPA's Response: EPA said that it is currently evaluating how to clean up the ground water; thus, it is premature to assume that surface water will have to be used in the future. Additionally, the cost of providing surface water far exceeds the cost of other alternatives evaluated, without providing greater public health benefits.

2. Comment: In the interests of cost-effectiveness, Citizens Against Contamination recommended installation of the GAC system as soon as possible.

   EPA's Response: The Record of Decision is based upon implementation of the GAC system alternative. The permanent system should be in operation by September 1988.

Community Relations Concerns

1. Comment: One resident expressed the opinion that the problem of delivering clean water should be solved in terms of growth.

   EPA's Response: EPA responded that it is the Agency's hope that with a permanent system for providing safe water, the citizens of Commerce City will not see a negative effect on growth.

2. Comment: CAC and SACWSD both expressed appreciation to EPA

for its concern about the problem, for the opportunity to comment on the proposed remedial alternatives, and for the cooperative spirit in which they have worked. CAC added that the process at the RMA Off-Post site has exemplified what can be accomplished when citizens' groups and the government work together.

EPA's Response: No response required.

C. Summary of Comments Raised after the Close of the Public Comment Period

EPA received additional comments dated March 5, 1987 from the U.S. Army. Although EPA is not required to respond to comments received after the public comment period closes, the Agency believes it is important to respond to these comments because of the U.S. Army's substantial participation in the project. The U.S. Army's general comments and EPA's responses are summarized below. Certain comments raised in the U.S. Army's March 5, 1987 letter of comment were raised earlier by their contractor and have already been addressed in Section III.B of this Responsiveness Summary.

1. Comment: The U.S. Army suggested that the title of the RI/FS Report be changed. They said that RMA is just one of many parties potentially responsible for the contamination that exists in the SACWSD distribution system, and the title should reflect this broader responsibility.

   EPA's Response: The Agency has determined that a title change is inappropriate. The RMA is a proposed NPL site, and RMA is one of two or more potential sources of south Adams County ground water contamination.

2. Comment. The U.S. Army said that EPA's preference for the GAC alternative relies heavily on possible future semi-volatile and non-volatile contamination that cannot be extrapolated from the existing data. The U.S. Army recommended that additional justification be provided before this method of treatment is selected as the preferred alternative.

EPA's Response: The detailed screening process in the FS identified three alternatives that were comparable in the cost effectiveness analysis. These alternatives are:

- o GAC.
- o Air stripping with off-gas treatment.
- o Air stripping with off-gas treatment at wells 14 and 16. GAC at wells 2, 3, 5, 15 and 17.

Since the costs of these alternatives are comparable, EPA recommended the GAC alternative over air stripping because of its ability to deal effectively with semi-volatile and non-volatile organic compounds, without modification, in the event such compounds pose a threat to SACWSD wells and public health in the future.

3. Comment: The U.S. Army stated that all of the air stripping alternatives were evaluated and compared to the GAC alternative based on their removal efficiency for Diisopropymethylphosphonate (DIMP) and Dicyclopentadiene (DCPD), two RMA-specific compounds not likely to be encountered in the study area. If the treatment efficiency for semi-volatile and non-volatile compounds is to be used as an evaluation criterion, compounds likely to be encountered in the study should be used.

EPA's Response: Two basic air stripping alternatives were developed. The first evaluated air stripping of volatile organic compounds. The second evaluated air stripping of both VOCs and semi-VOCs including DIMP and DCPD. Both of these alternatives were compared against GAC. Air stripping of only VOCs was comparable on a cost-effective basis to the GAC alternative. Air stripping for semi-volatiles was excluded during the initial screening because the cost of this alternative far exceeds the capital and O&M costs of other alternatives evaluated and does not provide substantially greater public health protection.

4. Comment: The U.S. Army recommended that EPA give greater consideration to the problems associated with using a GAC system to treat polar compounds, such as vinyl chloride and chloroform. These compounds are as likely, if not more likely, to be encountered in the SACWSD system as those semi-volatile and non-volatile compounds considered as problematic to the air stripping.

EPA's Response: EPA is continuing to monitor for vinyl chloride and other hazardous substances. The selected remedy provides for the addition of an air stripping facility to treat vinyl chloride in the event that vinyl chloride poses a threat to the SACWSD supply wells and the public health.

5. Comment: The U.S. Army recommended that carbon disposal be evaluated as part of the GAC alternative, as disposal may be an important financial consideration in final selection of alternatives. The U.S. Army said problems with obtaining liability insurance have made it increasingly difficult and expensive to find suitable disposal and regeneration facilities willing to accept used carbon from

RMA's own on-post GAC treatment systems.

EPA's Response: The vendors of GAC who will be solicited for supply of equipment and replacement carbon all have, or have access to, regeneration facilities which are under RCRA permits.

6. Comment: The U.S. Army expressed the opinion that the air stripping alternative could be the most efficient and cost-effective means of treating the SACWSD contamination problem for the reasons listed below.

   - o Both GAC treatment and air stripping merely transfer the contamination from one medium to another; and
   - o The contamination problem in the SACWSD system is solely volatile organic in nature at this time.

The U.S. Army added that a GAC unit could be added to the treatment system later if it should become necessary because of a future influx of semi-volatile and non-volatile organic contamination.

EPA's Response: The GAC alternative transfers the VOCs from water to the activated carbon. Spent carbon from the GAC treatment system will be regenerated at an incinerator in compliance with sections 3004 and 3005 of the Solid Waste Disposal Act, in accordance with section 121(d)(3) of CERCLA. Therefore, GAC permanently and significantly reduces the mobility, toxicity and volume of hazardous constituents. Morever, the potential inhalation of emissions from air stripping without off-gas treatment presents a greater risk to the public health than GAC and does not meet the permanency criteria under section 121 of CERCLA.

7. Comment: The State has objected to the conclusion in the Record of Decision that the ARARs for this operable unit are the final or proposed MCLs established under the Safe Drinking Water Act for all contaminants identified in south Adams County drinking water. (See May 22, 1987 letter from Thomas P. Looby to James Scherer, which is attached in Appendix C).

Response: EPA's rationale for selecting MCLs as an ARAR for this operable unit is set forth in the Record of Decision document.

8. Comment: The State has commented that insufficient financing exists to complete the construction and operation of the GAC treatment system.

Response: EPA is working closely with the State, the Army and SACWSD to identify sources of funding.

9. Comment: The State has also commented that other ARARs identified by the State of Colorado were not determined by EPA to be ARARs for this remedial action.

Response: State ARARs are addressed in the Record of Decision, including Appendix B.

ATTACHMENT A

TO APPENDIX A

COMMUNITY RELATIONS ACTIVITIES CONDUCTED AT THE ROCKY MOUNTAIN ARSENAL OFF-POST SITE

Community relations activities conducted at the Rocky Mountain Arsenal Off-Post site from April 1985 through January 1987 are listed below.

- Public Affairs Task Group of Memorandum of Agreement (MOA) parties is formed (August 1984).
- Tri-County Health Department followed up residential water sampling with letters informing residents of sampling results after each sampling event.
- EPA met with Colorado Citizen Action Network (CCAN) and Metropolitan Organization for People (MOP) about EPA's studies in south Adams County (May 1985).
- EPA attended public meetings held by the Citizens Against Contamination (CAC) on July 24 and November 25, 1985; and February 13, March 5, and May 22, 1986.
- EPA prepared a Fact Sheet that provided the public with a directory of agencies and contacts for issues relating to the site (February 1986).
- EPA conducted discussions with local officials and area residents to obtain first-hand information regarding community concerns about the site (February-March 1986).
- EPA prepared and distributed widely a videotape that answered common questions residents have had regarding the TCE in their water (April 1986).
- EPA prepared and distributed a Fact Sheet on RI/FS plans at the site, others studies in progress in the area, major agencies involved at the site, and the Superfund community relations program (August 1986).
- EPA has responded to numerous citizen, vendor, and press inquiries (Summer 1985 to present).

- EPA prepared and distributed a Fact Sheet on the FS Report for the First Operable Unit, other studies at the site, and ways citizens can obtain further information (December 1986).

- EPA held a public comment period on the remedial alternatives proposed in the FS Report for the First Operable Unit (December 12, 1986 through January 7, 1987).

ATTACHMENT B
TO APPENDIX A

RISK ASSESSMENT FOR THE VINYL CHLORIDE EMISSIONS FROM AIR STRIPPING

The following risk assessment for vinyl chloride emissions from an air stripper covers Occupational Safety and Health Administration (OSHA) and American Conference of Governmental Industrial Hygienists (ACGIH) standards and the 10^{-6} Cancer Assessment Group levels. In addition,, as identified in Section 2.3.1 of the Feasibility Study Report, a National Emission Standard for Hazardous Air Pollutants (NESHAPs) for certain industrial facilities may be relevant and appropriate for such an air stripper.

The NESHAPs standard for emission from vinyl chloride plants (see 40CFR61.63) is 10ppm, which is approximately equivalent to 21,000 ug/m^3 at 25°C at 5,200 feet elevation. The stack exit concentration reported from the air stripper is estimated to range from 610 ug/m^3 to 180 ug/m^3, depending on levels of vinyl chloride in the ground water. The stack exit concentrations of vinyl chloride would be well below the NESHAP standard for vinyl chloride plants.

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To: Michael J. Smith, CDM/Denver

From: S.H.S. Thomas Golojuch, ICF/Clement

Date: March 3, 1987

Project: RMA Off-Post RI/FS Site/First Operable Unit

Subject: Health Risks Associated with Potential Vinyl Chloride Emissions from an Air Stripping Facility

Document Control No: 198-RI 1-RT-DYGG-1

The Feasibility Study (FS) for the first operable unit of the EPA's Rocky Mountain Arsenal (RMA) Off-Post RI/FS Site focuses on remediation of public water supply contamination in the RI/FS study area. One of the groundwater treatment technologies under consideration for the South Adams County Water and Sanitation District (SACWSD) water supply could result in worker exposure to volatile organic compounds because emissions from the treatment units, if uncontrolled, would contain the organic compounds stripped from the contaminated water. The health risks associated with exposure of workers or nearby residents to vinyl chloride, one of the compounds that could potentially be released at an SACWSD air stripping facility, are briefly discussed below.

As an indication of plausible maximum exposure to on-site workers, Camp Dresser & McKee estimated the concentration of vinyl chloride in off-gases released directly from the air stripping towers. Off-gas concentrations were derived by assuming that vinyl chloride would be present at 10 µg/liter or 3 µg/liter in groundwater, that 2 air stripping towers would be used, and that 12 million gallons of contaminated groundwater would be treated per day. Under these assumptions, off-gases released directly from the towers would contain a combined maximum vinyl chloride concentration of 610 $\mu g/m^3$ and 180 $\mu g/m^3$ for the 10 µg/liter and 3 µg/liter groundwater exposure scenarios, respectively. Vinyl chloride concentrations at 100 meters frm the air stripping towers also were calculated to provide a less conservative estimate of potential worker exposure and plausible maximum estimate of potential exposure of nearby residents. Ambient concentrations of vinyl chloride at a distance of 100 meters from the air stripping towers were estimated at 0.155 $\mu g/m^3$ and 0.046 $\mu g/m^3$ for the 10-µg/liter and 3-µg/liter groundwater exposure scenarios, respectively.

The effects of vinyl chloride on both humans and experimental animals are described in the attached toxicity profile. The Occupational Safety and Health Administration (OSHA) and the American Conference of Governmental Industrial Hygienists (ACGIH) have recommended time-weighted average (TWA) occupational exposure limits of approximately 2.6 mg/m^3 (2,600 $\mu g/m^3$)

and 10 mg/m^3 (10,000 µg/m^3), respectively, for airborne vinyl chloride in the workplace. These values are intended to protect the health of workers exposed 8 hours/day for a working lifetime to chemicals in the workplace. Although ACGIH values are only recommended guidelines, OSHA TWAs are legally enforceable limits.

According to EPA's system for characterization of the overall weight of evidence for carcinogenicity, vinyl chloride is classified in Group A, meaning it is a human carcinogen based on evidence from epidemiologic studies. A cancer potency factor is therefore used to estimate the potential excess cancer risks associated with exposure to this compound. The 95% upper-bound cancer potency for vinyl chloride is 7.1×10^{-6} $(\mu g/m^3)^{-1}$. This value is an estimate of the excess cancer risk associated with continuous inhalation, at a rate of 20 m^3/day, of ambient air containing 1 µg/m^3 vinyl chloride by a 70-kg person over a 70-year lifetime.

For this analysis, it is assumed that nearby residents could potentially be exposed to vinyl chloride continuously for a 70-year lifetime or for a 2-year period. It is assumed that workers could potentially be exposed to vinyl chloride for 8 hours/day, 5 day/week, for 47 years (a working lifetime constituting employment from age 18 to 65) or for 2 years. The cumulative dose received during either the lifetime or 2-year exposure period was therefore expressed as an average daily exposure prorated over a 70-year lifetime, and the corresponding lifetime risk was calculated accordingly. This procedure is recommended in EPA's "Guidelines for Carcinogen Risk Assessment" (Federal Register 51:33998, September 24, 1986). Based on the exposure assumptions noted, the prorated average daily exposure for a lifetime worker at the air stripping facility would be a factor of approximately 0.16 times that of an individual exposed continuously for a 70-year lifetime to the same airborne concentration; for a 2-year worker this factor would be 0.0068.

Upper 95% confidence limits on estimated excess cancer risks associated with inhalation exposure of workers to vinyl chloride at the air stripping towers or at a distance of 100 meters and for residents at a distance of 100 meters were calculated using the EPA-derived cancer potency factor for this compound and the exposure assumptions noted above. These values are shown in Exhibit 1 for the tower off-gas or ambient concentrations and exposure periods considered. EPA encourages elimination of cancer risks to individuals resulting from exposure at a Superfund site where this is feasible. However, according to agency policy, the total individual cancer risk resulting from exposures may range between 10^{-4} to 10^{-7} (i.e., one excess cancer in every 10,000 and 10,000,000 individuals, respectively, exposed throughout their lifetime). Thus, an excess cancer risk of 10^{-6} is commonly used as an approximate guideline for determining an acceptable level of exposure within one or two orders of magnitude.

As shown in Exhibit 1, the lifetime excess cancer risks associated with exposure to vinyl chloride under the plausible maximum scenarios considered (worker exposure at the air stripping towers) range from 9×10^{-6} to 7×10^{-4}. For comparison, exposure to vinyl chloride for a working lifetime (47 years) at 0.9 µg/m^3 or for 2 years at 20 µg/m^3 would each be associated with an excess cancer risk of 10^{-6}. The air stripping tower off-gas concentrations of 610 and 180 µg/m^3 shown in Exhibit 1 are each less than the OSHA and ACGIH workplace criteria of 2.6 and 10 mg/m^3, respectively.

Lifetime excess cancer risks associated with occupational or continuous ambient exposure to vinyl chloride at concentrations that could potentially occur at a distance of 100 meters from the air stripping towers are less than or equal to 10^{-6} under all exposure scenarios considered.

EXHIBIT 1

EXCESS CANCER RISKS ASSOCIATED WITH INHALATION
OF VINYL CHLORIDE EMISSIONS FROM THE
SACWSD AIR STRIPPING FACILITY

Vinyl Chloride Concentration	Excess Cancer Risk[a] Lifetime Exposure	2-Year Exposure
Occupational Exposure[b]:		
At air stripping tower:		
610 $\mu g/m^3$	7×10^{-4} [A]	3×10^{-5} [A]
180 $\mu g/m^3$	2×10^{-4} [A]	9×10^{-6} [A]
100 meters from tower:		
0.155 $\mu g/m^3$	2×10^{-7} [A]	8×10^{-9} [A]
0.046 $\mu g/m^3$	5×10^{-8} [A]	2×10^{-9} [A]
Ambient Exposure[c]:		
100 meters from tower:		
0.155 $\mu g/m^3$	1×10^{-6} [A]	3×10^{-8} [A]
0.046 $\mu g/m^3$	3×10^{-7} [A]	9×10^{-9} [A]

[a]Vinyl chloride is classified in EPA's weight-of-evidence for carcinogenicity Group A, meaning it is considered a human carcinogen.

[b]Assumes exposure 8 hours/day, 5 days/week for a 47-year (working lifetime) or a 2-year period.

[c]Assumes continuous exposure for a 70-year lifetime or for 2 years.

VINYL CHLORIDE

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

Vinyl chloride is rapidly absorbed in rats following ingestion and inhalation (EPA 1985a,b). Dermal absorption of vinyl chloride is minor (EPA 1980a). Significant percutaneous absorption would not be expected to occur at exposures at 1 or 5 ppm (EPA 1980a). Following inhalation or ingestion of ^{14}C-vinyl chloride in rats, the greatest amount of radioactivity was found in the liver and kidney (EPA 1985a,b). It also distributed to the muscle, lung, fat, spleen, and brain (EPA 1985a,b). The toxicity of vinyl chloride appears to be attributable to its metabolism in the liver to reactive polar metabolites such as chloroacetaldehyde and chloroethylene oxide (EPA 1985a,b). Its metabolism to toxic metabolites is saturable (EPA 1985a,b) between 105 and 220 ppm (EPA 1985a,b). At higher exposures vinyl chloride is detoxified (EPA 1985a,b). At low doses (e.g., 1 mg/kg) of vinyl chloride, the metabolites are excreted primarily in the urine (EPA 1985a,b). In rats, urinary metabolites include N-acetyl-5-2-hydroxyethylcysteine and thiodiglycolic acid (EPA 1985a,b). At high doses (e.g., 100 mg/kg) most of the solvent is expired as vinyl chloride (EPA 1985a,b).

ACUTE/CHRONIC EFFECTS

At high inhalation exposure levels, workers have experienced dizziness, headaches, euphoria, and narcosis (EPA 1985a,b). In experimental animals, inhalation exposure to high levels of vinyl chloride can induce narcosis and death (EPA 1985a,b). Lower doses result in ataxia, congestion, and edema of the lungs and hyperemia in the liver (EPA 1985a).

Chronic inhalation exposure of workers to vinyl chloride is associated wtih hepatotoxicity, central nervous system disturbances, pulmonary insufficiency, cardiovascular toxicity, gastrointestinal toxicity, and acro-osteolysis (EPA 1985a,b). Chronic inhalation and oral studies of experimental animals exposed to vinyl chloride yield toxic effects similar to those seen in humans,

involving the liver, spleen, kidneys, hematopoietic system, and skeletal system (EPA 1984a).

TERATOGENICITY/REPRODUCTIVE EFFECTS

Inhalation exposures of rats, rabbits, and mice to vinyl chloride did not induce teratogenic effects (EPA 1985a,b). Potential effects on reproductive capacity have not been studied (EPA 1985a,b).

MUTAGENICITY

The mutagenic effects of vinyl chloride have been demonstrated in metabolically activated systems using S. typhimurium, E. coli, yeast, germ cells of Drosophilia, and Chinese hamster V79 cells (EPA 1985a,b). Vinyl chloride was effective in producing chromosome damage in rat bone marrow after a multiple exposure regime (EPA 1985a,b). Chromosome aberrations in humans have yielded inconsistent results (EPA 1985a,b).

CARCINOGENICITY

The ability of vinyl chloride to act as a carcinogen in the industrial environment was readily established because of the extreme rarity in exposed populations of the hepatic angiosarcomas with which it is associated (IARC 1979). Vinyl chloride exposure has also been implicated in brain, lung, and hemolymphopoietic cancers in humans (IARC 1979). Animal studies in several species support the findings of epidemiological studies. Chronic inhalation and ingestion of vinyl chloride has induced cancer in liver (liver angiosarcomas and hepatocellular carcinomas) and other tissues in rats and mice (IARC 1979).

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

Applying EPA's criteria for evaluating the overall weight of evidence of carcinogenicity to humans, vinyl chloride has been classified in Group A, meaning that it is a human carcinogen (EPA 1984a).

EPA (1984a) reported carcinogenic potencies (q_1^*) for exposure by inhalation and ingestion to vinyl chloride in its Health Effects Assessment (HEA) for this compound. The q_1^* for inhalation is based on an inhalation bioassay in rats (Maltoni and Lefemine 1975). Groups of 64 to 96 Sprague-Dawley rats were exposed to various concentrations of vinyl chloride for 4 hours a day, 5 days a week, for 52 weeks, and the survivors were sacrificed after 135 weeks. Angiosarcomas, particularly of the liver, were the predominant tumors observed. The linearized multistage model was fitted to the incidences of male and female rats with any type of malignant tumor (6/58, 10/59, 16/69, 22/59, and 32/59 in the 0-, 50-, 250-, 500-, and 2,500 ppm dose groups, respectively. The 6,000- and 10,000-ppm groups were not included in the final fitted model because the tumor incidence was said to have effectively plateaued at 51.7% and 62.3%. Using the linear nonthreshold model adopted by the EPA (1980b), the data of Maltoni and Lefemine (1975), and interspecies scaling factors, a human q_1^* of 2.5×10^{-2} $(mg/kg/day)^{-1}$ was calculated.

The q_1^* for oral exposure to vinyl chloride, as reported in the HEA for this compound, is based on a long-term ingestion study in rats (Feron et al. 1981). Groups of male and female Wistar rats were exposed to vinyl chloride via ingestion of polyvinyl chloride powder containing some unreacted monomer. The doses of vinyl chloride administered were 0, 1.7, 5.0, and 14.1 mg/kg/day. Dosing was continued for lifetimes with terminal sacrifices at 135 weeks for males and at 144 weeks for females. A significant dose-related increase in the incidence of hepatocellular carcinomas and hepatic angiosarcomas was observed in both males and females, with angiosarcomas becoming more prevalent with increasing doses. The linearized multistage model was fitted to the incidences of total female rats with tumors (2/57, 26/58, 42/59, in the 0-, 1.7-, 5.0-, and 14.1-mg/kg/day dose groups, respectively). The incidence of hepatocellular carcinoma was not included in these tallies; it was assumed that rats having hepatocellular carcinoma also had hepatic neoplastic nodules which were included in the tallies. In addition, the total number of animals bearing tumors in the high dose group was arbitrarily reduced to one less than the total number of animals examined, so the data would fit the linear non-threshold model used for estimation of carcinogenic potency. Using the data of Feron et al. (1981) and interspecies scaling factors, a human q_1^* of 2.3 $(mg/kg/day)^{-1}$ was calculated. The

concentration in drinking water corresponding to a 10^{-6} excess lifetime cancer risk is 0.015 ug/liter.* The CAG is presently reassessing the cancer risk estimate based on the Feron et al. (1981) study by taking into account the more recent data by Til et al. (1983) which is an extension of the earlier Feron et al. (1981) work, but including lower doses.

EPA (1985c) promulgated a drinking water RMCL of zero, because vinyl chloride is a human carcinogen. A drinking water MCL of 0.001 mg/liter has been proposed (EPA 1985d).

The EPA Office of Drinking Water developed 10-day health advisories (HAs) of 9.0 mg/liter for an adult and 2.6 mg/liter for a child (EPA 1985a). The HAs were based on a subchronic study in which vinyl chloride was administered by gavage to male and female Wistar rats at doses of 31, 100 or 300 mg/kg once daily, 6 days per week for 13 weeks (Feron et al. 1975). Several hematological, biochemical, and organ weight values were significantly different in both mid- and high-dose animals compared to controls. The NOAEL in this study was identified as 30 mg/kg.

An adjusted ADI of 0.046 mg/liter for noncarcinogenic effects was calculated using an oral feeding study in rats which reported that a dose of 1.3 mg/kg/day produced liver lesions; a dose of 0.13 mg/kg/day was identified as a NOAEL (Til et al. 1983).

SUMMARY OF VINYL CHLORIDE CRITERIA

EPA carcinogen classification	Group A
Oral carcinogenic potency factor (q_1^*)	2.3 $(mg/kg/day)^{-1}$
Inhalation carcinogenic potency factor (q_1^*)	2.5×10^{-2} $(mg/kg/day)^{-1}$
EPA drinking water health advisories (HA)	
Ten-day HA:	
Adult	9.0 mg/liter
Child	2.6 mg/liter

* This value was summarized and included in the recommendations of the Superfund Public Health Evaluation Manual. EPA 540/1-86/060.

Final RMCL	Zero
Proposed MCL	0.001 mg/liter
Drinking water concentration corresponding to 10^{-6} excess lifetime cancer risk	0.015 ug/liter
AWQC (concentration associated with a 10^{-6} lifetime cancer risk)	
Ingestion of water and aquatic organisms	2.0 ug/liter
Ingestion of water	2.0 ug/liter

REFERENCES

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ATTACHMENT C
TO APPENDIX A

ESTIMATED COSTS OF AIR STRIPPING

MEMORANDUM

TO: John Hopkins - Denver

FROM: Stewart Abrams - Edison SAbrams

DATE: February 5, 1987

PROJECT: EPA Contract No. 68-01-6939, RMA Off-Post RI/FS Site

SUBJECT: Conceptual Sizings: Vinyl Chloride Stripping

DOCUMENT CONTROL NO.: 198-FS2-IO-DXTG-1

As you requested, we have analyzed a range of sizings to remove vinyl chloride from a 12 mgd flowrate. We recommend that the flow be split, at a minimum, into two separate parallel flows. Therefore, the sizings are based on 6 mgd. We have evaluated two separate treatment objectives: 1) 0.1 mcg/l, which roughly corresponds to the lowest practical analytical detection limit, and 2) 0.015 mcg/l, which roughly corresponds to the 10^{-6} lifetime cancer risk. Two raw water concentrations have been evaluated for each scenario: 3 mcg/l and 10 mcg/l. We have assumed that the background water quality presents no unusual interferences to the stripping process. The costs of the towers include clearwell, pumps, tower and internals, and blowers. Design engineering is not included nor is the cost of a building to house the facilities, access roads, or other indirect costs. Therefore, for each case the following sizings and rough capital costs apply:

Case 1: Raw water = 3.0 mcg/l
Finished Water = 0.1 mcg/l

At 6 mgd: Tower diameter = 12 ft.
Packing height = 18 ft.
Air-to-water ratio = 20:1

Cost: 2 towers @ $401,000 each = $802,000

Case 2: Raw water = 10 mcg/l
Finished water = 0.1 mcg/l

At 6 mgd: Tower diameter = 12 ft.
Packing height = 24 ft.
Air-to-water ratio = 20:1

Cost: 2 towers @ $426,000 each = $852,000

Case 3: Raw water = 3 mcg/l
Finished water = 0.015 mcg/l

At 6 mgd: Tower diameter = 12 ft.
Packing height = 28 ft.
Air-to-water ratio = 20:1

Cost: 2 towers @ $481,000 each = $962,000

Case 4: Raw water = 10 mcg/l
Finished water = 0.015 mcg/l

At 6 mgd: Tower diameter = 12 ft.
Packing height = 33 ft.
Air-to-water ratio = 20:1

Cost: 2 towers @ $516,000 each = $ 1,032,000

In all cases, if the 12 mgd were treated in a single tower, we would recommend an 18 foot diameter. Otherwise, packing heights and air-to-water ratios would remain the same. Costs would also be about the same magnitude.

If you have any questions, or require further information, please call.

SA/ebe

cc: S. Medlar
G. Kroll
B. Roberts
File

(EBE36/7)

APPENDIX B

APPLICABLE OR RELEVANT AND APPROPRIATE

STATE STANDARDS

APPENDIX B

APPLICABLE OR RELEVANT AND APPROPRIATE STATE REQUIREMENTS

The State of Colorado provided the Agency with "a list of the applicable or relevant and appropriate on-post and off-post standards, requirements, limitations or criteria ["requirements or standards"] for the Rocky Mountain Arsenal" on January 8, 1987. The State amended this list on March 17, 1987, to delete several requirements and add an additional requirement. The State identified all applicable or relevant and appropriate standards (ARARs), not only those that are more stringent than similar federal provisions. 1/

The Agency has reviewed the State's submittal under the criteria of Section 121(d)(2)(A)(ii) of CERCLA, which provides in pertinent part:

> With respect to any hazardous substance, pollutant or contaminant that will remain onsite, if . . . any promulgated standard, requirement criteria, or limitation under a State environmental or facility siting law that is more stringent than any Federal standard, requirement, criteria or limitation . . . is legally applicable to the hazardous substance or pollutant or contaminant concerned or is relevant and appropriate to the circumstances of the release or threatened release of such hazardous substance or pollutant or contaminant, the remedial action selected under section 9604 . . . shall require, at the completion of the remedial action, a level or standard of control for such hazardous substance or pollutant or contaminant which at least attains such legally applicable or relevant and appropriate standard, requirement criteria or limitation." (emphasis added.)

1/ Although the State proposed ARARs for on-post and off-post of the Rocky Mountain Arsenal, this analysis is limited strictly to those requirements which are applicable or relevant and appropriate to this specific operable unit. This analysis is not intended to apply to or establish ARARs for the ongoing RI/FS work currently being conducted by the Army at RMA, and is not intended to establish any precedent for future remedial actions conducted on-post or off-post. ARARs must be established on a site specific basis.

If a State requirement that is identified as applicable or relevant and appropriate in this Appendix B is more stringent than a Federal requirement, the State requirement is the applicable or relevant and appropriate requirement to be attained for this operable unit. If the State and Federal requirements are equivalent, either the State or the Federal requirement must be attained. If an applicable or relevant and appropriate Federal requirement is more stringent than a State requirement, the Federal requirement is the applicable or relevant and appropriate requirement to be attained for this operable unit.

Section 121(d)(2)(C) of CERCLA limits the applicability of State requirements or siting laws which could effectively result in the statewide prohibition of land disposal of hazardous substances, pollutant, or contaminants, unless certain conditions are met. Since the proposed disposition of waste generated by or associated with any of the remedial action alternatives for this operable unit is not land disposal, Section 121(d)(2)(C) is not applicable, and was not considered by the Agency in reviewing the State's proposal.

Section 121(d)(4)(E) of CERCLA provides the Agency with discretion to select a remedial action that does not attain an applicable or relevant and appropriate State requirement if the State has not consistently applied the requirement in similar circumstances at other remedial actions. The Agency has not invoked this discretionary waiver with respect to any of the State's proposed ARARs. The Agency has not made any determinations, however, as to whether or not the State has consistently applied the requirements at other sites.

Applicable or relevant and appropriate State requirements are summarized in the attachment to this Appendix.[2/] In the event that EPA has determined that a State requirement is not applicable or relevant and appropriate for this specific operable unit, an explanation is provided.

2/ A requirement is applicable if it would apply to the remedial action if the remedial action were undertaken outside of CERCLA authority. A requirement is relevant and appropriate if, even though not applicable, it is designed to apply to problems or situations sufficiently similar to those encountered at the site that its application is appropriate. Requirements may be relevant and appropriate if they would be applicable but for the jurisdictional restrictions associated with the requirement.

ATTACHMENT TO APPENDIX B

APPLICABLE OR RELEVANT AND APPROPRIATE STATE STANDARDS, REQUIREMENTS, LIMITATIONS AND CRITERIA FOR THE EPA OFF-POST RI/FS SITE FIRST OPERABLE UNIT

I. General Comments

A. Enforcement Provisions

The State has listed numerous enforcement provisions as APARS for this operable unit. See e.g., C.R.S. Sections 30-20-113 (Enforcement-Civil Penalties); 30-20-114 (Violation-Penalty); 25-15-110 (Site deemed public nuisance - when); 25-15-211 (Violation-Criminal Penalties); 25-15-212 (Violation-Civil Penalties); 25-15-308 (Prohibited Acts-Enforcement); 25-15-309 (Civil Penalties); 25-15-310 (Criminal Penalties); 25-8-601 (Division to be notified of suspected violations and accidental discharges-penalty); 25-8-605 (Cease and Desist Orders); 25-8-606 (Clean-up Order); 25-8-607 (Restraining Order and Injunction); 25-8-608 (Civil Penalties); 25-8-609 (Criminal Pollution of State Waters-Penalty); 25-1-114 and 114.1 (unlawful to disobey public health laws and civil penalties; 25-1-107(x)(III)(B) (warrants for inspection); 25-7-115 (enforcement); 25-7-121 (injunctions); 25-7-122 (civil penalties); 25-12-104 (action to abate); 25-12-105 (violation of injunction - penalty); 33-6-103 (prosecution of offenses); 33-6-104 (imposition of penalty-procedures; 33-6-106 (suspension of license privileges); and 33-6-107 (licensing violations-penalties).

Such enforcement provisions are not standards, requirements, criteria or limitations under State environmental or facility siting laws that are legally applicable to the hazardous substances, pollutants or contaminants of concern or relevant and appropriate under the circumstances of the release or threatened release of such hazardous substance or pollutant or contaminant, as required by Section 121(d)(2)(A)(ii) of CERCLA. Rather, the provisions provide the mechanisms by which State regulatory agencies may enforce substantive environmental or facility siting laws which may be ARARs for a particular remedial action.

Section 121(d)(2)(A)(ii) provides that selected remedial actions must require, at the completion of remedial action, a level or standard of control for hazardous substances or pollutants or contaminants of concern which at least attains legally applicable or relevant and appropriate standards, requirements, criteria or limitations. The enforcement provisions do not contain environmental or facility siting requirements which describe, specify, require or otherwise provide for a degree of cleanup which the remedy must at least attain, nor do they describe, specify, require or otherwise provide for levels or standards of control (such as those contained in, but not limited to, ambient or chemical specific requirements, locational requirements, or performance design or other action-specific requirements) for the hazardous substances or pollutants or contaminants of concern for this operable unit.

Therefore, EPA has concluded that the enforcement provisions contained in the State's January 8, 1987 list of ARARs are not APARs for this operable unit. While the enforcement provisions are not ARARs under Section 121(d)(2)(A)(ii) of CERCLA, the State nevertheless may assert such enforcement provisions to the extent provided for by law, in instances of alleged non-compliance.

B. Permitting Requirements

The State has listed several permitting requirements, or the information submittals, notification requirements, monitoring, fees, data collection, and data reporting requirements contained within such permitting requirements, as ARARs for this operable unit. See e.g., C.R.S. Sections 30-20-102 (unlawful to operate site and facility without certificate of designation); 30-20-103 (application for certificate); 25-15-202 (application for certificate); 25-8-501(3) and (5) (permits required for discharge of pollutants); 25-8-503(1) (permits-when required and when prohibited); 25-8-502 (application-definitions-fees-water quality control fund); 25-7-114 (air pollution emission notices and emission permits; and implementing regulations. See also 6 CCR 1007-3 Part 100.

EPA is not determining at this time whether the selected remedy for this operable unit is an on-site or offsite response actions. Under Section 121(e) of CERCLA, no Federal, State or local permit is required for the portion of any remedial action conducted entirely on-site, where such remedial action is selected and carried out in compliance with Section 121. Conversely, permits will be obtained for any portion of remedial action conducted offsite.

Regardless of whether the selected remedial action is characterized as an on-site or offsite response, the substantive provisions of applicable or relevant and appropriate permit requirements (for example, environmental criteria under which a permit is reviewed, or monitoring requirements and data collection requirements to determine whether substantive environmental requirements are being attained) are ARARs. Substantive requirements generally include, but are not limited to, promulgated standards, requirements, criteria or limitations under a State environmental or facility siting law which describe, specify, require or otherwise provide for a degree of cleanup which the remedy must at least attain, or which describe, specify, require or otherwise provide for levels or standards of control for the hazardous substances or pollutants or contaminants of concern for this operable unit. The applicable or relevant and appropriate substantive permit requirements are discussed below in Section II, Specific Provisions.

Information submittals, notifications, fee provisions, and data reporting requirements contained in permit requirements are not substantive requirements of State environmental or facility siting laws. While the Agency does not consider such information submittals, notifications, fee provisions, and data reporting requirements to be ARARs for this operable unit, the Agency will maintain close consultation with appropriate State representatives to ensure that the State is provided with all relevant technical data, reports, notifications, and other information necessary for effective implementation of the remedy. In most cases, this means that the State will receive at least as much timely information, notice, and data as it would if the requirements were applicable or relevant and appropriate under Section 121(d)(2)(A)(ii) of CERCLA. Also, as previously noted, permits will be obtained for the portion of any remedial action conducted offsite.

In the event that any hazardous substance or pollutant or contaminant is transferred offsite from the treatment facility, such hazardous substance or pollutant or contaminant shall only be transferred to a facility which is operating in compliance with section 3004 and 3005 of the Solid Waste Disposal Act in accordance with Section 121(d)(3) of SARA, or equivalent or more stringent State requirements.

C. Legislative Declarations and Definitions

Legislative declaration provisions generally do not contain substantive requirements of State environmental or facility siting laws pursuant to Section 121(d)(2)(A)(ii) of CERCLA*, and are therefore not applicable or relevant and appropriate requirements. The Agency will maintain close consultation with appropriate State representatives to ensure that State concerns and legislative intent are addressed. In the event a legislative declaration contained substantive requirements, it would be evaluated to determine whether it is a relevant and appropriate requirement.

Definitional provisions generally contain substantive requirements or directly impact the scope or applicability of other substantive requirements. Definitional provisions generally are considered ARARs for this operable unit unless otherwise noted.

D. Scope of Specific Provisions Discussion

The Specific Provisions discussion which follows addresses only the Colorado requirements specifically listed by the State in its January 8, 1987, and March 17, 1987, letters to EPA. Other requirements not specifically listed by the State, but contained within the referenced statutes or regulations have not been evaluated.

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*For purposes of Appendix B and this Attachment, substantive requirements include, but are not limited to, promulgated standards, requirements, criteria, or limitations under a State environmental or facility siting law which describe, specify, require or otherwise provide for a degree of cleanup which the remedy for this operable unit must at least attain, or which describe, specify, require or otherwise provide for levels or standards of control for the hazardous substances, pollutants or contaminants of concern for this operable unit. See Section 121(d)(2)(A)(ii) of CERCLA.

II. SPECIFIC PROVISIONS

A. Colorado Solid Wastes Disposal Sites and Facilities Act, Sections 30-20-101 to 30-20-118, C.R.S. 1986.

- Not applicable or relevant and appropriate - Design, construction and/or operation of a solid waste disposal site are not contemplated as potential remedies for this operable unit. If solid waste is generated as part of the remedy (not contemplated currently,) such waste shall be disposed of at an approved solid waste disposal site or facility in accordance with the requirements of the Act and pertinent regulations.

B. Colorado Solid Wastes Disposal Sites and Facilities Regulations 6 CCR 1007-2, Sections 1.1 - 7.3.

- Not applicable or relevant and appropriate - Design, construction, and/or operation of a solid waste disposal site are not contemplated as potential remedies for this operable unit. If solid waste is generated as part of the remedy (not contemplated currently,) such waste shall be disposed of at an approved solid waste disposal site or facility in accordance with the requirements of the Act and pertinent regulations.

C. Colorado Hazardous Waste Act, C.R.S. §§ 25-15-101 to 313.

- Applicable to the extent the selected alternative involves the generation, transportation, treatment, or storage of hazardous wastes. The spent granular activated carbon from the GAC treatment system may contain hazardous wastes regulated under the Colorado Hazardous Waste Act and implementing regulations. The selected remedy does not contemplate disposal of hazardous wastes.

- The following requirements specifically listed by the State are not ARARs, since they are not substantive requirements of State environmental or facility siting laws pursuant to Section 121(d)(2)(A)(ii) of CERCLA: C.R.S §§ 25-15-102, 103, 200.2, 208, 215, 301, 302(2)(3)(4), and 304.

D. Rules and Regulations Pertaining to Solid and Hazardous Wastes, Part 2, Requirements for Siting of Hazardous Waste Disposal Sites

- Not applicable or relevant and appropiate. The selected remedy does not contemplate siting of a hazardous waste disposal site, or disposal of hazardous waste.

E. Colorado Hazardous Waste Regulations, 6 CCR 1007-3, Parts 260 to 267, 99 and 100.

The selected alternative, granular activated carbon treatment of the groundwater with incineration of volatile organic compounds adsorbed on the carbon, may generate hazardous waste (hazardous waste adsorbed in carbon) which may be stored temporarily or transported to an approved facility for incineration and regeneration of the carbon. The following provisions are applicable to such hazardous wastes:

Part 260 - Hazardous Waste Management System: General

Part 261 - Identification and Listing of Hazardous Wastes

Part 262 - Standards Applicable to Generators of Hazardous Waste
Note: Subpart E, Special Conditions, International Shipments and Farmers is not applicable or relevant and appropriate. The selected remedy does not contemplate such circumstances.

Part 263 - Standards Applicable to Transporters of Hazardous Waste.
Note: If hazardous waste is transported outside of the State of Colorado, the requirements of 40 CFR Part 263, or equivalent or more stringent State requirements, are applicable.

Part 264 - Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities

- Subparts A-H are applicable

- Subpart I is applicable if the selected remedy involves storage of hazardous wastes in containers

- Subpart J is applicable if the selected remedy involves use of tanks to store hazardous wastes

- Subpart K is applicable if the selected remedy involves the use of surface impoundments to store hazardous wastes

- Subpart L is applicable the selected remedy involves storage of hazardous wastes in piles

- Subpart M is not applicable or relevant and appropriate since land treatment of any hazardous wastes is not contemplated as part of the remedy for this operable unit

- Subpart N is not applicable or relevant and appropriate since the remedy does not contemplate disposal of hazardous wastes in a landfill

- Subpart O is applicable in the event incineration of the spent carbon occurs within the State. If incineration of spent carbon occurs outside of the State of Colorado, the requirements of 40 CFR Part 264, Subpart O, or equivalent or more stringent State requirements, are applicable.

- Appendices 1-6 are applicable to the extent they contain substantive requirements.

The following requirements are not applicable or relevant and appropriate:

Part 265 Interim Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

- interim standards do not apply to new storage facilities; remedies should comply with the more stringent Part 264 standards as these represent the ultimate RCRA compliance standards and are consistent with CERCLA's goals of longterm protection of public health and the environment.

Part 267 Interim Standards for Owners and Operators of New Hazardous Waste Land Disposal Facilities

- remedy does not contemplate land disposal of hazardous waste

Part 99 Notification

- Although the Part 99 notification provision is not a substantive requirement, the Agency will maintain close consultation with appropriate State representatives to ensure that the State receives timely notification of hazardous waste activities in accordance with the terms of Part 99.

Part 100 Permit Requirements

- See Section I(B), General Comments, Permitting Requirements. The substantive requirements within Part 100 are applicable or relevant and appropriate. The Agency will maintain close consultation with appropriate State representatives to ensure their concerns are addressed.

- Sections 100.13, 100.30, 100.31, 100.34, and 100.61(b) do not contain substantive provisions and are not APARs. Section 100.20 is not applicable or relevant and appropriate since an interim status permit is not contemplated as part of the remedy.

-Permits will be obtained for the portion of the remedial action involving any off-site hazardous waste activity.

F. Colorado Water Quality Control Act, C.R.S. Sections 25-8-501 to 25-8-612

- Not applicable or relevant and appropriate. No discharge of pollutants through point sources or non-point sources to waters of the State of Colorado is contemplated as a remedy for this operable unit. If there is a discharge of pollutants into waters of the State resulting from the remedial action (not contemplated), such discharge only may occur in accordance with the requirements of the Colorado Water Quality Control Act and pertinent regulations.

G. State Discharge Permit System Regulations, 5 CCR 1002-2, Sections 6.1.0 to 6.18

- Not applicable or relevant and appropriate. No discharge of pollutants through point source to waters of the State of Colorado is contemplated as a remedy for this operable unit. If such a discharge occurs or is contemplated, these regulations are applicable or relevant and appropriate. See Section I(B), General Comments, Permitting Requirements.

H. Effluent Limitations, 5 CCR 1002-3, Sections 10.1.1 to 10.1.7

- Not applicable or relevant and appropriate. No discharge of wastewater into State waters is contemplated as a remedy for this operable unit. If such a discharge occurs or is contemplated, these effluent limitations are applicable or relevant and appropriate.

I. Sewage and Storm Sewers, 5 CCR 1002-7, Sections 5.1 to 5.2

- Not applicable or relevant and appropriate. No discharge of wastewater to storm sewers or prohibited connections to storm sewers are contemplated as a remedy for this operable unit. If such a discharge occurs or is contemplated, these provisions would be applicable or relevant and appropriate.

J. Basic Standards and Methodologies, 5 CCR 1002-8, Sections 3.1.1 to 3.11.9

- Not applicable or relevant and appropriate. No discharge to waters of the State is contemplated under this operable unit, nor does this operable unit address remediation of surface water or the underlying aquifer within the EPA Off-Post RI/FS site.

K. Site Applications for Domestic Wastewater Treatment Works, 5 CCR 1002-12, Sections 2.2.1 to 2.2.7

- Not applicable or relevant and appropriate. No construction of domestic wastewater treatment works is contemplated as a remedy for this operable unit.

L. Colorado Safe Drinking Water Authorities - C.R.S. §§25-1-107(x),(Y); 25-1-114 and 25-1-114.1

-Generally, not applicable or relevant and appropriate. The cited provision are not substantive requirements. The Agency will consult with appropriate State representatives regarding any notification requirements to ensure effective implementation of the remedy. If substantive requirements are identified, they will be evaluated to determine whether they are applicable or relevant and appropriate.

M. Colorado Primary Drinking Water Regulations, 5 CCR 1003-1, Articles 1, 2, 4, 5, 6, 7, 8.

-Applicable or relevant and appropriate to the drinking water that will be supplied to the public through the selected remedy, for contaminants identified in the groundwater which supplies the South Adams County Water and Sanitation District ("SACWSD") supply wells.

N. Colorado Air Quality Control Regulations

-The air stripping alternatives would involve emissions of pollutants to the atmosphere. For remedies that involve air stripping, the Colorado Air Quality Control Regulations may be applicable or relevant and appropriate. Fugitive particulate emission regulations may be applicable or relevant and appropriate regardless of which remedy is selected. The regulations are discussed below:

-Common Provisions Regulation, 5 CCR 1001-2 - applicable or relevant and appropriate.

-Regulation No. 1, 5 CCR 1001-3, Emission Control Regulations for Particulates, smokes, carbon monoxide, and sulfur oxides.

a. Although no emissions of these contaminants are contemplated as part of the operation of the remedy, fugitive particulates may be generated during the construction of the remedy. Section III(d), Fugitive Particulate Emissions, is applicable if the jurisdictional prerequisites are satisfied, or relevant and appropriate if such prerequisites are not met. If particulates, smokes, carbon monoxide, or sulfur oxide are emitted as a result of constructing or implementing the remedy (not contemplated,) then other sections of Regulation No. 1 addressing these pollutants will be applicable or relevant and appropriate.

-Regulation No. 2, 5 CCR 1001-4, Odor Emission Regulations - Applicable

-Regulation No. 3, 5 CCR 1001-5, Air Contaminant Emission Notices, Emission Permits and Fees, PSD Regulations.

a. See Section I(B), General Comments, Permitting Requirements. The substantive requirements within the permit sections are applicable or relevant and appropriate. The Agency will maintain close consultation with appropriate State representatives to ensure their concerns are addressed.

b. The prevention of significant deterioration (PSD) regulations are not applicable or relevant and appropriate. None of the remedies contemplat for this operable unit involve facilities addressed by the PSD regulation

c. Although the emission notices provision is not an ARAR, the Agency will maintain close consultation with appropriate State representatives to ensure that the State receives timely notification.

d. The fee provisions are not ARARs.

-Regulation No. 6, 5 CCR 1001-8, Part A, Sections I, III, IX, and XIII, Part B, Sections I, II and IV, New Source Performance Standards

a. Not applicable or relevant and appropriate. The selected remedy contemplated for this operable unit would not involve facilities in any of these categories.

-Regulation No. 7, 5 CCR 1001-9, Volatile Organic Compounds

a. Applicable or relevant and appropriate if the selected remedy would involve the storage, transfer or disposal of volatile organics, petroleum operations, use of solvents or cutback asphalt or surface coating operations.

-Regulation No. 8, 5 CCR 1001-10, Control of Hazardous Air Pollutants,

a. Relevant and appropriate if the selected remedy involves emissions of vinyl chloride or benzene to the atmosphere.

-Ambient Air Quality Standards, 5 CCR 1001-14

a. No emissions of pollutants for which ambient air quality standards have been established are contemplated as part of the selected remedy this operable unit. (If an air stripper is required for the treatment of vinyl chloride, small amounts of VOCs may be released to the atmosphere and contribute to ozone formation. The ozone standard is relevant and appropriate to the contemplated remedial action for this operable unit if emissions from air stripping will contribute to the formation of ozone. Also, the total suspended particulate (TSP) standard is relevant and appropriate in the event fugitive particulate emissions result from the construction of the contemplated remedy.)

O. Colorado Air Quality Control Act, Sections 25-7-101 to 25-7-505

-The specific provisions identified by the State do not contain substantive requirements and are generally not applicable or relevant and appropriate. If substantive requirements are identified, such requirements will be evaluated to determine whether they apply.

-The Agency will maintain close consultation with appropiate State representatives to ensure that the State receives timely notification in accordance with C.R.S. § 25-7-114 (2) and (3).

-Section 123, Incinerators and Open Burning - Not applicable or relevant and appropriate. The activities regulated by this provision are not contemplated in the selected remedy for this operable unit. If these activities occur (not contemplated) this section will be applicable.

-Section 25-7-114 provides for emission permits. See Section I(B), General Comments, Permitting Requirements. The substantive requirements of this section are applicable or relevant and appropriate. The Agency will maintain close consultation with appropriate State representatives to ensure their concerns are addressed.

-Sections 25-7-501, 502, and 504. Not applicable or relevant and appropriate. None of the remedies contemplated for this operable unit involve asbestos control.

P. Colorado Noise Abatement Statute, Sections 25-12-101 to 25-12-108

-Sections 25-12-102 (definitions) and 25-12-103 (Maximum Permissible Noise Levels) are applicable requirements or relevant and appropriate requirements. The other specifically cited provisions do not contain substantive requirements and are not applicable or relevant and appropriate.

Q. Wildlife, C.R.S. Sections 33-1-101 to 33-1-120

-Section 33-1-101 (short title) does not contain substantive requirements and is not applicable or relevant and appropriate.

-Section 33-1-102 (definitions) is applicable or relevant and appropriate.

-Section 33-1-106 (management) is applicable if any of the selected remedies involve the taking, possession, transportation, exportation, shipment, removal, capture or destruction of wildlife which appear on the State's list of endangered or threatened species. It should be noted that none of the proposed alternatives contemplate any of the above-listed activivites for wildlife.

-See Section I(B), General Comments, Permitting Requirments. The Agency will maintain close consultation with appropriate State representatives to ensure their concerns are addressed.

R. Wildlife Enforcement and Penalties, C.R.S. §§ 33-6-101 to 33-6-130.

- Generally, the specifically cited provisions are not applicable or relevant and appropriate. See discussion on Enforcement Provisions, p.1 of this Attachment. Sections 33-6-109 (wildlife - illegal possession), 33-6-114 (transportation, importation, exportation and release of wildlife), and 33-6-120 (hunting, trapping or fishing out of season or in a closed area) are applicable or relevant and appropriate to the extent they contain substantive requirements. It should be noted that the selected remedy does not contemplate any activities covered or prohibited by these provision.

- See Section I(B), General Comments, Permitting Requirements. The Agency will maintain close consultation with appropriate State representatives to ensure their concerns are addressed.

S. General Provisions of the Division of Wildlife Regulations, 2 CCR 406-0, Article II.

- See Section I(B), General Comments, Permitting Requirements.

- Substantive requirements contained within these regulations are applicable or relevant and appropriate. The Agency will maintain close consultation with appropriate State representatives to ensure their concerns are addressed. The selected remedy does not contemplate any activities described by or prohibited by these regulations.

T. The Water Well and Pump Installation Contractors Act, C.R.S. §§ 37-91-101 to 37-91-112

- Generally, the Act does not contain substantive requirements and is not applicable or relevant and appropriate. Section 37-91-110 (basic standards and minimum standards) contains substantive requirements and is applicable or relevant and appropriate to pump installation. The selected remedy does not contemplate construction of water wells.

- See Section I(B), General Comments, Permitting Requirements. The Agency will maintain close consultation with appropriate State representatives to ensure their concerns are addressed.

U. Water Well and Pump Installation Contractors Regulations. 2 CCR 402-2

- See Section I(B), General Comments, Permitting Requirements.

- The substantive requirements contained within the regulations are applicable or relevant and appropriate to pump installation. The selected remedy does not contemplate construction of water wells. The Agency will maintain close consultation with appropriate State representatives to ensure their concerns are addressed.

V. Historical, Prehistorical and Archaeological Resources Act, C.R.S. §§24-80-401 et seq.

- Applicable or relevant and appropriate if the selected remedy involves the investigation, excavation, gathering, or removal from the natural state of any historical, prehistorical and archaeological resources within the State.

- See Section I(B), General Comments, Permitting Requirements. The Agency will maintain close consultation with appropriate State representatives to ensure their concerns are addressed.

APPENDIX C

STATE OF COLORADO AND SACWSD CONCURRENCES WITH REMEDY

STATE OF COLORADO

COLORADO DEPARTMENT OF HEALTH
4210 East 11th Avenue
Denver, Colorado 80220
Phone (303) 320-8333

Roy Romer
Governor

Thomas M. Vernon
Executive Director

MAY 1987

May 22, 1987

Mr. James Scherer
Regional Administrator
U.S. Environmental Protection Agency
Region VIII
One Denver Place
999 18th Street, Suite 500
Denver, Colorado 80202-2405

Re: EPA's RMA Off-Post First Operable Unit Approved Final Draft Record of Decision (ROD) - South Adams County Drinking Water Treatment System

Dear Mr. ~~Scherer~~ Jim:

The State of Colorado has reviewed the May 14, 1987 Approved Final Draft ROD for EPA's RMA Off-Post First Operable Unit. The State concurs with the selection of a granular activated carbon (GAC) water treatment system as the appropriate remedy for treatment of the contaminated ground water within the EPA Off-Post RI/FS site prior to its use as drinking water by customers of the South Adams County Water and Sanitation District (SACWSD).

While the State concurs with the selection of the GAC water treatment system as the permanent remedy, our concurrence with the ROD is conditioned upon the following:

1) To date, insufficient financing exists to complete the construction and operation of the GAC treatment system. Therefore, it may be necessary to utilize Hazardous Substance Response Fund money to implement the final remedy. However, the U.S. Army has been identified as at least one party responsible for the contamination of the drinking water supply. An investigation of other potentially responsible parties (PRPs) is in progress. Given that liability under CERCLA is joint and several, the State's position is that the identified responsible party(s) should provide the full costs of implementing the permanent remedy, including operation and maintenance costs.

   In the event Fund money is utilized to implement the remedy, CERCLA Section 104(c)(3) requires that the State enter into a contract or cooperative agreement with the President providing adequate assurances that the State will pay or assure payment of 10% of the

capital costs and all future costs for operation and maintenance for the expected life of the remedial action. However, pursuant to the current State Superfund Act, Section 25-16-101, et seq., C.R.S., State cannot make such assurances unless the site has been listed the National Priorities List (NPL). See Section 25-16-104.6 (2)(b). At this time, neither the Rocky Mountain Arsenal nor EPA's RMA Off-Post RI/FS site has been finally listed on the NPL.

Section 25-16-103(2) currently states that, "any State matching payment required by a cooperative agreement entered into pursuant to this section must be approved by the general assembly acting by bill." For these reasons, the State cannot make the 104(c)(3) 10% cost assurance for construction of the permanent treatment plant, or the assurance for all future operation and maintenance costs, at this time.

2) The State strongly objects to the conclusion in the ROD that the applicable or relevant and appropriate requirements (ARARs) for this operable unit are the final or proposed Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act for all contaminants identified in South Adams County drinking water. This conclusion deviates from the Section 121(d) Superfund Amendments and Reauthorization Act (SARA) provision that the "remedial action require a level or standard of control which at least attains Maximum Contaminant Level Goals (MCLGs) established under the Safe Drinking Water Act. . ."

This conclusion also deviates from the March 27, 1987 letter to EPA Administrator Lee Thomas from the conferees involved in the CERCLA reauthorization process. The letter was written "to advise you [Lee Thomas] of the requirements of Section 121 [of SARA] and the intent behind them, . . ." The letter also states that, "[t]he specific reference to MCLG's in the law makes it clear that these particular standards, where they are more stringent than the comparable MCL's, are the primary standards under the Safe Drinking Water Act that must be attained by Superfund cleanups of groundwater, . . ." The source of SACWSD's drinking water is groundwater. Therefore, pursuant to statutory requirement, unless the EPA determines that compliance with MCLGs is technically impracticable from an engineering perspective, MCLGs are the ARARs and must be attained. Section 121(d)(4)(C), SARA.

As you are aware, MCLs are often established based upon the analytic detection limits rather than on health based criteria. While the State does not agree with the use of MCLs as ARARs, if MCLs are to be used as ARARs, a safety factor must be incorporated which approximates the 10^{-6} Cancer Assessment Group (CAG) cancer risk value. For example, with trichloroethylene (TCE), one major contaminant of concern at this operable unit, the 10^{-6} CAG number is approximately 2 ug/l lower that the MCL. Therefore, a criteria that incorporates an operational safety factor based upon a health related standard should be used as the ARAR.

- The EPA has determined that other applicable or relevant and appropriate standards, requirements, criteria or limitations (ARARs) identified by the State of Colorado are not applicable or relevant and appropriate to this remedial action. There are many instances where the State disagrees with this determination.

To expedite implementation of the remedy for this operable unit, the State concurs with the selection of the GAC water treatment system. However, we feel it is necessary to meet with you to discuss and attempt to resolve the issues outlined above at your earliest convenience. The State looks forward to working closely with you to complete construction of the SACWSD permanent water treatment system to protect the health and welfare of the citizens of Colorado.

Sincerely,

Tom Looby

Thomas P. Looby
Assistant Director
Colorado Department of Health

TPL/CS:me

cc: Howard Kenison, Deputy Attorney General
Robert Lawrence, U.S. EPA
Larry Ford, SACWSD
Dave Brown, Esq.
Citizens Against Contamination
Senator Strickland
Senator Martinez
Representative Blesdoe
Representative Reeser
Representative Hume
Joel Kohn

MAY 1987

5:15 PM

SOUTH ADAMS COUNTY WATER AND SANITATION DIST.
6595 EAST 70TH AVENUE
COMMERCE CITY, COLORADO 80022
TELEPHONE 303 288-2646

May 18, 1987

Mr. Robert L. Duprey
U.S. ENVIRONMENTAL PROTECTION AGENCY
Region VIII
999 Eighteenth Street, Suite 500
Denver, CO 80202-2405

BY HAND-DELIVERY

RE: Final Draft Record of Decision ("ROD") for
First Operable Unit, EPA's RMA Off-Post RI-FS Site;
Document No. 198-FS2-RT-ENBC-1

Dear Mr. Duprey:

South Adams County Water and Sanitation District has been consulted by EPA with regard to the above-referenced ROD. Now that the ROD has been reviewed by the District's staff and consultants, I am authorized by the Board of Directors of the District to inform you that the District concurs with the selected remedy set forth in the ROD.

We look forward to working closely with EPA in implementing this next, and most important, milestone for the protection of our customers.

Sincerely,

SOUTH ADAMS COUNTY WATER
AND SANITATION DISTRICT

By: _____
Jean Klein, President

cc: Mr. Connally Mears
Hon. Hank Brown
Patricia L. Bohm, Esq.
Mr. Randall J. Krueger
Lysle R. Dirrim, Esq.
David M. Brown, Esq.

APPENDIX D

INDEX TO THE ADMINISTRATIVE RECORD

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DOCUMENT DATE	DOCUMENT TYPE	ISSUED BY	DOCUMENT TITLE OR DESCRIPTION
12/19/83	REPORT	E&E	PRELIMINARY ASSESSMENT REPORT SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT COMMERCE CITY, CO
03/14/84	HRS PACKAGE	E&E	EPA HAZARD RANKING SYSTEM FORMS FOR ROCKY MOUNTAIN ARSENAL EXCLUDING BASIN F
10/19/84	PLAN	EPA	COMMUNITY RELATIONS PLAN TO ROCKY MOUNTAIN ARSENAL OFF POST CONTAMINATION ASSESSMENT
04/23/85	PLAN	CDM	DRAFT WORK PLAN MEMORANDUM RI/FS ROCKY MOUNTAIN ARSENAL - OFF SITE ADAMS COUNTY, COLORADO
05/07/85	LETTERS	CDM	TRANSMITTAL OF DRAFT WORK PLAN MEMORANDUM TO INTERESTED PARTIES FOR COMMENT
05/15/85	LETTER	C. HAHN/SHELL	COMMENTS ON DRAFT WORK PLAN MEMORANDUM
05/15/85	LETTER	HRS/SACWASD	COMMENTS ON DRAFT WORK PLAN MEMORANDUM
05/31/85	PLAN	CDM	FINAL WORK PLAN MEMORANDUM RI/FS ROCKY MOUNTAIN ARSENAL ADAMS COUNTY, COLORADO
06/15/85	GUIDANCE DOC	EPA	GUIDANCE ON FEASIBILITY STUDIES UNDER CERCLA OSWER 9355.0-5C
06/15/85	GUIDANCE DOC	EPA	GUIDANCE ON REMEDIAL INVESTIGATIONS UNDER CERCLA OSWER 9355.0-6B
07/15/85	REPORT	SACWASD/JMM	WATER AND WASTEWATER SYSTEM MASTER PLAN UPDATE & SYSTEM DEVELOPMENT FEES
08/06/85	DRAFT PLAN	CDM	DRAFT WORK PLAN FOR ROCKY MOUNTAIN ARSENAL EPA OFF-POST RI/FS AND OVERSIGHT ACTIVITIES COLORADO
08/13/85	REPORT	E&E	REPORT OF SAMPLING ACTIVITIES MILT ADAMS, INC. OIL AND SOLVENT PROCESSING CO. COMMERCE CITY CO
08/26/85	LETTER	T. LOOBY/CDOH	STATE COMMENTS ON DRAFT WORK PLAN FOR RI/FS IN RMA OFF-POST STUDY AREA
08/26/85	LETTER	T. GILMER/SACWASD	SACWASD COMMENTS ON DRAFT WORK PLAN FOR RMA OFF-POST RIFS
09/09/85	PLAN	CDM	FINAL WORK PLAN FOR ROCKY MOUNTAIN ARSENAL EPA OFF-POST RI/FS AND OVERSIGHT ACTIVITES COLORADO
09/23/85	REPORT	E&E	REPORT OF ANALYTICAL RESULTS AT SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT, COMMERCE CITY, CO
11/01/85	PLAN	CDM	REM II HEALTH AND SAFETY ASSURANCE MANUAL
11/06/85	LETTER	G. BROETMAN/CDOH TO L. FORD/SACWASD	LETTER REQUIRING SACWASD TO TAKE ACTION ON TCE CONTAMINATION
12/18/85	REPORT	E&E	FINAL SITE INSPECTION AND ANALYTICAL RESULTS REPORT STAPLETON AIRPORT - SAND CREEK DENVER, COLORADO
01/08/86	REPORT	CDM	PHASE IA FIELD SAMPLING REPORT IN THE ROCKY MOUNTAIN ARSENAL EPA OFF-POST REGION
01/12/86	MEMO	TAT	PRELIMINARY EVALUATION OF INTERIM TREATMENT ALTERNATIVES
01/17/86	REPORT	CDM/CLEMENT	PRELIMINARY RISK ASSESSMENT OF THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT WATER DISTRIBUTION SYSTEM
01/28/86	REPORT	CDM	PHASE IB FIELD SAMPLING REPORT FOR THE ROCKY MOUNTAIN ARSENAL EPA OFF-POST RI/FS AREA
02/03/86	DATA	EPA/ENECHOTEC	BORING LOGS AND WATER LEVEL MEASUREMENTS FROM THE SAND CREEK OIL PLUME INVESTIGATION
02/11/86	REPORT	E&E	ANALYTICAL RESULTS REPORT FOR LANDFILL, INC. COMMERCE CITY, CO
02/13/86	FACT SHEET	EPA	SUPERFUND PROGRAM FACT SHEET - ROCKY MOUNTAIN ARSENAL OFF-POST SITE COMMERCE CITY, CO

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03/01/86	PLAN	EPA	ROCKY MOUNTAIN ARSENAL PUBLIC AFFAIRS PLAN 1986 - 1990
03/05/86	LETTER	R. LAMM/CO TO L. THOMAS/EPA	LETTER REGARDING USE OF ARMY FUNDS AND SUGGESTION TO SET ASIDE THE SEARCH FOR OTHER CONTAMINATION SOURCES
03/06/86	ADVISORY	CDOH	STATE OF COLORADO HEALTH ADVISORY ON SACWASD DRINKING WATER
03/19/86	AGREEMENT	EPA & ARMY	AGREEMENT BETWEEN US EPA AND DOA REGARDING $1 MILLION FOR TEMPORARY TREATMENT SYSTEM FOR SACWASD
03/31/86	LETTER	L. THOMAS/EPA TO R. LAMM/CO	LETTER REGARDING EPA SEARCH FOR OTHER TCE SOURCES
04/04/86	PLAN	CDM	FINAL SAMPLING AND ANALYSIS PLAN FOR ROCKY MOUNTAIN ARSENAL EPA OFF-POST RI/FS, COLORADO VOLUMES I & II
04/17/86	PLAN	CDM	FINAL QUALITY ASSURANCE PROJECT PLAN RI/FS EPA OFF-POST SITE ROCKY MOUNTAIN ARSENAL ADAMS COUNTY, COLORADO
04/17/86	REPORT	CDM/CLEMENT	PRELIMINARY RISK ASSESSMENT OF THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT WATER DISTRIBUTION SYSTEM
04/23/86	REPORT	E&E	ANALYTICAL RESULTS REPORT DENVER ENGINEERING OPERATIONS CENTER DENVER BULK MAIL FACILITY
05/21/86	MEMO	T. FIELDS/EPA TO J. PORTER/EPA	EXEMPTION FOR $1 MILLION LIMIT AND CEILING INCREASE FOR SACWASD TEMPORARY TREATMENT SYSTEM
05/29/86	REPORT	SACWASD/JMM	TREATABILITY/FEASIBILITY STUDY FOR DISTRICT WATER QUALITY IMPROVEMENT
06/01/86	MEMO	T. FIELDS/EPA TO J. PORTER/EPA	REGION VIII REQUEST FOR CEILING INCREASE FOR SACWASD REMOVAL ACTION MEMORANDUM ADDENDUM
06/11/86	REPORT	CDM	PHASE IC FIELD SAMPLING REPORT FOR THE ROCKY MOUNTAIN ARSENAL EPA OFF-POST RI/FS AREA
06/24/86	REPORT	E&E	SOUTH ADAMS COUNTY SOIL GAS SURVEY INTERPRETATIVE REPORT SOUTH ADAMS COUNTY, COLORADO
07/22/86	REPORT	E&E	ANALYTICAL RESULTS REPORT FOR NINE SITES IN SOUTH ADAMS COUNTY, COLORADO
07/22/86	MEMO	R. DUPREY/EPA TO J. WELLS/EPA	REQUEST FOR SIX MONTH TIME EXEMPTION FOR CONTINUATION OF REMOVAL ACTIVITIES AT SACWASD
07/22/86	MEMO	J. WELLS/EPA TO J. PORTER/EPA	CEILING INCREASE REQUEST FOR SACWASD REMOVAL ACTION
07/31/86	LETTER	J. WELLS/EPA TO L. WALKER/ARMY	REQUEST FOR FUNDING FOR PERMANENT TREATMENT SYSTEM
08/01/86	DATA	SACWASD/HRS	RESULTS OF WATER LEVEL, WATER QUALITY, AND HYDROGEOLOGIC INVESTIGATIONS
08/01/86	DATA	ARMY/ESE/EBASCO	RESULTS OF DRILLING, WATER LEVEL MONITORING, WATER AND SOIL SAMPLING IN RMA WEST TIER SECTIONS
08/14/86	PLAN	EPA	DRAFT COMMUNITY RELATIONS PLAN ROCKY MOUNTAIN ARSENAL OFF-SITE STUDIES
08/15/86	MEMOS/DATA	CDM/CCJ	DATA VALIDATION REPORTS AND DATA USABILITY SUMMARIES FOR CONTRACT LABORATORY PROGRAM ANALYSIS RESULTS
08/15/86	FACT SHEET	EPA	SUPERFUND PROGRAM FACT SHEET - ROCKY MOUNTAIN ARSENAL OFF-POST SITE COMMERCE CITY, CO
09/01/86	DATA	E&E	BORING LOGS, WELL COMPLETION DIAGRAMS, AND SURVEY DATA FOR WELLS INSTALLED BY FIT SOUTH OF 56TH ST
/03/86	MEMO	R. DUPREY/EPA TO MOA PARTIES	ARMY - EPA AGRE TO TRANSFER $6 MILLION FOR PERMANENT TREATMENT SYSTE SACWASD

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10/09/86	REPORT	SACWASD/B&V	DETAILED ANALYSIS OF ALTERNATIVES FOR ORGANIC CONTAMINANT REMOVAL
10/15/86	GUIDANCE DOC	EPA	SUPERFUND PUBLIC HEALTH EVALUATION MANUAL EPA 540/1-86/060
10/20/86	DRAFT REPORT	CDH	MOA REVIEW DRAFT REMEDIAL INVESTIGATION FIRST OPERABLE UNIT ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS SITE
10/21/86	DRAFT REPORT	CDH	MOA REVIEW DRAFT FIRST OPERABLE UNIT ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS SITE
10/28/86	LETTER	ATSDR	REQUEST FOR ATSDR ASSISTANCE IN REVIEW OF FIRST OPERABLE UNIT RI AND FS DOCUMENTS
11/04/86	LETTER	T. LOOBY/CDOH	COMMENTS ON MOA REVIEW DRAFTS OF FIRST OPERABLE UNIT REMEDIAL INVESTIGATION AND FEASIBILITY STUDY DOCUMENTS
11/05/86	LETTER	SACWASD/HRS	SACWASD COMMENTS ON MOA REVIEW DRAFT REMEDIAL INVESTIGATION REPORT
11/06/86	LETTER	R. DUPREY/EPA TO T. LOOBY/CDOH	REQUEST FOR STATE IDENTIFICATION OF ARAR'S
11/07/86	LETTER	SACWASD/B&V	COMMENTS ON MOA REVIEW DRAFT FIRST OPERABLE UNIT FEASIBILITY STUDY
12/08/86	FINAL REPORT	CDH	REMEDIAL INVESTIGATION FIRST OPERABLE UNIT ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS SITE
12/08/86	FINAL REPORT	CDH	FEASIBILITY STUDY FIRST OPERABLE UNIT ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS SITE
12/10/86	REFERENCE	CDH	REFERENCE LIST USED IN PREPARATION OF FIRST OPERABLE UNIT RI AND FS REPORTS
12/10/86	NOTICE	EPA	CERTIFICATION OF OFFICIAL NOTICE OF PUBLIC COMMENT PERIOD ON FIRST OPERABLE UNIT FS REPORT - DENVER POST
12/11/86	NOTICE	EPA	CERTIFICATION OF OFFICIAL NOTICE OF PUBLIC COMMENT PERIOD ON FIRST OPERABLE UNIT FS REPORT - COMMERCE CITY SENTINEL
12/12/86	TELEPHONE	J.CROWE	COMMENTS ON FINAL FIRST OPERABLE UNIT RI AND FS DOCUMENTS
12/15/86	TELEPHONE	MRS.LONG	COMMENTS ON FINAL FIRST OPERABLE UNIT RI AND FS DOCUMENTS
12/15/86	FACT SHEET	EPA	SUPERFUND PROGRAM FACT SHEET - ROCKY MOUNTAIN ARSENAL OFF-POST SITE COMMERCE CITY, CO
12/24/86	GUIDANCE DOC	EPA	INTERIM GUIDANCE ON SUPERFUND SELECTION OF REMEDY OSWER 9355.0-19
12/29/86	LETTER	SACWASD/B&V	COMMENTS ON FINAL FIRST OPERABLE UNIT RI AND FS DOCUMENTS
12/31/86	LETTER	CITIZENS AGAINST CONTAMINATION	COMMENTS ON FINAL FIRST OPERABLE UNIT RI AND FS DOCUMENTS
01/05/87	LETTER	SACWASD	COMMENTS ON FINAL FIRST OPERABLE UNIT RI AND FS DOCUMENTS
01/06/87	LETTER	SCHOOL DISTRICT 14	COMMENTS ON FINAL FIRST OPERABLE UNIT RI AND FS DOCUMENTS
01/06/87	LETTER	TRI-COUNTY HEALTH DEPARTMENT	COMMENTS ON FINAL FIRST OPERABLE UNIT RI AND FS DOCUMENTS
01/07/87	LETTER	HRO	COMMENTS ON FINAL FIRST OPERABLE UNIT RI AND FS DOCUMENTS
01/07/87	LETTER	KARLIN/CDOH	COMMENTS ON FINAL FIRST OPERABLE UNIT RI AND FS DOCUMENTS
01/08/87	LETTER	T. LOOBY/CDOH	STATE LETTER ON APPLICABLE RELEVANT AND APPROPRIATE REQUIREMENTS FOR OFF-POST AREA
01/09/87	LETTER	CITY OF COMMERCE CITY	COMMENTS ON FINAL FIRST OPERABLE UNIT RI AND FS DOCUMENTS
01/21/87	LETTER	ADAMS COUNTY COMMISSIONERS	COMMENTS ON FINAL FIRST OPERABLE UNIT RI AND FS DOCUMENTS